Exploring electroacoustic compositional structure through urban underground acoustic environments

Trent Crawford

A thesis submitted in partial fulfillment of requirements for the degree of Master of Music (Composition)

Sydney Conservatorium of Music

The University of Sydney 2017

Statement of Originality

I declare that the research presented here is my own original work and has not been submitted to any other institution for the award of a degree.

Professional editor, Owen Kavanagh, of Jera Editing Services, provided copyediting and proofreading services, according to the guidelines laid out in the university-endorsed national 'Guidelines for editing research theses', published as part of the Australian standards for editing practice.

Signed:....Trent Crawford.....

Date:.....20/02/2017.....

Abstract

The aim and creative intent of this research project is to digitally capture the sonic fingerprint found throughout our cities' underground transport systems with the purpose of creating new modes of compositional sound works. When arranged, these compositions will motivate and challenge ideas of what constitutes musical structure, in the context of exploring creative expression across the full electroacoustic genre. The portfolio of compositions will consist of arrangements made up from sound elements captured from within Sydney's central business district underground rail system, and reflects an intended artistic vision explored over three distinct compositional movements.

The first aim is to identify and digitally capture hi-definition stereo recordings within areas of acoustic interest. These areas include the sampling of inner-city subway platforms, rail tunnels and underground car park facilities. The focus is to sonically capture the acoustic properties and sound events occurring as a direct result of the daily human migration that accrues below the city of Sydney, with attention to recording both the existing biophony and anthrophony soundscapes. The sound recordings will then be used in exploring three individual frameworks including: how the audio recording can be used to express compositional structures; how integrating synthesis can influence new approaches in sound design; and what effects pitch and resynthesis have on the audio recordings themselves. This compositional portfolio and thesis aims to reflect a discussion of the composer's intent, with insights into new areas of electroacoustic music production aiming to widen the framework set by traditional electronic music compositional practice, and examines links between our man-made acoustic environments, and how they can both influence and create a unique artistic vision.

Table of Contents

List of Figures

Chapter 1

Introduction

1.0 Reflection and Background

Electronic music production, although not a new medium, in recent times is becoming more accessible to a wider mainstream community of individuals seeking to produce music under the newly formed title of electronic music producer. Through innovative advances towards user-friendly inexpensive computer-based music composition software, new classes of non-musically trained individuals are attempting to enter the mainstream music industry, taking advantage of these new production tools.

> Music technology is a natural component of this revolution, digital is not only sets of hardware or methods for composing and listening to (consuming) music; it has changed the role of music in modern life from a relatively context-dependent, social activity to an individualised and personalised production of experience (Rudi, 2015, p.34).

While innovation is an important consideration in the context of digital compositional tools, this movement by mainstream digital instrument manufactures towards building a non-musically trained generation of computer-based music composers, could be argued as destructive to the evolution of this genre. With this in mind, new approaches to electronic music production will need to evolve if we are to avoid a period of repetition and musical stagnation (Britton, 2016).

This observation lies at the heart of this compositional research. Over the past decade, as a composer I have personally only explored working within genre-based electronic music production. If indeed this new work, as suggested, is to approach and define new areas of composition, avoiding both personal and industry repetition, a

decision to move towards a more academic form of composition style will be explored throughout this research project by way of working within the field of electroacoustic music. Unlike traditional forms of electronic music from the past two decades that bases its sound design principles around ideas of electronically produced subtractive synthesis designed to produce or replicated the sounds of physical instruments, electroacoustic music, while sharing workflows and production environments with electronic music production, explores the use of audio recording and playback technologies to produce compositional structures that include the physical architectural space as part of a compositional process. Electroacoustic music also allows the composer to approach composition from the perspective of the contemporary artist, and move towards ideas of composing and arranging with recorded sound that is not limited to instrumentally produced music.

1.1 A New Paradigm into Reinterpretation Ideologies

The art of recognising environmental soundscapes occurring throughout traditional music compositions is to examine the work's structure, identify a relationship to its known locational influence and interpret an individual account of the actual environmental presence throughout the work (Drever, 2002). Each person's conclusion will be based on how the composer has chosen to reinterpret the aural location, and factor in his or her own individual account of the composition in question. This basic account of musical appreciation lies at the core of most environmentally reinterpreted musical experiences. However, since the incarnation of the industrial revolution, the ability to capture and play back audio has changed the art of reinterpretation from solely a musical instrumental form of expression, to exploring new composition ideas through electronic sound generation and the use of audio playback systems. This practice has developed new compositional means of expression, both in

musical base forms and expanding to areas of contemporary sound art, a form of musical expression that takes it influence when approaching composition from the contemporary artistic view point. (Litch, 2009)

With the aim of creating new paradigms surrounding reinterpretation ideologies, this research will explore the idea of using a collection of recorded soundscapes in a bid to communicate an intended locational compositional theme. This thesis, through a process of spectral analysis, will explore each recorded acoustic location, identify the existence of musical information captured with electroacoustic technology and later analyse the content with the use of spectral analysis techniques. In the tradition of Pierre Schaeffer's *musique concrète* philosophies, the proposed works will be built according to what audio content has been captured (Battier, 2007).

Identifying musical relationships occurring within recorded sound material aims to explore a re-thinking of the reinterpretation process. This idea of isolating each acoustic location allows the reinterpreted process to form the work's compositional structure in a more linear or animate way. Consequently, this allows the composer to become an arranger of sound, which forms the composition's structure, allowing the acoustic environment to become a reinterpretation of itself.

1.2 Creative context

Humanity's aural experience has dramatically changed over the century since the industrial revolution. For those of us living in mass population areas, our experience of the natural soundscape is predominately filled with the background noises of modern development and the constant drone of transport industries. Though this sonic change has not occurred overnight, those born and raised in the inner city confines can only guess how the past one hundred years of industrialism has changed our suburban aural environments. (Blesser & Salter, 2007; Truax, 2008)

When looking at architecture and other artificial public facilities, as suggested by Barry Blesser and Linda-Ruth Salter in their book titled *Spaces Speak, are you Listening*, note that buildings do have a natural built-in acoustic archival system, meaning they, without intention, pass on through the life of the building its acoustic properties that Blesser and Salter have termed this occurrence "a building's aural architecture". Furthermore "Historical evidence suggests that aural architecture resulted from unplanned and inadvertent acoustic accidents, which were then passed through the cultural filter of social and religious values" (Blesser & Salter, 2007, p. 64).

This may be the case for buildings with social and religious applications, such as churches and political meeting places of the past; however, when addressing public spaces with lesser social significance, the attitudes towards preserving the buildings comes from an architectural stand-point, and not from the perspective of preserving the building's aural signature. Therefore, unless the building's architectural form has some social need for preservation, original building technologies will give way to the newer techniques and without purposeful decisions to maintain or preserve past acoustic integrities, a building's identifiable aural architecture may be lost in time. (Blesser & Salter, 2007)

This observation raises the question of how our urban sonic environments can influence individual thought and creative practice. This explorative work aims to address this discussion of sonic preservation in the form of three electroacoustic/electronic compositional movements. By understanding the correlation between sonic phenomenon and musical artistry, new areas of expression can be reached and a permanent digital preservation of urban aural awareness made present. The compositional portfolio attached to this thesis will attempt methods of sonic representation and preservation by developing an adaptive method to the compositional process, while at the same time preserving the acoustic properties of the locations in

question. This means that no preconceived musical structure has been assumed, andonly the location audio recordings that encodes the aural architecture will be used as a means of creating the compositional structure. With this in mind, and by adapting a mode of re-composition by using a chosen acoustic environment around which to build compositional works, the aim is to directly respond to the question of sonic preservation. At the time the recordings are made, a moment in time is captured and a reformatted version of itself made identifiable through artistic expression. (Westerkamp, 2002).

1.3 Portfolio Framework and Creative Intent

The first composition will be built and arranged using only the recorded soundscapes taken from Sydney's underground railway systems. Methods of subtractive EQ, Compression, Low Frequency Oscillator (LFO) modulation and added reverberation, are the only means of sound modification. Starting with a process of spectral analysis, frequency content will be identified and documented for each stereo audio recording. This information will then be used to form the compositional structure and aid in the sound design process. By understanding the frequency content of each location's recording, compositional structure can be approached using newly defined methods of sound sculpting. This sculpting of sound refers to a process of identifying and layering recorded sonic events based on their closest residing fundamental frequency. Through a process of re-composing, the newly formed sound palette will then be arranged to form compositional Movement One. (For further information on sound sculpting theories, see Chapter 3, page 14)

The second movement will take its influence from a selection of supportive sound atmospheres taken again from Sydney's underground. Further to this, digital and analogue synthesis will be introduced to create an additional sound palette. Building the

synthesis sound design around the chosen supportive atmospheres will be the main compositional focus of this second movement. For example, the included soundscape will have its fundamental or closest fundamental frequency identified through methods of spectral analysis, then each analogue/digital synthesiser's voice will be designed based on these findings. An arrangement will then be made to continue with the intended artistic vision expressed throughout the first movement.

The third and final compositional movement will use a selection of captured audio from the first two pieces, and utilise them in the creation of a digital sample-based keyboard instrument. Each audio file will be placed inside Ableton Live's Sampler device (an open platform digital plugin device supplied with the digital audio workstation), then layered parallel to each other in the creation of a new playable instrument rack device. This device enables the user to layer soundscapes recordings for the purpose of recomposing sound to pitch. This idea is to see how the re-pitched versions of the same audio content can be re-composed, and to investigate the effects it has on the direction of the compositional movement in relation to the first two pieces.

This compositional work will use mainstream digital audio workstation Ableton Live, with the purpose of taking advantage of popular present-day electronic music production technologies. However, this work will not utilise any pre-set sounds, FX pre-sets or any other sound-making device that has been pre-manufactured by a third party manufacturer, nor use samples from any previously released or recorded musical content. All sound design throughout the supporting compositional portfolio will consists of originally recorded audio and manually tuned analogue/digital synthesis. All sound modification and manipulation will use the digital audio workstation-supplied devices working from their non-present initial state. The synthesis used will come from analogue/digital hardware instruments, starting all sound creation from its original unmodified voice parameters and working through the sound modification process until

the desired tones have been achieved. This framework has been set to allow documentation of the creative process and show how, with intent, an artistic vision can manifest itself from idea to the finished work.

This thesis aims to provide an individual's account, taking its form from a perspective of a modern day sound theorist and objectifying the realisations of an electronic music composer exploring sound theories and methodologies within the genre of electroacoustic musical composition. This personal account aims to give insights into newly developed creative processes with the purpose of exchanging production method ideas with a community that shares simular ideals, and to inspire a continuation of methodologies presented. Other topics of discussion this thesis will explore include the question of how sound sculpture can be viewed and used as a terminology for modes of practice within a modern electroacoustic composition and listing practices described and put into practice from author and sound art theorist Salome Voegelin (2011), focusing on her work described in *Listening to Noise and Silence*.

Chapter 2

Literature Review

2.0 Historical works

John Cage's lecture series *Silence*, written in 1961 could be considered one of the most important viewpoints relating to the sound art movement today, Cage forms a new philosophy of "what music is" and how it can be expressed without using traditional music practices.

> The composer or (organizer of sounds) will be faced not only with the entire field of sound but with the entire field of time. The frame or fraction of a second, following established film techniques, will probably be the basic unit in the measurement of time. No rhythm will be beyond the composer's reach. (Cage, 1961, p.5).

This commentary from the past suggests a future where the composer using the latest electronic technologies will have a limitless palette to work from, and must veer away from traditional composing methods in order to allow themselves to redefine what experimental music is.

While this thesis does not explore Cage's work in any detail, or practice his compositional methodologies, his work will no doubt be reflected within the idealism behind this thesis and portfolio of compositions, as his work has been extensively recognised and noted as being pioneering when dealing with ideas exploring sound in a composition format. It could be argued that Cage's influence will be present in any post-Cagean composition idealisms, whether with intention or not; this rings true in Julia Robinson's book *October Files*: John Cage, where she writes in her closing statement, following a detailed analysis of Cage's career - "No analysis of the history of this process can ignore the space cleared by Cage. In redefining the composer and

emphasising a complex, politicised model of organisation the creative means, Cage left a plan for an individual future" (Robinson, 2011,p.208).

Another key figure in the early sound theorist movement is R. Murray Schafer. His book published in 1977 titled *The Soundscape*, addresses new concepts for this time period concerning how sound is perceived. He opens up topics relating to new ways of defining sound and how it can be expressed as experimental forms of environmental awareness. He writes; "Noise pollution results when we do not listen carefully. Noises are the sounds we have learnt to ignore" (Schafer, 1977, p.4). His methodology in thinking aims to introduce new ways of approaching and perceiving our localised sound environments by redefining how we listen. Schafer unlocks our associations to noise and how it could be considered as a music event. His philosophy and attitude towards the sonic environment is key to understanding how naturally occurring and artificial sounds can be considered works of compositional art or "sound art." Schafer has been identified as being the first to coin the term "soundscape" and uses it to describe and classify individual sound generators found in both artificial and naturally occurring environments, and how they can work together to create sonic landscapes. Through categorisation, sounds become layered environments, and by defining and understanding each element, Schafer argues that a better understanding of humanity will be arrived at (Schafer, 1977). The term acoustic ecology also refers to Schafer's works as a whole and offers a wider perspective within the genre of sound composition. Other works by Schafer that need to be mentioned resulted from his collective World Soundscape Project, that itself resulted from a direct response to the changing sonic landscape of Vancouver. His intentions at first with the group were to bring attention to noise pollution through extensive recordings of the inner city aural environments. Though not as successful as the group's later works exploring the more positive aspects of soundscape recording, it is widely documented that these series of recordings are the

beginning of a soundscape environmentalist movement, and widely influenced other genres, including sound art and avant-garde noise works (Drever, 2002).

This application of recording sound for artistic purposes does resonate through the ideologies to this compositional work and thesis, and although not a direct continuation of Schafer's work and teachings, this body of work must acknowledge and appreciate a mode of influence. These influences are obtained mostly in Schafer's move to push the environmentalist message through his soundscape work, though this work is not a direct response; there is a subconscious afterthought of environmentalism to the portfolio present here. By presenting the underground recordings in a compositional format, one could draw their own individual conclusions about whether or not this work is an act of environmentalism. However, it is the intention to present this series of sound works without a positive or negative standpoint, only exploring the chosen acoustic environment for artistic expression and to leaving the political agenda to each individual's own conclusions.

When combining the philosophies of Cage with the principles and techniques explored by Schafer, the portfolio of compositions attached to this thesis will no doubt inherit some influences from both these artists. Though without a direct intention to carry on the work of both these individuals, it is for this purpose that these two artists' works are referenced only in this chapter.

2.1 Modern Perspective on sound art

The book by Salome Voegelin, *Listening to Noise and Silence*, is a collection of essays and articles formed around an artistic sound art perspective of listening. From the viewpoint of the sound artist and active listener, her work moves from philosophy to descriptive methods of the listener as a listening practitioner. Her work could be considered a continuation of Murray Schafer's, and attempts to not just highlight the

importance of understanding sonic environments, but to investigate the role the individual plays as listener, and their connection to the artist or musician. Voegelin's aim throughout this series of critiques is to approach each sound work from the prospective of the listener as an active participant of the pieces in discussion. By becoming part of the works and not just an observer, she argues one will obtain a deeper understanding of what the artist/ musician was trying to achieve and develop an individual perspective of their own experience of the heard.

> Listening is a subjective task that demands an attending engagement with the work for the time it plays rather than for the time I am prepared to listen, I am producing the work in my temporal presents, and that may take a while. (Voegelin, 2011,p.27)

This work is important to understanding and defining the connections of both elements involved in any type of listening act from the perspective of composer and listener. When identifying each role, we can see how similar both activities can be. Voegelin takes her influence and philosophy methods from both John Cage's and R. Murray Schafer's work, and puts them to work through these listening critiques and observations. Instead of only philosophising, Voegelin puts these teachings into active listening practices moving the research of sound art forward. This research aims to take these ideals by examining Voegelin's listening practices and implementing them as a composer. (see Chapter 4, page 24)

2.2 Reflections on Classification

John Young's thesis *Source recognition of environmental sounds in the composition of sonic art with field recordings* (Young, 1989) argues that when using recorded material for an interpretive compositional purpose, a mode of classification is important when compiling audio material for compositional use.

> Essentially, models of environmental classification deal with either of the two fundamental ways in which such sounds can be approached, as being either concrete, as literal reference or indicators of the object and situation in the environment form which the sounds arise, or abstract, the purely acoustical sensation of the phenomenon of sound itself, as patterns of initiation and resonance, without regard for the literal source of the sound. (Young, 1989, p.4)

This classification process, while providing clear indicators and guidelines could place limitations on the experimental behaviours when exploring new modes of electroacoustic compositional methods. The very nature of experimentation should free itself from classicisation in order to progress from existing works. The portfolio of compositions this thesis will hypothesise aims to use recorded material in a more linear fashion, meaning to work with the captured source material letting the compositional work base its form and structure around the actual recorded sounds, whether as indicators or literal reference. While it is important to maintain a creative direction throughout the works, the classification process outlined in Young (1989) will not be utilised in order to maintain creative freedom of expression.

Mitchell Akiyama's paper *Transparent listing; Soundscape Composition's Objective of Study*, investigates the known links soundscape compositions have to musicality, and its relationship to modes of documentary. Akiyama's view resides in noting the link between the recorded and source location, Akiyama writes; "soundscape compositions are an ontological study that reflects the environment they are taken from" (Akiyama, 2010). Akiyama also points out that a clear distinction between soundscape compositions and electroacoustic exists through processes of classification that define one practices apart from the other. Akiyama writes:

> In contrast with acousmatic forms of electroacoustic composition which advocate an abstraction of sound in order to cultivate a practise of reduced

> listing, soundscape composers have argued that the transformation of source material beyond the point of recognition is undesirable. (Akiyama, 2010,p.54).

This idea that soundscape composition should reflect its place of origins and contain elements of sonic preservation, is a basic requirement that make up the traditional ideals of soundscape composition. However, when this work is then presented within a new context such as an exhibition space or experienced through personal playback systems, the question is then raised, should this work now reside in the electroacoustic music form of classification? While classification is important to paint a clear distinction between genre definitions, it could be said that this distinction interferes with the individual evolution of the composer's artistic intent. Should, through a process of artistry, a work be free to move from its intended genre definition? Will the work be abandoned as a result? Or should the modern sound artist be free to express sound works free from the restrictions that are associated with genre definition and modes of classification?

These questions will attempt to be answered by approaching the portfolio of compositional movements, with the intended aim to express compositional sound structures that free themselves from the restrictive state that exists when working within genre-based forms of expression. This will aim to encourage a move towards producing a body of work that is influenced and shaped around a chosen acoustic environment, allowing the works to naturally abstract from its original sound texture if so desired.

The next chapter opens up the discussion of possible use of sound-sculpture as a descriptive means for describing the process of working with digital sound from the perspective of a modern contemporary digital sculptor of sound.

2.3 Recent Australian Influence to the Sound Works Genre

Jordan Lacey's book titled *Sonic Rupture: a practice-led approach to urban soundscape design* (Lacey,2016*).* explores topics surrounding acoustic ecology, soundscape design by way of field recordings and a detailed account of the creation process of a practice based artist from the perspective of both the artistic practitioner and sound theorist. This work successfully produces new theoretical approaches and exchanges new knowledge within the sound genre. The work presented throughout this thesis resonates some of Lacey's main topics such as capturing and defining individual sound generators that make up an inner city soundscapes identifiable sound distinction. Also his approach at presenting these soundscapes to individuals from a removed perspective, while not in the same expression outlet as this thesis work, it is an identifiable connection. This idea to extend a listing practice that is removed from the soundscapes, original environment lies at the core of this practice based research. Other similarities to Lacey's work can be found through the detailing of a sound practitioner presenting his work, while defining production methods discovered as a result of process and the inclusion of a theoretical discussion of ideas put into practice.

Another Key Australian figure found working within the sound genre is artist, musician and curator Lawrence English. Like Lacey, English's work deals mostly with sound recordings, though from a different abstracted perspective of environment, which include elements of a more musically influenced approach to composition. The term musically influenced is used because when focused listening is applied to English's work, there is a distinctly purposeful move towards musicality, hints of tonal colour, key and a familiar musical arrangement to composition, lie at the hart of his works noisiness. His recent album titled *wilderness of mirrors* (English, 2016) explores the composition of sound/noise through a musical approach to both production method and song layout. When observing Lacey's ethnographical and environmentally driven

approach to sound installation and comparing it with English's more abstracted reinterpreted approach to sound composition. It can be noted that Lacey aims to bring the soundscape to his audience outside of its original location, while English through compositional practices, hides its original soundscape within layers of noise and planed chaos. These two individual approaches to sound composition will no doubt have an influence on the compositional approach, presented throughout this thesis. While the underground environments explored for compositional purposes do hold on to their original soundscape identity, there is a purposeful move towards abstraction and musicality.

Chapter 3

Ideas For New Sound Work Approaches

3.0 Defining New Working Spaces and Terminologies for Sound Sculpture

Sound sculpture today can be defined within many sub-genres of artistry, but are more clearly evolved by the merging of two independent art practices, sound art and the building or sculpture of non-musical base machines that generate sound by either human interactions or through a process of mechanical self-perpetuation. The historical context of this practice arose from musicians wanting to break away from traditional confines of orchestral composition throughout the late 1950s. The Baschet brothers, two French composers, have been the first to coin the term “sound sculpture”:, while seeking out new musical experiences they developed entirely new instruments that produce non-musical sound within the context of a sound artist. This practice paved the way for new works that explore sound in the compositional form, and saw the beginnings of a newer contemporary sound art movement as in “Sound sculpture i.e. sculpture produced with an inherent sound-producing facility, as opposed to a musical instrument crafted to produce specific pitches is the oldest form of sound art.” (Licht,2009)

While this practice has been identified and worked within a context for more than five decades, sound sculpture still finds itself difficult to define as a single practice. Falling into categories of sound art while sharing the contemporary idealisms of a practicing sculpturist has led to what Vadmin Keylin states in his article *Corporeality of Music and Sound Sculpture; a blurring of genre definition with all parties laying claim to this artistic practice.* (Keylin, 2015). He argues that to understand the numerous definitions of sound sculpture one must first look at its historical development and relate it back to its musical foundations. Once this has been hypothesised, one can view

the many sub-genres as a whole, and paint a clearer discourse of study (Keylin, 2015). Keylin's theory of merging sub-genres attached to sound sculpture highlights the importance of relating this practice back to its musical foundation and contributes to ideologies expressed concerning how to approach and practice sound sculpture in today's digital environment. Taking this into account, Keylin's thoughts surrounding sound sculpture and acknowledging its relationship to musical backgrounds brings attention to the need for new working spaces and terminologies to be identified when connecting this practice to our modern digital age.

3.1 Identifying New Design Environments for Sound Sculpture

The idea of reworking the processes attached to traditional sound sculptural practices aims to widen the framework already set in place by original practitioners' standards. When the two words "sound" and "sculpture" are used together, they traditionally describe a sculptural work that produces sound, however, when this practice is explored in the modern age, a new working space must be identified when exploring the digital domain as the sculpturing plain. This claim comes from the realisation that when dealing with audio manipulation, viewed from the perspective of a modern day sculpturist, a new use for this terminology can be realised when describing methods of sound design while working solely within the computing domain. (Sterne, 2006)

This use of the terminology also aims to give the listening participant a clearer insight and better understanding of the work involved when undertaking a modern sound project. When describing methods used throughout the sound design process as a form of sound sculpture, this descriptive nature behind the use of words aims to better formulate the objectives and methods used throughout the production of the work in question.

3.2 Background into the use of Sound Sculpture Terminology

This need to reinvestigate new terminologies for practicing modern sound compositions comes from a viewed perspective, and the realisation of a paradigm shift in discourse concerning the past two decades of sound-related composition. The portfolio attached to this thesis, in the attempt to explore new areas of sound structures, has approached methods of production from both soundscape and electroacoustic style of composition. The aim is to produce a body of work that reflects an artistic intention, without the need to abide by genre-related requirements. This blurring of genre definition could be argued as a result of recent modern computing technology developments, allowing the modern digital composer the scope to freely explore sound composition without the restrictions that once came from expensive, unattainable audio equipment, as when this practice was in its yearly years of being defined (Britton, 2016). This ability to freely work from small home studios using powerful, inexpensive audio equipment has given the independent artist the means to express artistic purpose through any means they wish. This, and also having the ability to communicate and experience the world stage through the internet, has contributed to the cultural barriers of the past having all but been taken away. Barry Truax, in his article; *Soundscape Composition as Global Music: Electroacoustic music as sound scape*, views similar ideals concerning the effects that technology advances have had over the years on sound work compositions. He writes, "At the professional level, the electroacoustic community, like many other sectors of society, is becoming increasingly global in its communication practices, mainly through the internet" (Truax, 2008, p.104).

Truax, being one of the individuals that helped pioneered soundscape practices and terminologies, comes from the age where sound work studies primarily came out of the university institutions and from a time when the ability to share works and ideas came only through closely connected circles. In this 2008 article, Truax elaborates his

observations and concerning thoughts on the progressive state that modern sound works are currently in, he objectifies whether the abilities individuals have now to practice and communicate ideas through global channels will inspire uniformity or diversity (Truax, 2008)

When an analysis is made of early works in this field, the paradigm shift in discourse becomes evident with a change of thinking, considering the use of sound as a means of artistic expression. This becomes apparent when noting how soundscape studies have evolved from sonic awareness to the more modern musicality approach to electroacoustic sound structures. This continuation of an evolution in sound work studies, and definitions, could be argued as a direct response to advances in audio technologies and the accessibilities that come from global communications.

This thesis is arguing the latter, but still observing the fact that advances in technology have influenced how individuals approach and work with sound. David Brooke Wetzel considers technology advances concerning the involvement of electroacoustic integrations with traditional musical performance, a barrier for most traditional performers. In his publication *A Mode of Conversation of Interactive Electroacoustic Repertoire: Analysis, Reconstruction, and Performance in the Face of Technological Obsolescence,* he outlines the need for a simpler standardisation of technology that any performer can easily intergrate into a performance without the need for elaborate audio engineering expertise. Wetzel writes:

> In the case of interactive electroacoustic music, therefore, it may be necessary to separate the music from its original instrumentation in order to ensure its long-term survival. For each new work, not only will the technology used at the time of composition become unavailable, but eventually so will the composer. (Wetzel, 2016,p.274).

Wetzel's consideration for technology standardisation, although not a direct link to this

thesis hypothesis, still acknowledges the impact technology has had to working practices attached to electroacoustic works. These considerations come from a rapidly progressing sound genre that overlaps its basis, covering multiple genres and hints at the need for a merging of genre definitions to allow for clearer purpose to sound composition progression that won't interrupt the experimental nature of sound works.

While it is apparent that technology is impacting the way individuals approach working in sound composition, it could be argued that its effects are both positive and negative. When considering the need to repurpose and approach terminologies when describing production methods surrounding audio editing, a need to consider technology advances will no doubt need to be considered. This novel way of working within the digital domain across multiple media platforms, has introduced new opportunities to not just repurpose sound location recordings, but to easily manipulate these recordings to the point of creating completely new audio material. This practice has grown from our abilities to merge methodologies of soundscape composition, while investigating and integrating methods familiar to electroacoustics production.

3.3 Using Sound Sculpture as a Descriptive Compositional Terminology

The possible use of sound sculpture as a descriptive compositional term has been identified through the development of Movement One, the compositional work attached to this thesis. When approaching the post-recording phase (see Chapter 5.4) a form of digital audio sculpting has been identified and put into practice. This method is best described through the development of creating new modes of sound that form its basis from a collection of recorded acoustic profile. This method comes from working with digital audio in such a way as to remove certain frequencies while layering and combining similar recordings containing acoustic properties, in the act of creating new sound experiences.

This practice of recording digital audio works and placing them into today's modern digital audio workstations for editing and composition purposes, is a practice shared by the majority of audio engineers, music composers and sound designers. These practices have allowed the modern musical composer, unwilling or not, to learn and practice skill sets of all three industries. "The field of music technology is by definition interdisciplinary" (Landy, 2013, p.459). In fact, musical arrangers and composers today will need to utilise computer based compositional tools as a necessary means to becoming both employable and encompass the ability to share and release their material, across a new digital landscape of online sharing systems.

The approach to sound design throughout the portfolio attached to this thesis shares simular sound editing approaches used by the film and television industry. For example, a common practice for film sound designers is to take a sound recording, that is, taking a location recording and manipulating it to the point where it can be used to express a totally new sound application. Mark Underwood, in his article *I wanted an electronic silence, Musicality in Sound Design and the Influence of New Music on the Process of Sound Design for Film*, suggests that, resulting from a century of cinema, an overlapping of film scoring and sound design techniques has resulted from a shared compositional environment that modern digital technology has brought to the industry. He also notes the similarities sound design techniques have to electronic music production, and identifies how the two practices are being utilised to create new sound possibilities."Starting with THX 1138, Murch's film sound work brings together many of the techniques and philosophies of new music. He deconstructs sounds, alters them, uses them rhythmically, places them in a world context." (Underwood, 2008),

This manipulation of sound using processes of time manipulation, subtractive equalisation and adding of artificial reverberations, are techniques that can be described as, and relate to processes of, sculpting digital audio material. The art of taking an

original sourced audio material and designing new aural experiences from its core structure as described by the process of digital sound sculpting, is the foundation to the hypothesis within this chapter.

3.4 Describing Methods of Sound Sculpture through a Visual Colour Chart System

The process of describing sound-based compositional editing as a form of digital sound sculpture, raises thoughts on how digital sound can be represented visually, and how its structural form can be expressed when little to no traditional musical information exists. To help define this idea, and back up the notion that sound sculptural works need not to contain a physical instrumental element in order to remain a sculptured piece, a profile of the sound works has been identified through the creation of a visual chart that correlates how the audio frequencies sit within the stereo field, its individual volume of loudness for each of the subgroup layers, and through the use of a coloured block system, a map illustrating the final compositional structural form. By understanding the visual representation to each sound element, what frequency content is being used, how it has been layered and where it sits in relation within the stereo field, a model of the sonic work can be realised and the compositional work expressed visually. The visual chart also aims to express how the sound works can be viewed from a visual perspective, how each sound element can be broken down to its frequency sub-groups and how the listener perceives the listening space created by the sound works. When an individual experiences a series of sound works with the ability to see how the works have been composed and what sound elements have gone into making up the composition, a form of sound sculpture can be realised and a visual account of the work understood. (See Fig 1.0 below, for the completed visual chart to composition Movement One from the portfolio of this thesis).

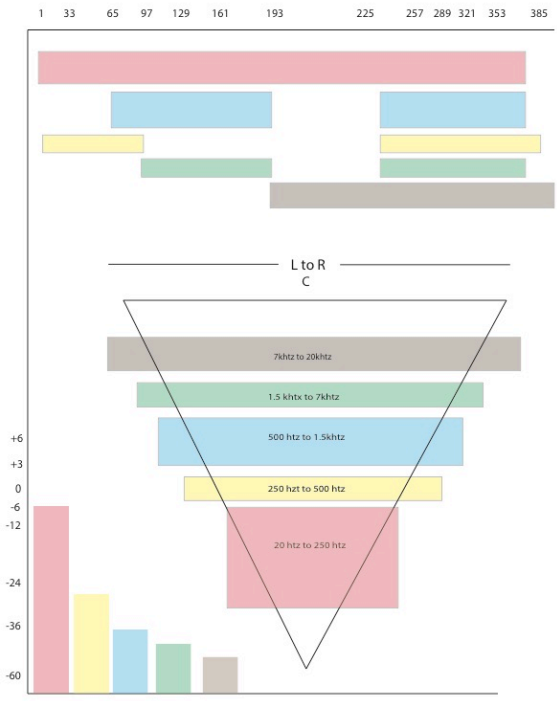


Fig 1.0 Illustrates the visual perspective to Movement One. Starting at the bottom of the chart, the graphic blocks indicate each frequencies subgroup of loudness relating to the master fader inside the digital audio workstation. The triangle represents the stereo field and how each subgroup sits within it. The blocks at the top of the chart display how each subgroup has been composed throughout the composition. The numbers are equal to the musical bars retaining to 120 beats per minuets. The colours are used help to maintain continuity as they match the colours used through the Ableton Live project file and relate to each subgroups frequency content.)

In summary, this chapter reflects the objectives that have resulted following the act of producing the portfolio of composition attached to this thesis. By keeping an open-minded approach to the framework surround production ideas and composition techniques, the process has opened up the discussion surrounding the use of sound sculpture as a terminology used to describe a modern approach to digital audio editing and sound design techniques used, although its use is widely known to define Sound Sculpture as a genre unto itself. The descriptive nature behind its meaning, when viewed from a modern perspective of audio editing, with the distinct purpose to sculpt new sound material from existing source materials, should at best be discussed for future working methodologies.

The next chapter proposes a personal reflection on descriptive listening practices, and aims to give an autoethnographic look into how a composer approaches and defines subject matter.

Chapter 4

A Dissertation of Listening Practices

4.0 Background

The underground for most of the city's populace is a place simply used to commute to work each day. It serves the purpose of reducing the amount of traffic within the central business district and helps move the daily migration of the working class from their homes in and around the city limits, to its centre, where the majority of its professional positions are held. As a result, the underground tunnels and walkway systems have created a sub-environment with its own unique sonic fingerprint. For the purpose of this series of sound works, identifying the underground system's acoustic profile i.e. sound recordings containing acoustic properties, will be the first stage to better understanding this sonic environment. This attempt at defining the underground's acoustic profile is derived from methodologies described in Voegelin's book *Listening to Noise and Silence.* Her discussion of detailing the heard, with a clear purpose towards artistic intent, aims to bring forward a new aural consciousness of the now. Through a method of practicing listening with purpose, new appreciations of sound art awareness can be shared and understood. Voegelin's practiced method of listening has been employed throughout the pre-production phase, and on reflection helped formulate the foundations and approaches that have gone into the making of this series of sound compositions. This new distinction of purpose is to become an objective listener with intent, and not just a user of its means. Through the process of gaining a better understanding of the underground sonic environment, it has been important to view its characteristics from a removed perspective, to observe with intent and to allow the environment to influence creative thought and purpose.

4.1 A Personal Testimony of descriptive Listening

Note: This personal testimony is derived from a collection of field notes written for creative purposes and does not claim to reflect a scientifically correct evaluation of the acoustic profile throughout the locations discussed. This personal account aims to give an individual interpretation of an aural environment and illustrates an artistic background to the portfolio's approach to methodologies.

Friday 8.15am October 17th 2014, Devonshire Tunnel and Central Railway Station

Entering the Devonshire Tunnel system from the Railway Square entrance via George Street, leading you under the traffic and towards Central Station, is the first encounter with the underground subsonic environment and the first place explored with an objective of practicing listening with a creative intent (See Appendix 1.0) The term sub sonic environment is used to describe the unnatural artificial element to the aural experience, the two words are separated, so not to confuse with term "subsonic" which normally describes machines that travel at less than the speed of sound. The word sub is shortened and refers to the subterranean nature of the location, while sonic refers to its acoustic profile and presence of sound.

When first entering the walkway, I am surrounded instantly by a drone of footsteps traveling both to my left and right side, this convergence of bodies traveling with equal purpose immediately dulls the sound of the city's traffic that now fades to a soft continuous murmur from behind. Being the fastest route to Central Station by foot from the adjacent bus stop, a mass of bodies converges at the tunnel's entrance which funnels the flow of commuters together like a tightly-packed group of salmon struggling to swim upstream. This new aural awareness is met with a strong silent gush of forward moving wind that meets you when first entering the tunnel. This pushing of wind can best be described as a welcoming ceremony performed by the underground system, and

marks the beginning of this new subsonic environment. As the tunnel slowly unfolds, the inner tunnel's acoustics become more present as the nature of the porcelain tiles that cover the walls, floor and ceiling reflects sound in all directions. The only acoustic absorption comes from the mass of bodies mainly travelling in the same direction towards Central Railway Station. The movement of their bodies consists mainly of a strange polyrhythmic shuffle, produced from men's hard leather shoes scraping the ground and is accompanied with a sharper, fast transient attack of woman's high-heel shoes that seem to tap along with the less audible shuffle of fabric rubbing together produced by the mass of forward moving bodies. Occasionally, random coughing or the occasional artificial sound of a mobile phone breaks this rhythmic sound. Behind all this human-produced sound lies the drone of the tunnel's acoustic profile, it seems to hum a continuous tone and one can only image its similarities to being stuck inside an air-conditioning vent.

As we all progress further down the tunnel, sub-frequencies are now emerging and sitting behind the sound of the moving crowd. The omni-directional nature of sub-frequencies makes it hard to detect the location of its source, but the occasional rumbling sensation hints that it's the trains passing underneath our feet that produce this ominous event. I stand to one side now as we approach the halfway point to allow the commute to continue without me, the soundscape becomes less identifiable, the sound of people now blurs and becomes lost in the flow of movement that reverberates from both directions; the-sub frequency rumble is now the dominating sound source, and I am standing, eyes closed, stationary, and with purposeful intent while practicing listening with artistic intent. The idea to isolate each sonic event during the recording phase comes to mind. When breaking down the soundscape into its individual sound sources, it becomes evident that the underground itself is a composer of sound, and

when brought to attention, this audible material could be used for compositional purposes.

Moving again with the crowd of commuters towards Central Railway Station, the acoustic space begins to open up and become wider, with higher frequencies seeming to now be able to reflect due to the larger space and the flow of bodies now breaking off to three separate locations. The first change to the soundscape profile when leaving the Devonshire Tunnel is the clicking sound of the ticket machines sucking in people's daily or weekly train tickets. It starts off from the distance, but as I move closer, fills the acoustic space with an off-tempo click-clack, followed by the harsher deeper sound of the gates opening and closing. This strange automated sounding aural environment reminds me of a food processing line within a manufacturing plant. People silently approaching the ticketing gate line, waiting for their turn to be processed. Now past the gates, I head to the lower underground platforms, via a downward moving escalator. This people-moving automated system has its own unique sound profile, its rolling wheels vibrate through your legs and produce a pulsating hum like that of an oscillating square wave tuned to sub-frequencies. A push of wind greets me again, like when first entering the tunnel system, and is followed immediately by the distant sound of trains approaching from below. The platform itself is a new soundscape onto itself. The noisiness of approaching and leaving trains eliminates any human-produced sounds, and the room's acoustic profile is filled with mechanical noisiness. My aural consciousness becomes filled with the grinding of metal on metal and there is nothing I can do to escape its presence, "this sound is all there is". I walk to the end of the platform and sit at the entrance of the subway tunnel. I wait for the approaching sound of the next train. The acoustic profile of this new space is wide and free of early reflective sounds, unlike the first aural experiences of the Devonshire Walkway. With this new larger space, longer reverberation time is evident and made clearer when the

train announcement's chime is played over the loudspeaker system. It comes to life with the sounding of three distinct bell-like notes, followed by a female voice announcement; at times, two overlapping announcement occur producing from where I sit at the end of the platform a washing of tonal colours with the acoustic space adding to its textures by echoing certain phrases.

Looking down the abyss of the rail tunnel entrance (see Appendix 4.0) I am filled with a lightheaded uneasiness and reminded of the horrors that could meet anyone game enough to enter its blackness. The tracks now begin to vibrate and are followed with a familiar gust of wind; the onset of low frequency rumbling begins to fade in towards the station. A few seconds after the gush of wind subsides, the approaching train bursts into the platform filling the acoustic space with the scraping of train brakes and the sound of multiple engines winding down. (see Appendix 4.1) At first, this aural space is just white noise and almost reaching my personal threshold of sound tolerance, but after a few seconds of chaos the soundscape begins to wind down as the train's speed slows and eventually comes to a stop.

The second location of acoustic interest has resulted from this same evaluation process as previously discussed. The underground parking facilities found throughout the city's CBD show equal potential as a suitable location for exploiting expressions for sound composition. Through this first personal exercise in listening, the same evaluation process has been attempted and is worth documenting here, to paint a clear picture of artistic intent and communicate why this location is suitable for recording acoustic profiles.

Friday 3.25pm October 17th 2014, The QVB Multilevel Underground Car Park Facility

After sound walking with purposeful listening throughout a number of underground car parks facilitates, I came across the Queen Victorian Building's (QVB)

car park (See Appendix 2.0). By entering through the entrance provided for vehicles, the acoustic profile immediately becomes apparent. Like that of the underground walkways leading to rail platforms, this acoustic space, right from its entrance, has its own distinct characteristics. Unlike the busy multifaceted commuter space that contains many different layered sound environments, the car park was empty and free of closely occurring acoustic events. This did not invoke a realisation at first; however, when proceeding to the lower levels of the underground facilities a new sonic experience was taking shape, and its presence becomes clearer. It's the silence that appeals most, and until now was never a pre-empted consideration until this exercise in listening had been practiced. Sitting there still, for quite some time, against the far wall to level six (See Appendix 2.1) the absence of closely occurring noise sources reveals the acoustics of the space, and the idea of capturing the location's acoustic profile becomes apparent. This term "acoustic profile" is used to describe the physical acoustic space that is free from sonic events that occur louder than the space's naturally-occurring noise floor. The thought of recording a room's noise floor, both straight after a noise event and during a period of silence, aims to capture the acoustic profile of the underground space in question. Moving around this enclosed space I notice how its characteristics change as I move from its walls to the centre. A definite signature of the space are car doors opening and closing. When not on the same level, they appear to contribute random sub-frequency pulses. As the door is closed, the low-end frequencies are really all that can be heard through the layers of cement. Footsteps are the other contributors to this acoustic space, both of other people using the facility but mostly my own. When practicing listening with so much attention on the micro acoustics of a location, the acoustic response of my own feet scraping on to the hard concrete surface dominates this unusual cave-like acoustic space. Its effects could be described like when caught in a snowstorm, the density of snow acts as an acoustic absorber blocking out the rest of

the word, creating a bubble-like effect, with your individual movements the only sonic events being heard.

This act of listening, based on practices and experiences detailed throughout Salome Voegelin's (2010) book, *Listening to Noise and Silence,* has been the most important contributing factor influencing this compositional work. Before undertaking this listening exercise, the idea existed to record the city's underground facilities for re-compositional purposes. But just how to approach this process was far from being realised. This act of self-evaluation has led to a better understanding behind the nature of how the underground acoustic environments behave. It has brought about the attentions to micro-sonic environments that occur within larger soundscapes; it has shown that an acoustic space, even when silent, can have unique, useable sonic characteristics.

Chapter 5

Compositional Movement One

5.0 Defining use of Terminology

It is important to note at this point the idea behind referring this series of compositions as three compositional movements, and not recognising them as individual arrangements or songs. The term, Movement, usually relates to a body of work residing in the format of an orchestral symphony. This traditional format usually consists of four compositional movements, all conforming to a strict body of musical form. The usual format consists of an opening Sonata, a slow movement referred to as an Adagio, a Minuet and closing, again with the Sonata. Though this body of work is not a score written for orchestral instrumentation, it does express three notions of idealisms that reflect through each of the compositional arrangements. Each of the compositions conforms to three separate research-based ideologies in the attempt to formulate a continuation of process and aims to objectify a complete body of work that is based on a predetermined artistic intent. By setting out three distinct compositional conclusions, each of which related and attribute to simular ideals and production methodologies, the aim is to carry through each movement a similar sonic voice that resonates a completed body of work.

5.1 Details of Recording Equipment Used

It has been acknowledged through the active listening practice described throughout Chapter 4, that the main goal to the field-recording phase is to identify and digitally capture the micro layers that exist throughout Sydney's underground transport facilities. Capturing the entre sonic fingerprint as individual layers of sound, will potentially supply the arrangement phase to Movement One with enough audio

resources to produce a convincing body of work that resonated the intended artistic theme.

As for equipment being used, a decision has been made to invest in the best portable audio recording device available at the time of the recording phase. When attempting to record sound events that occur only a few decibels above the location's noise floor, high quality professional microphone pre-amps were required, given the recordings would mostly be of a higher gain structures; the ability to record at 24 bit/96khz will also be important as large digital dynamic range levels were needed to be maintained to support the editing phase should multiple stages of compression need to be applied (Mennitt & Fristrup, 2012). It is for this reason that the 702 two-channel portable audio recorder from Sound Devices was chosen. It is well regarded throughout the post-production industry as the professional industry standard when attempting field recording. The microphone chosen for audio capture throughout this recording phase is an XY formatted stereo condenser, the Rode NT4. The choice to record in a stereo/two-channel format has been made given the majority of recording has been identified as attempting to capture the enclosed acoustic sound signature i.e. a sound event characterised by a repeatable occurrence within an acoustic space, free from closely occurring sound events. This decision to record only in a stereo format is based on an evaluation of what the majority of the audio recordings would need to be presented in. Because that most important format to the project is stereo, a decision to convert louder, more direct signals to mono during the mixing phase seems, at this point, like the best working trade-off, as the project's budget does not support the purchasing of two microphones, one stereo and one mono. Capturing a stereo signal also allowed for a decision to be made in the future, to mix the audio in a 5.1 format; while this will not support a true 5.1 recording by definition, it will be attainable and a suitable option if the desire presents itself at a later stage in production. The objective behind the

recording phase is not in reproducing a perfect acoustic model of representation, but to capture the acoustic properties i.e. a sound event shaped by its acoustic enclosure, in an attempt at retaining elements of soundscape recognition. It is, however, the intention to represent the aural location as best as possible, but not allowing this process of sonic representation to obstruct the project's artistic goals or objectives by investigating difficult scientific base audio engineering methods of acoustic modelling.

5.2 Recording Methods Used and Observations Made

The detailing of recording methods and documentation of personal observations described throughout this section aims to produce a body of work that reflects the perspective of a composer, and anticipates a form of influence or continuation of the process explored. The act of capturing audio of the underground rail systems, walkway tunnels and car park facilities occurred over a two-year period. All the audio that has been used throughout the compositional movements has been captured within two separate recording segments, for example: Movement One's audio has been recorded and utilised from a collection of recordings put together from a single block in time. This will maintain the movement's sonic representation as a moment captured throughout a particular time period. The second recording segment occurred 15 months after the first recording phase; these audio files have been utilised throughout Movements Two and Three.

Movement One's arrangement from the start of this compositional process has been identified to be made up from only the audio recordings, given this framework as described in Chapter 1, the recording phase has produced a number of creative and engineering challenges. It should be also noted that the actual recording for this first movement has taken the longest out of the three to objectify and complete, due to unforeseen production limitations and difficulties in producing the final result. These

difficulties will be identified throughout this chapter, and show documented solutions that have manifested as a result.

The first locations explored for recording are the walkway tunnels used by commuters to gain access to rail platforms. Locations noted are; The Devonshire walkway described throughout Chapter 4 (See Appendix 1.0); Newtown's walkway tunnel leading under the tracks towards the Train Station (See Appendix 3.0); and the many underground platforms and walkway tunnels found throughout Central Station (See Appendix 3.1). Also explored is the tight crawl space found underneath the train line at Circular Quay Station. The method of capturing sound is directly taken from the film and TV industry, it consists of a stereo microphone encased within a blimp and mounted on a two-metre extending boom pole. This method of sound capturing allows for ease of transport and eliminates any unwanted sound of wind that may pollute the audio signal. It has also proven to be beneficial to accessing high or hard-to-reach aural locations. The field recorder Sound Devices 702, is placed in an over-the-shoulder style carry bag allowing headphones to be used to monitor the audio signal. This location recording system has been chosen to allow for easy movement from location to location on foot, while being able to capture high quality audio without movement restrictions.

The first difficulties noted throughout this first session of recording, was the time it takes to capture the indented soundscapes of interest. Having a train pulling up or pass through a particular location on observation, has resulted in producing different sonic responses according to its speed, direction and placements on the tracks above. This observation has led to unforeseen lengthy waiting periods when trying to capture each different acoustic response throughout the tunnel systems. Another difficulty and probably the most apparent problem faced throughout the entire recording phases came from simple timing issues. Trying to capture an acoustic sound signature without the pollution of other sonic events occurring outside the chosen location i.e. human,

mechanical or public announcements over loudspeakers. Attempting to capture the sound signature of the Devonshire Tunnel (the actual ambient sound of the tunnel system itself) is a relatively easy task to objectify, when observing without a recording device (Zhao & Malik, 2013). However, a recording device, on reflection, does not have an interpretive means of isolating each sonic event like the human brain achieves, in real time. It simply records what's within its capabilities. This subconscious isolation of each sonic element that exists as a natural humanistic ability has not been a factor taken into to account until reaching this final stage of the productions development.

> While it is an interesting discovery and important to be mentioned here, human cognitive responses to sound verses a machines ability to record it, does not fit within the scope of this thesis framework and for this reason will not be followed by a full scientific evaluation of this occurrence, however it should be documented here to encourage further inquiry. (Smiley, 2015).

The response to this observation above has resulted in a change of plan for how to approach the recording process. Instead of turning up to each location and waiting for an appropriate time to record each space, a more detailed plan has been put together before any attempt to record again. This guideline has been put into place so as to take full advantage of each week's recording routine, as there are limits to how much time can be spent on each location. These guidelines are simple and as follows: each sonic location has been identified in two distinct categories - close microphone placemat, and ambient sound recording. By definition, close microphone placement recordings are utilised for sounds produced by mechanically occurring or human interactions throughout an acoustic space. The close microphone method has proven to be the easiest method of collecting sound material, by turning up the gain and placing the microphone within centimetres of the sound event, leads to the rejection of ambient sound occurrences in and around the acoustic location. While this technique is good for

capturing individual sound sources, it is not effective when attempting to collect a large architectural sound signature. The ambient recordings, by definition, are detailed by the absence of these mechanical and human sonic responses throughout a space. A new plan to record these ambient signatures is to approach recording times throughout the week that are not as congested; night time and early mornings on weekends are noted to be the best available time to record and are noted upon reflection to be the most successful (Smiley, 2015). While these times have provided the best sonic outcomes it is worth noting that the spaces are still quite difficult to record in; no city's public space is really ever free from unwanted noise outside of the desired room's ambient signature. However, through persistence and over the 15-month period a large number of recordings have been achieved with a total of 45 individual sound files captured and used through the development of Movement One.

5.3 Audio Categorisation Process

During the recording phase a process of categorisation has been identified as the best method of storing the audio files. When listening back to the day's recording session, each usable file has been saved in its related recording technique of close/ambient and sorted into its dominating frequency content. For example, the ambient recording is placed into DAW Ableton live; a quick look at its frequency content is made through a spectral analysis plugin, the audio file is then labelled and sorted into its category of Sub/Low/Mid/High frequencies. Having this basic file management system has also given insights on how to approach the compositional structure, by identifying the range of dominant frequencies throughout each individual audio files leads to the idea of how each recording element can used to form the movement's body and compositional form. This observation of process forms the foundations that sound editing and layering, when dealing with audio manipulation, can

be viewed from the perspective of a modern day sculpturist, (See details throughout Chapter 3)

5.4 Method of Sound Design Techniques

Truax (2010) said "Soundscape composers use a variety of electroacoustic techniques to expand the communicational scope of their compositions beyond a seemingly literal representation of actual soundscapes." The process of sound design begins with the layering together of recorded soundscapes using DAW Ableton Live as the sculpturing plan. Through spectral analysis frequency content will be identified starting with the sub-frequencies 0 to 125hz, then by grouping each sound relating to its spectral category of Sub, Low, Mid and High frequencies will form the new sonic experience and begin the foundation to start the re-composition process. (Zhao,2013) Starting with a process of subtracting equalisation each audio waveform will have the usable frequency content isolated by subtracting any unwanted audio material. How the unwanted audio content is determined comes from identifying the soundscape's dominant frequency content or closest residing, all other audio content outside the usable frequency material will be removed using a hi and low pass filter together in combination i.e. (Band Pass) within the working space of Ableton Live. (see Fig 2.0 below).

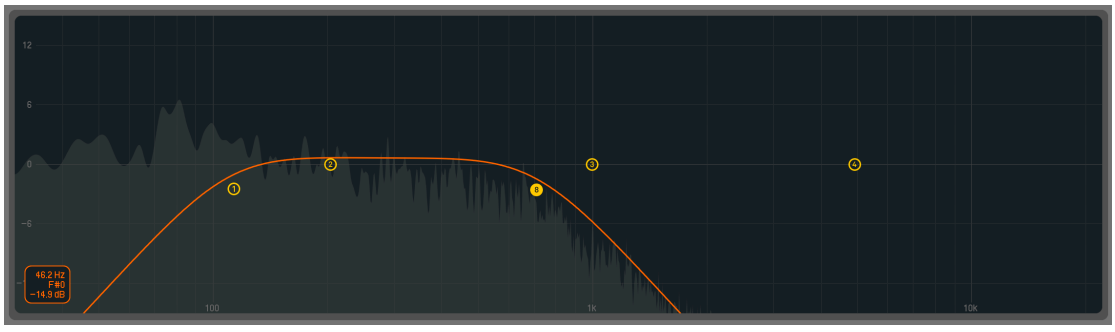


Fig 2.0 is an example of a sound recording placed in Ableton Live. It shows the audio content in the form of a spectral wave highlighted in grey. The graphical representation of the filter curves indicates that from 46.2hz to 1khz is the audio being used while the rest of the audio content outside these frequencies has been removed.

Working within the digital audio workstation Ableton Live, each audio recording will be placed within an individual audio track and coloured according to its frequency content illustrated in Chapter 3 (Fig 1.0). This process of categorisation allows each individual sound element to then be grouped together within a sub track to allow for easier handling of large volumes of audio material throughout the audio mixing process. By identifying each ambient recording and how it sits within each subgroup is the foundations of the compositional process. When hearing how each sound file plays back when grouped together with simular sounding atmospheres, a new form of sound expression becomes apparent. From an engineering standpoint, each audio track is approached with the same audio processing technique. The first stage of processing is subtractive equalisation (see Fig 2.0); this will allow for any unwanted audio frequency content to be removed and lets the usable frequency content be focused on. This process will not include the boosting of any frequencies allowing for the composition's stereo space to be filled with only originally recorded content. The second device in the chain is compression; this stage of audio processing is used to boost the audio signal while evening out its dynamic range. The third stage in processing is adding reverberation to the signal. It was never the intention to add artificial reverberation to any of the recording signals when formulating this project from the beginning stages, however, upon reaching this sound design stage it has become apparent that the composition will benefit by adding some space and colour to each of the ambient signals. The aim was not to distract from the original signal but to allow each audio file to breathe in its own space, following this decision the result has meant that each ambient recording is now working together more effectively, resulting in new forms of sound while maintain its original distinct sound signature. The technique of adding reverberation has been approached by an untraditional method of application. By standard engineering practices, time-based FX are usually applied to a

signal via a return and send bus, keeping the FX device separate from each individual audio track while allowing each track to then be sent to a single reverberation unit via a send and return track. This technique is used to allow for individual audio tracks to be processed by signal reverb unit, allowing the artificial space to be applied to all tracks within the recording session. (Case, 2007). For the purposes of this project it has been decided not to work within this traditional methodology, but to apply an individual reverberation plugin to each ambient track and work through its non-pre-set state till the appropriate level of sound modification has been applied, based on each individual sound element. This method has been chosen as each recorded acoustic atmosphere has its own distinct characteristic, when working within the traditional method of applying FX, the individual element of each signal was lost through the nature of using a signal reverb device. To understand the signal processing and sound design arrangement (see below in Fig 2.1)

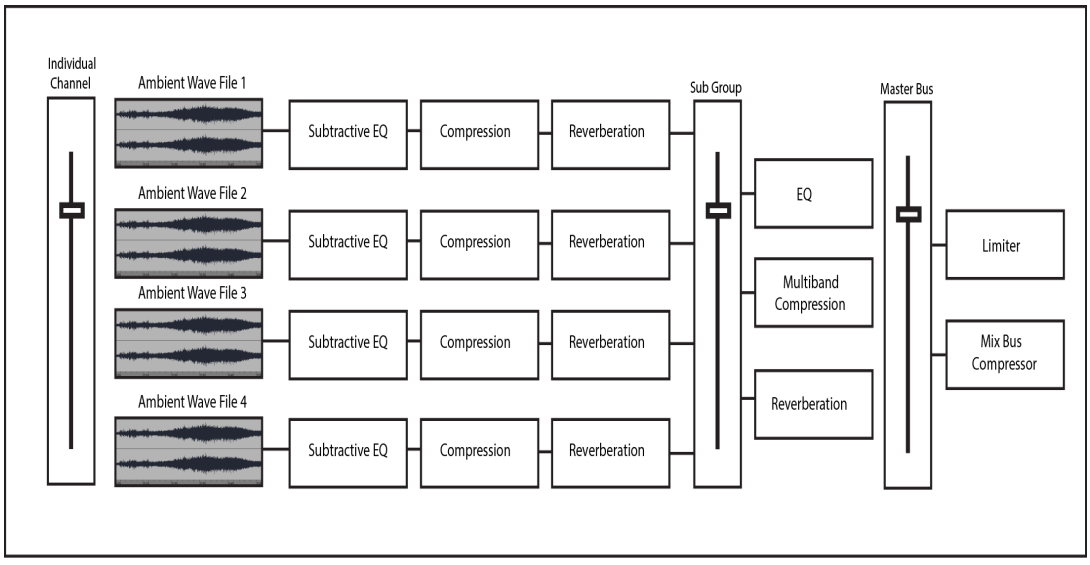


Fig 2.1 Illustrates the FX and sub-grouping technique used throughout the sound design method to Movement One. The diagram indicates how each audio wave form is placed on an individual audio channel, it then works through the FX chain through to the sub-group then through to the master bus This method of arranging audio signals also demonstrates how a form of sound sculpture can be achieved.

5.5 Method of Compositional Arrangement

With the sound design process complete, all individual tracks are now placed within their frequency related subgroup, the arrangement process can now be attempted. (see Fig 2.2 below)

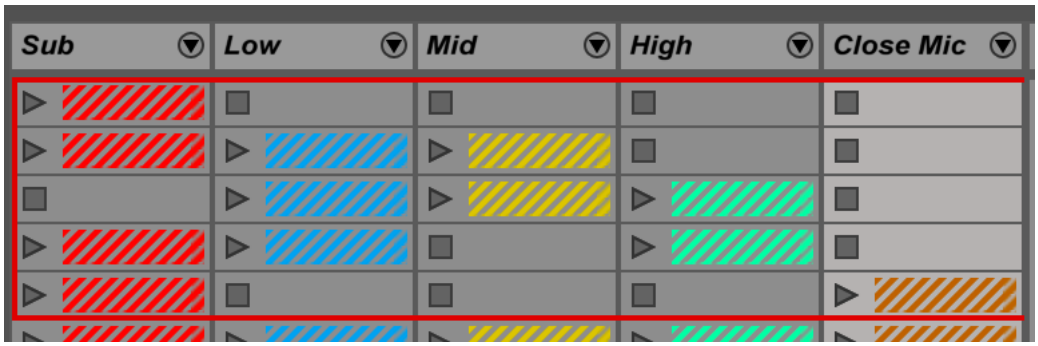


Fig 2.2 is a screen shot taken from the Ableton Live's session window of Movement One; it shows from the session view window, five subttracks and how they look before the arrangement process starts; each colour relates to its frequency content and microphone techniques used (see also Fig 1.0).

When attempting to arrange the collection of sound recordings, a clear picture of how to approach this process has not yet been predetermined until this point. When all of the tracks are played simultaneously they do portray a massive unworldly soundscape that is reminiscent of the chosen aural locations. But when attempting to arrange this newly sculpted sound material, the challenge was to keep the composition interesting and clear in purpose. When the comparison is made with the choices and tools a traditional composer has when arranging, the absence of key changes, adjusting tempo and abilities to change instrumentation choices become apparent. The challenge to keep the composition interesting while moving forward without becoming too repetitious has been approached through a process of audio analysis. When assessing each of the audio waveforms that have been captured throughout the underground locations, the realisation to form the compositions structure based on a single recorded event

manifests itself into being. The audio waveform in question has been captured from the end of a railway platform in Town Hall Station. The recording was made by placing the microphone as close to the mouth of the tunnel system as possible. The recording starts at the first signs of the approaching train (See Appendix 4.0), it continues recording as the train burst in to the platform (See Appendix 4.1) and finishes as the train comes to a halt (see Appendix 4.2). When an analysis is made of this recording both aurally and visually, its compositional structure is viewed as a means of influence supporting the method to approach the Movement One's overall arrangement structure. (see Fig 2.3 below)

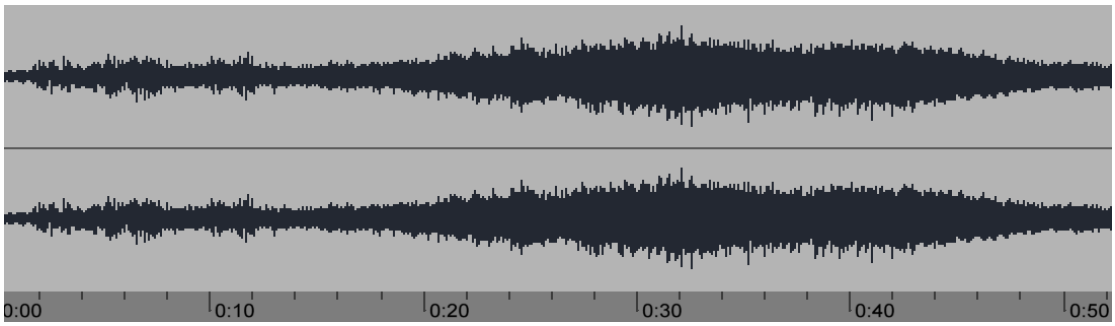


Fig 2.3 is a screen shot taken indicating the digital audio wave form of the audio file used for compositional structural influence for Movement One, it's the recorded sound of a train approaching Central Station located within an underground platform.

The audio event used for compositional influence was chosen because it embodies a complete representation of the sonic characteristics explored throughout this research-based compositional work (McCartney, 2002). When an analysis is attempted aurally, a map of its structural form can be realised and documented. The recording starts with the introduction of sub-frequencies produced from the motion and weight of the train pushing through the tunnel system. As it moves closer, the tonal signature becomes more familiar with the introduction of the train's engine to the soundscape. With every second, the train approaches closer, more volume and frequency information is being added to the overall acoustics tonal shape. This succession of events then builds

to the eventual crescendo of white noise as the train enters the rail platform. The noisiness of soundscape at this point is all that is present, the sound of trains braking system scrapes metal on metal and the engine winding down fill the space with an osculating noise that when reaching its peak, quickly reduces in volume and comes to an eventual stop, leaving the space with its engines idling a low frequency hum (Rennie, 2014). This aural analysis of the recorded event answers the question of how our sonic environment can impact and be utilised as a mode of compositional influence. From this observation a system of structure can be formulated and described.

Movement One begins with a fade-in introducing sub and low frequency, as the composition continues just like the sound of the approaching train, more frequency content is introduced. The Movement then fades back to introduce different tonal colours and close mic sound samples, then, like the introduction, builds slowly again introducing more sound information till its inevitable crescendo of white noise, influenced directly by the train's sound signature i.e. a sound event characterised by a repeatable occurrence captured during the original stereo recording. When the Movement reaches its peak it then quickly reduces in volume and sound material, just as the approaching train winds down to find its position within the train platform before moving off again (Drever, 2002). When a visual comparison is made of both waveforms, the completed Movement bounced down to a stereo file (see Fig 2.4) and the original recording its compositional form is based on (see Fig 2.3). A visual likeness can be identified. To allow the Movement to explore and profile all of the different acoustic locations recorded, two build-ups were necessary to build tension and fill out its compositional form; the first fade-in being to introduce and contextualise theme, and the last to convey the approaching noise of the train entering the platform.

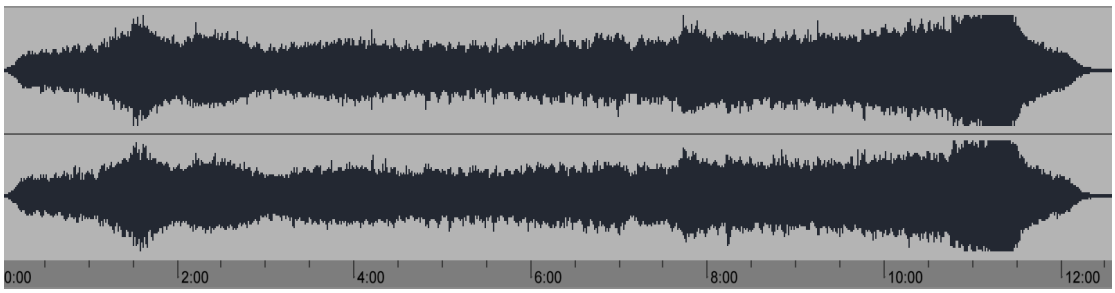


Fig 2.4 shows the stereo waveform of Movement One's composition. It indicated the visual likeness to the shape and succession of the original source of influence shown in Fig 2.2.

Chapter 6

Compositional Movement two

6.0 Methodologies to Compositional Structure

The approach to the second movement detailed throughout Chapter 1.3 is to record a second series of field recordings maintaining the original artistic intention and methodologies expressed throughout Movement One. The goal of this second composition is in demonstrating the influence the recorded soundscapes have on the sound design processes to digital and analogue synthesis, and exploring how the two audio mediums can work in combination forming new ideas of sound work expressions. This method of compositional exploration aims to highlight new working practices for the electroacoustic artist, while providing a new resource of practice from the perspective of the composer.

The compositional process begins with the recording of six newly identified underground locations with a concentration on capturing the acoustic profile of each space. This method of recording aims to capture the ambient soundscape free from interferences of unrelated noises. The locations explored include Town Hall railway station's numerous walkways tunnels (See Appendix 4.0 to 4.2), and Wynyard CBD underground car parking station. (See Appendix 1.2), Having intentions already in place and now being well versed in recording sound in these environments, each location was captured with minimal effort and complications.

6.1 Sound Design Processes

Using the same categorisation process detailed throughout Chapter 5.3, each audio recording is analysed by way of spectral analysis, and any undesirable audio content removed through a process of subtractive equalisation. Six ambient locations have been used in the making of this second movement, all of which, when playing

together, form a suitable new sound palette i.e. the overall tonality of the composition of ambient recordings that will support the sound design process for digital and analogue synthesis. When all of the six audio recordings are played back simultaneously, a spectral analysis has been taken from the sub-group output. When observing the absolute frequency content formed by this new sound material, the results indicate a possible insight regarding how to approach the integration of sound synthesis. When actioning this method, it reveals there is no identifiable fundamental frequency present; however, there is an identifiable peak forming at F3 to the lesser F#3 or around 171hz/175hz. This occurrence shows promising results and will be a starting point for sound design processes to sound synthesis integration. (See Fig 3.0 below).

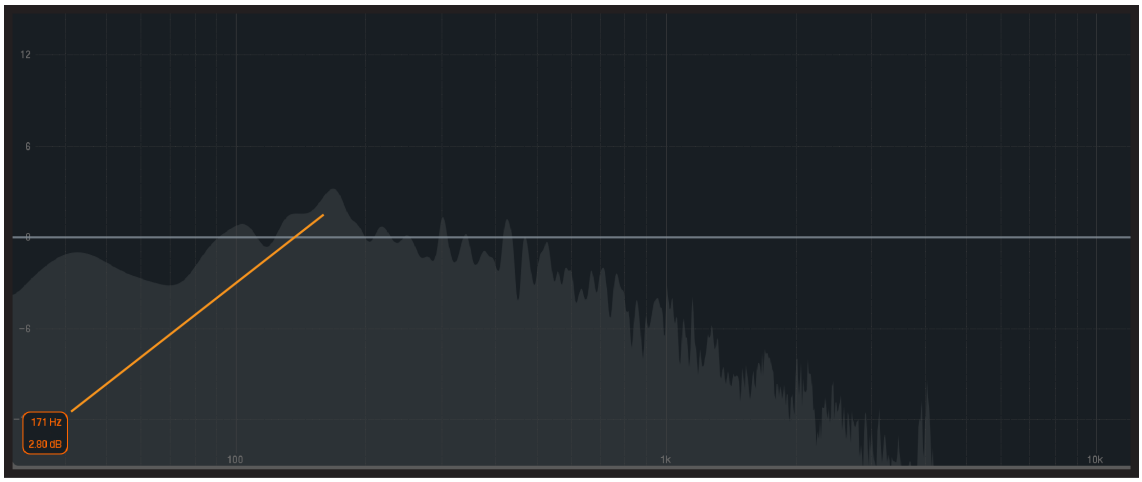


Fig 3.0 Indicates the presents of F3/F#3 or 171hz illustrated by the grey spectral peak forming from the analysis of the ambient recording's subgroup output. This is clearly not a fundamental frequency given the amount of noise surrounding the peak and indicates no obvious presents of additional partials or additional harmonic content. The analysis does show a potential for oscillation harmonisation and the possible integration of sound synthesis.

The choice to start synthesis integration using the virtual analogue plugin device named Anolog, supplied with Ableton Live, is based on the fact that it's the easiest method of application to start exploring possible sound design choices. It's a digital plugin that's already wired within the digital compositional platform and replicates a

two oscillator subtractive analogue synthesiser. Based on the description of process throughout earlier chapters, the choice to utilise mainstream technology will also benefit a continuation of process, as the device is readily available to the Ableton Live community. The sound design process begins following the observation of the peak found at around F3 when analysing the output of the sub-group track of all six-field recordings; the synthesis will base its design around this note. By creating a midi track clip within Ableton Live's session view, then drawing a F3 midi note out in the length of 4 bars, the Anolog instrument device is then added to the signal path. Using the device in its non-present initial state, the next step is to choose the appropriate oscillator types and apply sound shaping techniques till the desired outcome is achieved. (See Fig 3.1 below for the complete sound design details used).

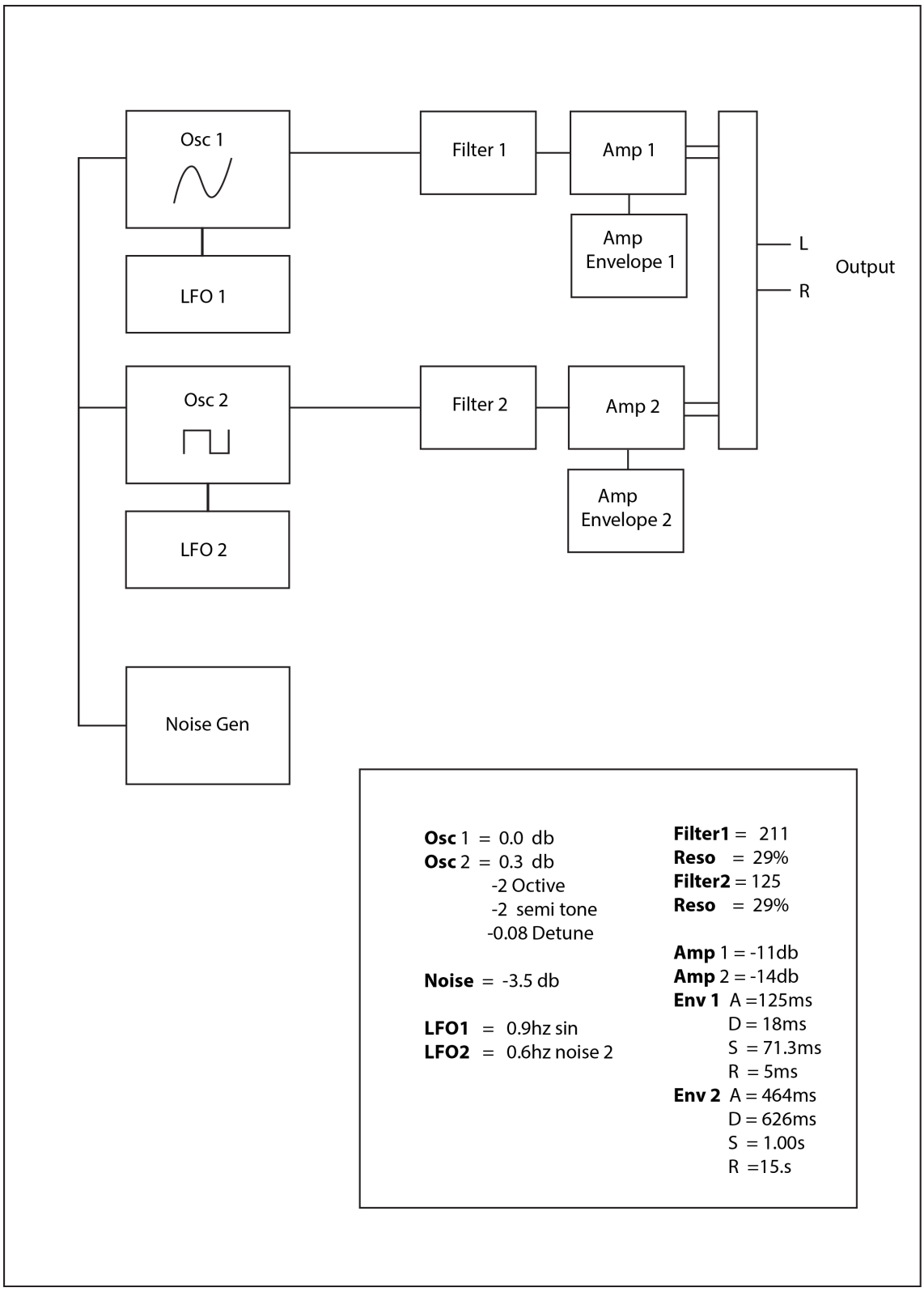


Fig 3.1 Documents the first sound design example used to integrate sound synthesis, the block diagram indicates a basic indication of the signal path used to produce the desired tone using Ableton Live's plugin synthesiser Anolog. It details all the parameters modified to complete the desired sound palette, this has been included to allow for third party signal reproduction and to allow a clearer insight to methods used.

The method of sound synthesis integration has been achieved by approaching the sound design process in a way to not detract from the original sound palette. This means sound synthesis comes from an attempt to harmonise with the ambient recordings in a bid to add to its sound palette without introducing new or separate sound identities to the composition. It is apparent through this exercise that in order to integrate these two sound materials successfully, sound synthesis has to be approached through a processes of mimicking the original ambient profile. This has been achieved by selecting parameter changes to the initial state of the instrument that reflect and support the ambient sound recordings. The process starts with oscillator choice and how the two are mixed together, a key method applied to the synthesiser was to de-tune the second oscillate by 0.08 % and automate its corresponding LFO. This setting helped to achieve harmonisation that is sightly dissonant in its application. To successfully integrate the two sound materials, the synthesis choices have resulted in forming long droning noise base sounds that contain highly resonate modulating harmonic content. Further to the sound modification changes to sound synthesis outlined in Fig 3.1 above, a number of FX devices have been introduced to further enhance the sound synthesis; this method of adding FX comes from the additive synthesis methodologies aiming to achieve new tonal characteristics to the signal path. These sound modification tools have been used to apply audio compression, signal delay, filtering modulation, bit depth reduction, LFO modulation, resonance boosting, enhancing harmonic content and artificial reverberations.

With a desired sound achieving audio integration, the digital synthesiser is then duplicated five times. A series of modifications were then made to each new instrument to further enhance the original synthesis idea. These modifications include oscillation variations both in choice of tone and tuning, amp and filter changes to attack, sustain and release times, and new FX chain variations based on the original settings. The goal

to adding the extra instruments is to fill out the sound space to include a wide range of frequency content that further enhances the original sound palette, without detracting from the original intended artistic intentions and to add sound material options for re-compositional purposes.

The next method of sound design explores the introduction of analogue synthesis. The instrument of choice is the Moog mono subtractive synthesizer sub32. Working from its initial state again, sound modification process has been approached through mirroring the sound design palette achieved through digital synthesis detailed in Fig3.1. Because its sound is produced and controlled by voltages and not produced digitally, this action of introducing analogue synthesis to the composition has produced interesting results. Given that the analogue tonal characteristic employs more harmonic content to its signal generation process means that the actual tones produced by the Moog synthesizer appear to sound more musical when placed within the digital compositional environment. While the debate is well documented towards the argument of digital vs analogue (Conversation with Bob Moog, 2015), the characteristic differences between the two have never really been a factor worth mentioning as an electronic music composer. The fact that the two mediums are just different tonally and harmonically has meant in the past that the two contrasting elements have worked well together when approaching composition from a musical perspective. When working in the field of electroacoustic composition, it has proven a difficult process to remove the musicality elements that this particular analogue synthesis produces. It should be noted that working with an analogue signal generator for this type of sound works at this stage in the sound design process, although it has been challenging to achieve the desired results. Being a mono signal, rich in harmonic detail, and working with Moog's recognisable latter filter has produced only dominating sound signatures to the overall mix. Further audio manipulation had to be applied to the analogue signal to successfully

integrate this new sound element within the compositional environment. Integration has been achieved mostly by way of audio shaping in the digital domain after recording the instrument using digital filters and multiple FX delay and reverberation stages. This process, while detracting from the original idea of analogue integration, has produced the desired result.

6.2 Compositional Analysis

With all the sound elements working together forming new experiences of sonic expression through the process of harmonisation documented in Chapter 6.1, the compositional process now starts by grouping the three elements into their audio origins of ambient recordings, digital synthesis and analogue synthesis. The compositional goal to this second movement is to present all three sound elements working together, forming new sound work experiences while maintaining a continuation of artistic expressions of compositional Movement One. This continuation has been achieved by organising the compositional structure to flow throughout the arrangement demonstrating both its exploration of sound signal integration and how they are able to work in combination without just producing three different sound ideas.

The composition starts with the introduction of each ambient recording slowly fading in, until all six architectural locations are playing together. The aim to the introduction is to build the sound work's identity presenting the underground recordings without the presence of sound synthesis; further to this, is the opportunity to highlight the ambient recordings tonal characteristics starting the movement with a recognisable sound palette based on characteristics explored throughout Movement One. By 1:53 min, each of the digital synthesis elements has been introduced allowing for the harmonisation process to be presented. By this point in the composition a continuation of Movement One's ideals have been fully reintroduced and the continuation into new expressions of synthesis integration marking the second movements identity is now

fully evident. The aim of this section of the composition is to demonstrate how both sound elements can work seamlessly together producing, through its sound design intentions, a new form of sound exploration.

At 2:15 min, all but one track remains of the ambient recordings and the analogue synthesis is slowly introduced. The aim of this part of the composition is to demonstrate how the two forms of synthesis can work together expressing the sound design elements influenced by the ambient recordings, and how they both can continue with the movement's overall theme without the listener being aware that it's only the synthesis being played with one accompanying ambient recording. By 5:30 min, this theme fades out to introduce the middle point in the arrangement by taking out the synthesis containing high frequency sound material and leaving only the darker tonalities to the piece; this also aims to provide the piece with dynamics representing a rest period from the earlier noisiness. At this point, a new sound element is introduced, being a digital synthesiser reproducing the sound signature captured in the Town Hall car park facility. This aims to artistically reproduce the aural experience of being within the deepest part of the underground station while adding new textures to the composition. At 10:50 min, the piece moves into its closing stages by slowly reintroducing all sound elements. This finale expresses the completed sound palette achieved when exploring how to successfully integrate sound synthesis with electroacoustic ideals in ambient sound recordings. This process directly answers the question raised in Chapter 1.2 on, "how our sonic environments can influence individual thought and creative being" with intentions to integrating these sound materials ambient recording and sound synthesis; composition and sound design choice has been directly driven forward by the presence of real world acoustic environments and could have only manifested in this way as a result of the work's creative intent and the continuation from themes expressed throughout Movement One.

Chapter 7

Compositional Movement Three

7.0 Methodology to Compositional Structure

Compositional Movement Three bases its design principle around a continuation of the first two movements by employing methods of multilayered sample based re-synthesis to the recorded underground locations. This will be achieved by utilising eight of the recorded soundscapes, taken from the first two movements and using them to build a sample-based playable keyboard instrument plugin, within the digital audio workstation Ableton Live. The focus of compositional structure will centre on how the underground recordings are affected by pitch, and how, when working within a musical based environment, a continuation of the original work's theme can continue throughout its compositional development. This third movement aims to explore methods of electroacoustic design within an electronic music production environment by investigating forms of soundscape composition directly influenced again by the underground sub sonic acoustic environments.

The introduction of this third methodology of compositional structure showcases how, through artistic intent, a continuation of process can lead to an exploration of new working environments for electroacoustic compositions. This process also aims to introduce new methodologies to composers, by organising the sound palette in way that musically-trained individuals can reinterpret this philosophical based medium within a familiar musical working space.

7.1 Exploration into Micro Sampling Techniques.

The working space used to build the intended sample-based keyboard instrument will be the device known as an "Instrument Rack" within popular DAW Ableton Live. This compositional tool allows users to layer, edit and organise audio samples across

the 88 notes of a digital keyboard. This tool can be saved and recalled for use in any Ableton live project. It is for this purpose it will be utilised.

Choosing which audio samples to use will go through the same categorisation process described throughout Chapter 6.1. An analysis is made through visualising each audios waveform, this, in turn, will indicate each audio's closest related fundamental frequency and determine its best position within the full octave rage of the midi piano roll. A selection of both closely-occurring sound material and acoustic profiles are selected, based on their ability to provide a variety of textures and suitable sound signatures. The aim is to create a playable instrument that is able to compose a complete arrangement, being multilayered in its design and able to be modified in real time adding both musical interest and functional playability. (see Fig 4.0)

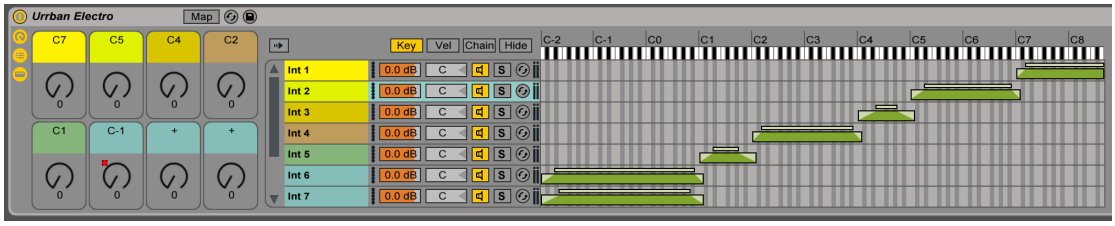


Fig 4.0 Shows the finished instrument rack device within Ableton Live. It indicates how each audio sample is placed within the 88-note range of a piano; the device has been colour coded to make each sample easy to identify with each sound's corresponding macro adjuster.

When first listening to how each sample plays back within its chosen octave range, an unexpected result occurred. While the categorisation process has indicated the most suitable position of each sample within the keyboard instrument's limits, it has produced unfavourable results. The audio, while retaining its original sound signature, has not introduced or provided the compositional movement with any new or original sound exploration possibilities. The previously-used sound material when responding to musical key changes has not moved the sound design process into new areas of design

concepts, and when investigating the playability of the instrument plugin, it is at best a reinterpretation of Movements One and Two.

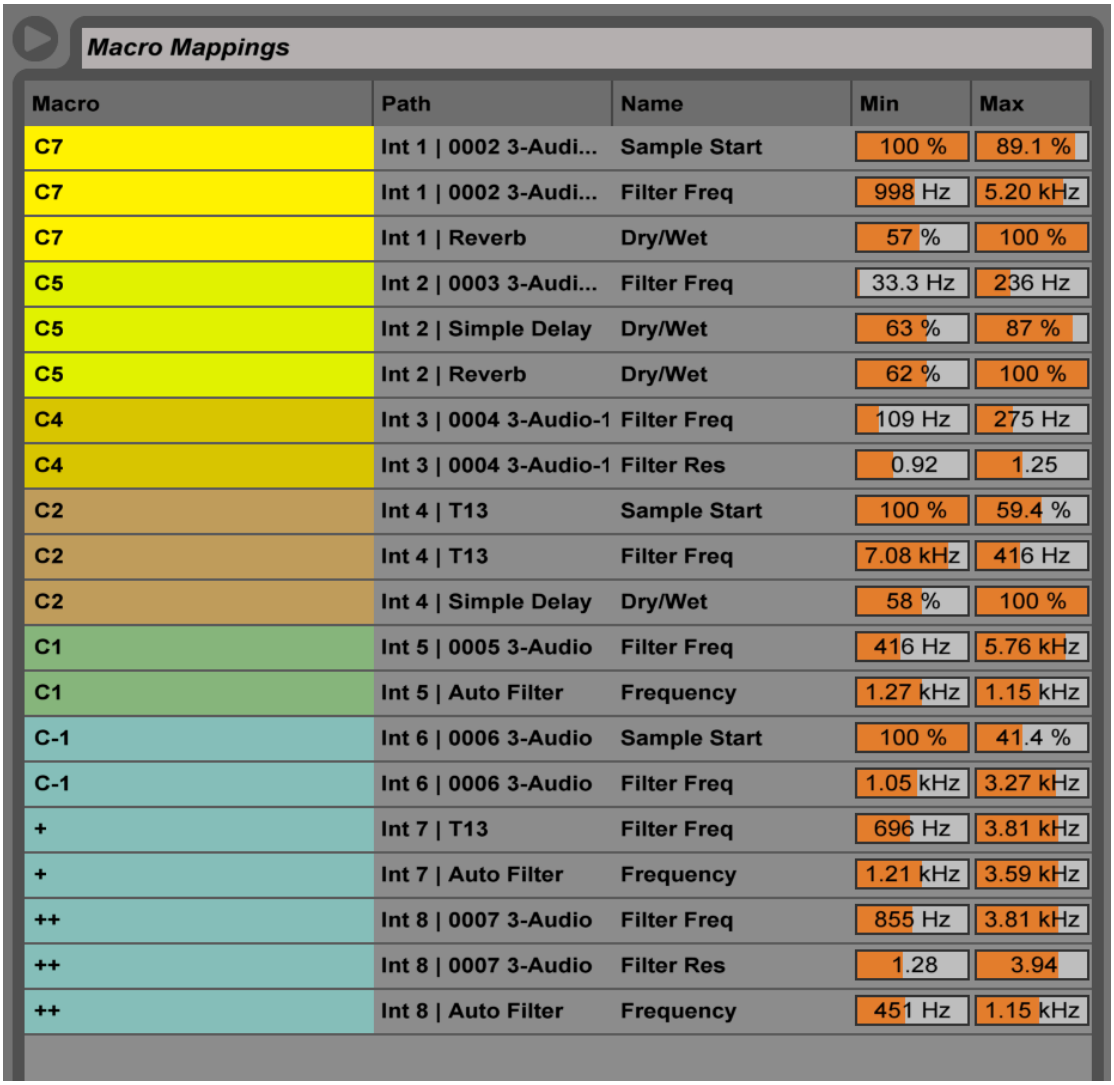
From this early observation within the sound design process, different approaches to exploring the underground recordings has been attempted. Ideas explored were automating the sample's start and stop positions as each note is being played; stacking all eight samples so that they all playback together when one note is played; and experimenting with numerous FX devices on each audio channel. All of these ideas, while producing promising results, were still not moving the composition into new areas of possibility. It was during this pre-phase to sound design process that the thought to explore smaller regions of the audio sample came into being. Zooming into the micro regions of each sample and looping its playback until a new resonate frequency is produced, yielded the most exciting results. This new resonate frequency produced from the existing sound material has allowed the composition process to explore new ways of reinterpreting ideas already expressed throughout Movements One and Two, while still using the previously-used sound material but in the way to express entirely new areas of sound exploration.

Fig 4.1 below shows how each sample is placed in Ableton Live's simpler device within the Instrument Rack, and set up to employ the use of micro sampling.

Fig 4.1 Illustrates how each audio sample is set up to play back the micro regions of the audio as seen in the top area of the plugin device illustrated in the yellow area, where 0.001 milliseconds of audio play back is being looped when playing a note on the instrument rack device.)

In addition to exploring micro sampling, each instrument layer has had to undergo further audio processing to achieve a final result. The new resonate frequency produced by looping extremely small proportions of audio within a selected note value, requires a chain of FX processing to help maintain the movement's sound signature. This has been achieved by applying an additive synthesis approach to the FX chain. The aim to this process is to add space, duration, texture and resonance to each instrument layer in the bid to produce new sound material based on the original audio recording's sound signature. The FX chain starts with a stage of compression followed by filtering and the adding of resonance textures by a plugin device named Corpus. This device enables audio signals to add variations of different resonances based on textual themes like string, tube and plates. Next in the chain is delay, then the final stage is the adding of artificial reverberation. All instrument layers have had this same FX chain added to their signal path; individual parameter changes have been made based on each individual instrument's desired tonal outcome. Also, to further enhance the playability of each instrument part, a macro control has been mapped to each layer to introduce changes to textual response. The macro mappings have been added to create expression and movement to the composition, allowing the user to automate certain parameters

during the arrangement process. A full list of macro control parameters can be viewed in Fig 4.2 below.



Macro Mappings

Macro	Path	Name	Min	Max
C7	Int 1 | 0002 3-Audi...	Sample Start	100 %	89.1 %
C7	Int 1 | 0002 3-Audi...	Filter Freq	998 Hz	5.20 kHz
C7	Int 1 | Reverb	Dry/Wet	57 %	100 %
C5	Int 2 | 0003 3-Audi...	Filter Freq	33.3 Hz	236 Hz
C5	Int 2 | Simple Delay	Dry/Wet	63 %	87 %
C5	Int 2 | Reverb	Dry/Wet	62 %	100 %
C4	Int 3 | 0004 3-Audio-1	Filter Freq	109 Hz	275 Hz
C4	Int 3 | 0004 3-Audio-1	Filter Res	0.92	1.25
C2	Int 4 | T13	Sample Start	100 %	59.4 %
C2	Int 4 | T13	Filter Freq	7.08 kHz	416 Hz
C2	Int 4 | Simple Delay	Dry/Wet	58 %	100 %
C1	Int 5 | 0005 3-Audio	Filter Freq	416 Hz	5.76 kHz
C1	Int 5 | Auto Filter	Frequency	1.27 kHz	1.15 kHz
C-1	Int 6 | 0006 3-Audio	Sample Start	100 %	41.4 %
C-1	Int 6 | 0006 3-Audio	Filter Freq	1.05 kHz	3.27 kHz
+	Int 7 | T13	Filter Freq	696 Hz	3.81 kHz
+	Int 7 | Auto Filter	Frequency	1.21 kHz	3.59 kHz
++	Int 8 | 0007 3-Audio	Filter Freq	855 Hz	3.81 kHz
++	Int 8 | 0007 3-Audio	Filter Res	1.28	3.94
++	Int 8 | Auto Filter	Frequency	451 Hz	1.15 kHz

Fig 4.2 Shows to the left each audio sample's corresponding octave range and is coloured to better identify its position. C-1 + and ++ indicate the last three octaves of the keyboard instrument; they are coloured the same as they are layered together. To the left of the screen shot the code indicates each sample's corresponding macro mapping parameters that allows the user to changing, in real time, multiple parameters throughout the sample and FX chain.

7.2 Third Compositional Analysis

Compositional structure has been approached with an aim to exploit the entire instrument plugin device's tonal sound signature; its purpose is to form a continuation

of the first two movements while articulating new forms of compositional expression. Based on the findings throughout Movement Two, a decision has been made to keep the notes of F and F# as the main two notes in focus. While having the choice to express any musical key throughout this composition, as a means of continuation keeping to the same method explored by synthesis integration, throughout Movement Two the aim is to keep this composition within simular textural boundaries and maintain the work's original soundscape quality captured throughout the underground acoustic environments.

The compositional arrangement has been broken up into six main movements within the main body of the arrangement, consisting of an introduction, break down, main theme, break down, main theme extended, then to a conclusion. These movements are expressed to maintain a complete body of work and help to maintain composition interest while exploiting the instrument plugin's main feature set. (See Fig 4.3 below).

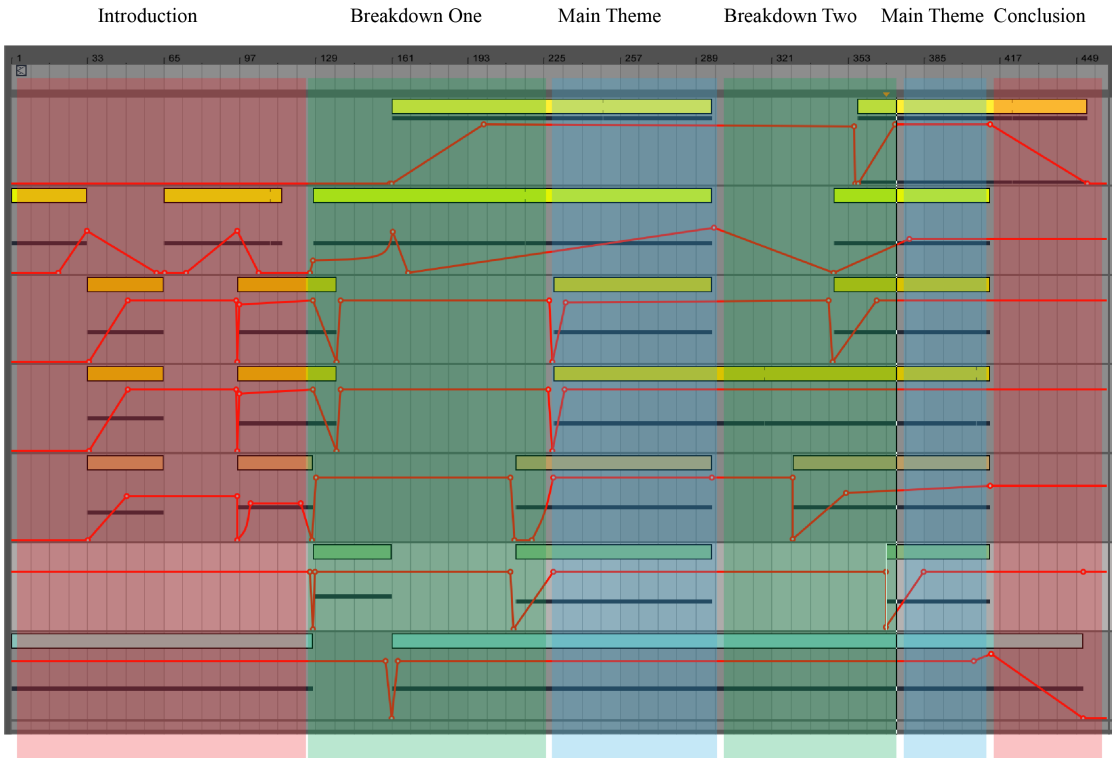


Fig 4.3 Indicates compositional structure of Movement Three taken from the Ableton Live arrangement window. The colour blocks indicate each movement's position throughout the completed arrangement.

The goal of the introduction is to convey a moment of acoustic isolation, its sound signature consists of samples taken from the acoustic profile of both a train tunnel and underground car park facility that remain free of any outside noise interferences. Three layers of F1 start the movement and provide the piece with the lowest frequency content; the higher harmonic content comes from F#5. This has been added to provide the introduction with an overall sense of balance and create a feeling of dissonance. The introduction then fills out the remaining frequency content by adding F2, F#2 and F4. The introduction then breaks down to return to a theme of acoustic isolation. The main theme is achieved when all aspects of the keyboard instrument are being utilised, this includes all underground locations and introduces the use of macro parameter adjustments illustrated in Fig 4.2. The movement then moves into another break down to relieve the listener of the past noisiness and to prepare for the second main theme, which contains all of the same audio material as the first, with the addition of each note an octave higher throughout each instrument part. This aims to add body to the final theme and helps to move the compositional into its final movement, the conclusion, which is a continuation of the introduction, but in a reverse order.

Conclusion

When a distinction is made highlighting all the elements explored throughout a modern approach to electroacoustic composition, it becomes apparent that through recent advances in music technology a blurring of genre definition can be identified, arguing its affects are influencing the current direction of discourse, concerning electroacoustic, soundscape, sound art, sound installation, electronic music and computer music composition. As a result, the modern composer can now work across a number of different sound genres within the one body of work, using solely the digital domain as the compositional environment. By identifying this possible transformation in sound base compositional discourse, the portfolio accompanying this thesis has addressed this statement, by exploring soundscape / electroacoustic archetypes within an electronic music production environment. This production approach has led to the creation of sound works that are formed without a predetermined outcome, and that depend both on the intended artist vision and the acoustic environments to form the compositional outcome.

Through a means of sonic representation and in a bid to answer the question, "how can our sonic environments influence individual thought and creative being?" three compositional movements have been formed utilising Sydney's central business district railway systems and urban underground acoustic environments for compositional basis and influence. Movement One's compositional structure has been formed by identifying and digitally capturing each of the chosen locations naturally-occurring sound signatures. This has provided the compositional process with both direction and usable sound material to build and form original sound works. The compositional form has been derived through a system of identifying what frequency content has been captured and how these sound recordings can be layered according to

the audio's dominant frequency content. Using methods of sound layering and subtractive equalisation, compositional form has been achieved.

Movement Two's compositional structure has been formed by successfully identifying closely-related fundamental frequencies existing within the recorded sound material. With the musical foundation of F3/F#3 or 171hz/175hz identified through spectral analysis, the composition has successfully explored integration possibilities of analogue and digital synthesis. This integration of voltage-controlled/digital sound generation in conjunction with the audio material has led to the creation of new sound compositional structures, which base their synthesis design directly on the underground acoustic environments.

The third compositional movement explores the sound material by placing the sounds in a sample-based digital keyboard instrument environment. The aim is to see how the recorded sounds react to musical pitch when expressed through a digital sampling plugin device. While this approach was again different to the first two Movements, the outcome was at first undesirable, with the composition at best a reinterpretation of the first two Movements. To indeed explore new approaches in compositional sound structures, a decision was made to utilise the micro regions of the recorded audio. Zooming into the audio region and looping play back between extremely small regions of the audio has, while still maintaining the acoustic sound profile, explored new sound intentions by creating a new resonate frequency based on the original acoustic texture.

As a direct result of this compositional process—the exploration into designing and arranging electroacoustic music compositions within an electronic music production environment—a sound design process has been employed throughout all three compositional Movements, which can be best described as a process of sound sculpturing. This method of digital sound sculpture has been achieved by layering

acoustic recorded sound material within the digital audio workstation Ableton Live. This process of forming new experiences of sound by layering multiple underground location recordings, has been derived through experimentation, while sound sculpture already describes a genre unto itself. This claim of using sound sculpture to describe a form of compositional sound design process comes from a realisation that when dealing with audio manipulation viewed from the perspective of a modern day sculpturist, new digital forms of sound sculpture can be realised when composing with modern day tools and working solely within digital practices.

References

Akiyama, M. (2010). Transparent Listening: Soundscape Composition's Objects of Study. RACAR: Revue D'art Canadienne / Canadian Art Review, 35(1), 54-62. Retrieved from http://www.jstor.org.ezproxy1.library.usyd.edu.au/stable/42630819

Banard, M. (2012). *The Sounds of Displacement: A Portfolio of Binaural Compositions*.

Battier, M. (2007). *What the GRM brought to music: From musique concrète to acousmatic music.* Organised Sound, 12(3), 189-202. doi:10.1017/S135577180700190

Bennett, A., & Rogers, I. (2014). *Street music, technology and the urban soundscape.* Continuum, 28(4), 454-464. doi:10.1080/10304312.2014.89399

Blesser, B., & Salter, L-R. (2007). *Spaces Speak, Are You Listening? Experiencing Aural Architecture*. Cambridge, MA: The MIT Press.

Blauert, J. (2013). *The Technology of Binaural Listening* (Vol. 1). Springer.Britton, E. (2016). *Genre and capital in avant-garde electronica.* Organised Sound, 21(1), 61. doi:10.1017/S1355771815000382

Cage, J. (1961). *Silence*, Lectures and writings MIT Press

Case, A. U. (2007). *Sound FX: Unlocking the creative potential of recording studio effects* (1st ed.). Amsterdam: Focal Press.

Conversation with Bob Moog. (2005).Retrived from https://www.moogmusic.com/legacy/conversation-bob-moog-analog-vs-digital-sound-generation

Drever, J. L. (2002). Soundscape composition: The convergence of ethnography and acousmatic music. *Organised Sound*, 7(1), 21.

Emmerson, S. (2007). *Living Electronic Music*. Aldershot, Hants, England.

English, L.(2014), Wilderness of Mirrors. Retrieved from http://www.lawrenceenglish.com/sound

Heidenreich, A. (2009). "shaping electronic sounds like clay": The historical situation and aesthetic position of electroacoustic music at the ZKM/Institute for music and acoustics. *Organised Sound*, 14(3), 248-256

Hyde, J. (2012). Musique concrete thinking in visual music practice: Audiovisual silence and noise, reduced listening and visual suspension. *Organised Sound*, 17(2), 170-178. doi:10.1017/S1355771812000106

Lacey, J. (2016). Sonic Rupture. New York: Bloomsbury Academic & Professional. Retrieved from http://ebookcentral.proquest.com.ezproxy1.library.usyd.edu.au/lib/usyd/detail.action?docID=4471170

Ikeda, R. (Producer). (2013, 11/04/2014). *Test Pattern no. 5*. Retrieved from http://www.carriageworks.com.au/?page=Event&event=Ryoji-Ikeda-test-pattern-No-5-installation

Keylin, V. (2015). Corporeality of Music and Sound Sculpture. *Organised Sound*, 20, (pp. 182-190). doi:10.1017/ S1355771815000060

Landy, L. (2013). Music technology, music technology or music technology? *Contemporary Music Review, 32*(5), 459. doi:10.1080/07494467.2013.84987

Lennox, P. (2004). *The Philosophy of Perception in Artificial Auditory Environments:Spatial Sound and Music*. (Doctoral thesis), University of York, England.

Licht, A. (2009). Sound art: Origins, development and ambiguities. *Organised Sound*, 14(1), 3-10. doi:10.1017/S1355771809000028

Ljungdahl, M. B. (2009). *Soundsape attribute identification*, Audio Enginerring Society (7793).

Manning, P. (2006). The significance of techné in understanding the art and practice of electroacoustic composition. *Organised Sound*, 11(1), 81-90. Retrieved from http://ezproxy.library.usyd.edu.au/login?url=http://search.proquest.com.ezproxy1.library.usyd.edu.au/docview/215105736?accountid=14757

McCartney, A. (2002). Circumscribed journeys through soundscape composition. *Organised Sound*, 7(1), 1.

Mennitt, D. J., & Fristrup, K. M. (2012). Obtaining calibrated sound pressure levels from consumer digital audio recorders. *Applied Acoustics*, 73(11), 1138. doi:10.1016/j.apacoust.2012.05.006

Rennie, T. (2014). Socio-sonic: An ethnographic methodology for electroacoustic composition. *Organised Sound*, 19(2), 117-124.

Rudi, J. (2015). Past and current tendencies in technology-based music. *Organised Sound*, 20(1), 30-36. doi:10.1017/S1355771814000399

Schafer, R. M. (1977). *The Sound Scape.* New York: Destiny Books.

Smiley, S. (2015). Field recording or field observation? Audio meets method in qualitative research. *The Qualitative Report*, 20(11), 1812.

Sobaskie, J. W. (2001). *Noise, water, meat: A history of sound in the arts*, (1999), , Cambridge, MA; The MIT Press

Sterne, J. (2006). *Interdisciplinary science reviews*, 2006, Vol.31, No.4. Retrieved from; http://sterneworks.org/deathandlife.pdf

Truax, B. (2008). Soundscape Composition as Global Music: Electroacoustic music as soundscape. *Organised Sound*, 13, pp 103-109. doi:10.1017/S1355771808000149

Truax, B. (2012). Sound, listening and place: The aesthetic dilemma. *Organised Sound*, 17(3), 193-201.

Voegelin, S. (2010). Listening to Noise and Silence. London: Continuum Publishing .

Westerkamp, H. (2002). Linking soundscape composition and acoustic ecology. *Organised Sound*, 7(1), (pp. 51-56).

Young, J.(1989).Source Recognition of Environmental Sounds in the Composition of Sonic Art with Field Recordings. Retrieved from https://ir.canterbury.ac.nz/handle/10092/4615

Zhao, H., & Malik, H. (2013). Audio recording location identification using acoustic environment signature. *IEEE Transactions on Information Forensics and Security*, 8(11), (pp. 1746-1759). doi:10.1109/TIFS.2013.2278843

Appendix

1.0 The Devonshire tunnel leading in from Pitt Street towards Central Railway Station.

1.1 Train approaching Wynyard station underground rail platform

1.2 An example of Wynyard underground car park, Pitt Street, Sydney

1.3 The Original wooden escalators lead out of the Wynyard underground platforms

2.0 Entrance cavity to Queen Victorian Building underground car park

2.1 Level six of the Queen Victorian Building underground parking facility

3.0 Newtown underground tunnel leading under the main railway line

3.1 An example of a location used for recording at Central Station's underground walkway

4.0 An example of a location used for recording at Town Hall underground rail platform, before a train approaches.

4.1 An example of a location used for recording, as a train approaches Town Hall underground platform

4.2 An example of a location used for recording, as a train arrives at Town Hall underground rail platform