COMPOSING ENTANGLEMENT:

TEMPORAL STRUCTURES OF

AUDIO AUGMENTED REALITY

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ABSTRACT

Through an integrated portfolio of practice and writing, this research proposes a compositional framework for audio augmented reality (AAR). In articulating the relationships between time (experiential and measurable), geospatial movement and sound it signposts how AAR might offer a critical and aesthetic response to contemporary ecocritical debate. Though focused on the specifics of the mediated soundwalk, it grapples with tensions between authorship and indeterminacy generated when designing experiences for uncontrolled environments. The tools proposed will be of relevance to practitioners and researchers across performance, sound studies, critical geography, immersive experience design and ecocriticism. The methodologies developed are applicable in investigations seeking to simultaneously capture quantitative and qualitative data from an audience's journey through time-space within experiential artworks.

The practice element consists of two major artworks combining print, walking and mediated sound that encourage a form of eco-critical attention in the audience. The written thesis is built around three core chapters. The first establishes historical and critical contexts for the practice, situating it on a thread connecting Allan Kaprow's performances, mobile audio experiences and concepts of time drawn from music, philosophy and critical geography. It eventually lands in the ecocritical thinking of Ursula Heise and Timothy Morton. The second chapter details the rigorous cyclic methodology used to create and analyse the practice. Key to the methodology is the application of Torsten Hägerstrand's concept of time geography. Its use as a tool for understanding the production of creative experiences is a key contribution of this research. The third chapter presents an analysis of the practice viewed through frames of measurable time, subjective time and ecocriticism. Each one combines qualitative studies of participant experiences with quantitative data capture, imbricated with critical theory. The final section explores how the interface of spatial, sonic and temporal elements create a form of entanglement between the participant and the world, speaking to how it might feel to confront the Anthropocene.

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And to Jo, my lighthouse,
whose love and support carries me through it all.

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"All control systems try to make control as tight as possible, but at the same time, if they succeeded completely there would be nothing left to control"

William Burroughs (1978)

INTRODUCTION

This thesis will explore a compositional methodology for the temporal structure of audio augmented reality. I will argue that composing works in this field necessitates attending to a quaternary framework of content, experiential time, clock time and spatial movement.[1] I will also propose that this framework embodies a complex entanglement that speaks to contemporary ecocritical thinking. The key contributions of the thesis are both the quaternary framework and a set of methodologies for analysis and development of experiential artistic practices. Drawing from time geography and musicology it offers tools for practitioners and researchers across performance, sound studies, critical geography, immersive experience design and ecocriticism. The methodologies developed are applicable in investigations seeking to simultaneously capture quantitative and qualitative data from an audience's journey through time-space within experiential artworks.

The initial impetus for the research was the consolidate of over 15 years of my artistic practice. This practice has been described by critics and curators as soundwalks, locative media, immersive theatre or augmented reality.[2] Despite this fluid taxonomy my work has been consistent in its combination of music, mobile audio technology and the physical movement of audience members through uncontrolled environments.[3]

[1] quaternary: (adjective) Definition: of, relating to, or consisting of four units or members. C15: from Latin quaterni - four at once. Not to be confused with the capitalised noun Quaternary that described our current geological period.
[2] To date my work has been presented at interactive documentary festivals, selected for British Council showcases of immersive theatre and written about as post-cinematic performance. As will be detailed in Chapter 1.02, within this thesis I am positioning my practice as soundwalks within the field of augmented audio reality.
[3] I use the term 'uncontrolled' to describe any location or environment that has not been altered for the

As I began to survey the field of existing research two things became quickly apparent. Firstly, there is a lack of how-to guides. A plethora of studies of affect, and sometimes narrative, exist but almost no concrete methods for actually composing this kind of work are shared. As Steve Benford describes, much design experience exists in the field but it is "wrapped up as craft knowledge" (Benford *et al.*, 2009, p.1) and often only passed on through apprenticeship models. Key to the outcomes of this research was the ability to share my existing knowledge as I refine and analyse my own work. The second notable absence I found was a study of temporality, while there have been some acknowledgements of how layers of time are experienced in this kind of work, there is almost no critique or analysis of how one might structure and compose these temporalities.

One might sensibly ask that if research in this established field of practice has rarely investigated temporal structures, why do *I* believe it to be so important? It is possible to point to my history of composing music for film, theatre and dance where duration and synchronisation are considered so essential (and consequently widely studied). But what of their importance in my current practice? The following text provides an imagined but archetypal description of an audience member experiencing my work:

> *They are standing on a pedestrian area in a busy city, people continuously passing them. They are wearing headphones in which they hear a dense musical composition, it drowns out the noise of their surroundings. A recorded voice begins to speak over the music, it says "Where are you right now? Have you been in this place before? Who built this place, who first settled here? I'd like you to take a walk now, to seek out a place you could shelter, stop there when you find one". The music continues to play, they begin hesitantly walking, moving with the flow of passers-by.*

In this small moment there are a whole set of temporal complexities, and I would like to unpick a few of them here. Firstly, when the recorded music drowns out the city sound it severs synchronised connections between the audible and the visual, the audience hears the time of the music recording

sake of staging the artwork (e.g. with ushers or physical additions/signage). This also avoids the commonly used term 'public space', which is actually a legal definition, and it is up to participants in my work to choose if they enter private or public space.

but sees the time of their present experience. The recorded voice carries with it the time in the past that it was recorded (if we assume the audience has an idea it is recorded and not live), yet the spoken words address the audience's present moment ("right now"). The spoken questions push the audience to further consider time frames beyond their present moment ("this place before") and then returns to the present moment, even attempting to influence it through the instruction to ("take a walk"). Asking an audience member to walk through this uncontrolled environment, seeking an unknown location automatically introduces agency, they have to continuously interact with and navigate their surroundings. What control does an author really have over this interaction?

This is not a dancer performing a rehearsed movement across space, and unlike in film the composer does not know what the audience is seeing while they hear the music. The connections between site and sound become unpredictable, and not just in what those connections are but in when they are. The author may want the audience to hear a certain piece of sound while standing in a specific location and for this they could use technical solutions such as geographically located triggering of media content to create synchronisation. However, regardless of how they are engineered, these moments of synchronicity do not exist in isolation, they are part of a time continuum that spans the entirety of the artwork. There may be gaps between delivery of media content, but between whatever is considered the beginning and the end of the artwork there is no gap in the time experienced by the audience. If audiences are required to move their bodies from one location to another, the laws of physics mean that it will take time to travel between them: Can this time requirement be known in advance; What is the relationship between the measurable seconds that tick by as they move and the time they see, hear or feel passing? It is here we see the foundation of my enquiry, how might authors in this field work with the unknown caesuras in structure that audience agency creates? Can both measurable and experiential time be composed? As such, the research began with the question:

> *What approaches can be developed that support the understanding and adoption of time as a compositional element in audio augmented reality?*

The question breaks down into enquires of:

- Tensions between measurable time and experiential time.
- The role of participant agency in temporal structure.
- Analysis and composition methods for soundwalks.

To address these, my methodology pulls together practice with threads of qualitative and quantitative data collection, auto-ethnographic reflection, critical geography, phenomenology and eco-criticism. Articulating research questions at the outset of a practice as research study can be problematic since it often “assumes a fixity that is not necessarily always possible or productive in ephemeral practices” (Petralia, 2010, p.11).
While the primary questions of temporality were the starting point of this research, the practice as research methodology generated a secondary enquiry into *how audio augmented reality resonates with contemporary ecological theory.* This secondary question is addressed primarily at the end of Chapter 3, where the research presents less of an answer, and more a springboard for further enquiry.

My primary concern is the temporal structure of an audience’s journey through the continuous time-space of an experiential artwork. Focusing on the specificity of audio augmented soundwalks, the investigation will lead to the proposition of a quaternary framework (Fig. 1) that composers could attend to if they wish to retain a balance of authorship and agency. I will show that this framework creates a deeply reflective experience of an individual’s position within the multiple interwoven and interdependent temporalities of their environment.

Approaching questions involving the nature of time runs the risk of confronting some of the most fundamental philosophical and scientific investigations human beings have grappled with. This research is not a fundamentally philosophical enquiry, its core purpose is to develop compositional tools for particular kinds of artworks. As such it does not need to demonstrate an awareness of the entire field of temporal philosophy, rather it needs a set of practical terms that artists and makers from different fields can understand. It also needs a set of pragmatic frames that allow them to conceptualise timing and experience. To make the concept of time a

manageable (and useful) facet of this enquiry I am initially bifurcating it into the measurable and the experiential.[4] I will be drawing on the Greek terminology of *chronos* for time which is measured and *kairos* for that which is lived and experienced.

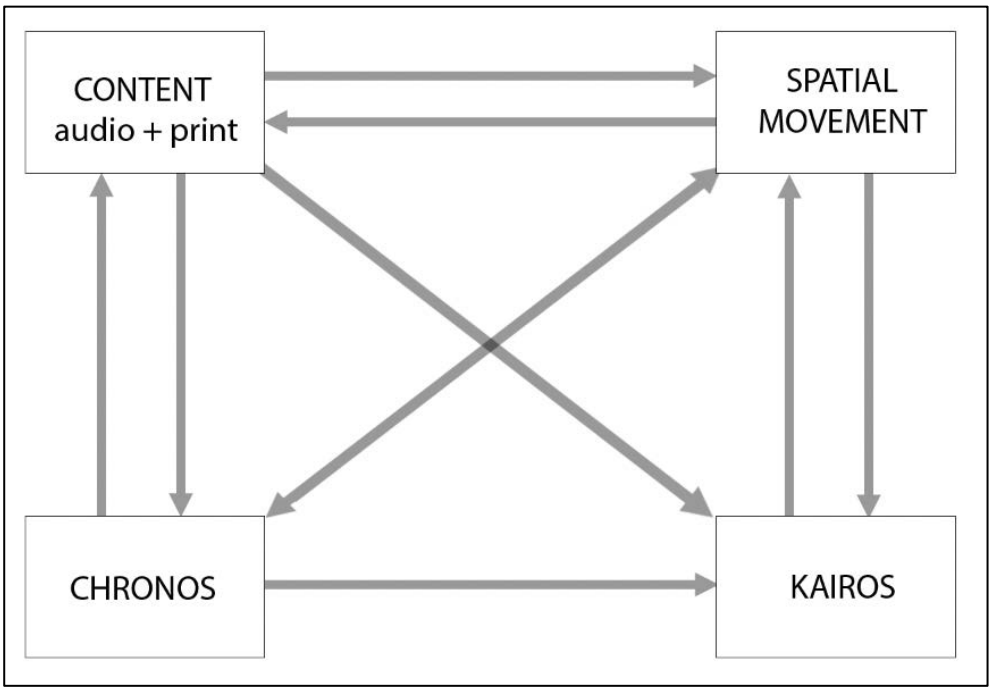


Figure 1- The quaternary framework

As my research focused on works that involved a mobile audience, I also needed to look at time and space cohesively, and for this I turned to Torsten Hägerstrand's concept of time geography for my enquiry. While my approaches will be discussed in much greater detail in Chapters 2 and 3 there is a methodological point to made here. While I do draw analytical methods from time geography, I isolate these from its wider political intentions. The commonality with time geography that I focus on is an intention to make a set of complex relationships visible and maybe even tangible. When considering the extensive philosophies of ecology and time, I am demonstrating how they can be used as lenses to make revelations about the form of practice under investigation. This approach also allows the practice itself to offer insights into the usefulness of the frameworks for analysis and their potential applications in creative practice.

[4] This simplification is inspired by Alfred Gell who, in "The Anthropology of Time" (1992) sought to make competing philosophies of time useful within anthropology.

It is also important to state that while the temporal composition of my practice is the core of this study, it is only one aspect of the artworks. There are thematic, narrative and aesthetic considerations which will not come under scrutiny here. For me to believe in the work as an artist all of these aspects need to be present. It is for this reason that rather than developing work reduced in scale for the sake of research, the practice here involved two major artworks created within professional and public contexts. *It Must Have Been Dark By Then* (from now on referred to as *Dark By Then* for brevity) is a hybrid print-digital work that takes the audience on a journey through their own city, bringing them sounds and stories from remote locations that are given resonant connections to the site of the work. *Only Expansion* also involves a journey through a city but is focused on an audio system that manipulates the sound of the audience's surroundings in realtime and combines it with field recordings from ambiguous sites of climate collapse. So, while many aspects will not be studied, those that are, exist within a relevant complete work. This allows me to retain passion and expression in the work unhampered by over analysis, while developing essential new craft knowledge.

This approach of practice in context does not mean the research exists as a separate entity, rather that there was a continuous dialogue between and imbrication of the two. This will be demonstrated through the impact on the form of the practice and extension to the scope of enquiry that occurred over the arc of my research journey. When I began creating *Dark By Then* I pulled together many elements from my history of practice in locative media and soundwalks. I undertook field trips in Latvia, Tunisia and the United States of America documenting changing environments and human migrations. The process of making and analysing the work had a huge impact on the direction of the research. Firstly, the field trips gave me a direct experience of human influence on and relationship with climate collapse. I became excited by the idea that making work involving audiences physically engaging with their own lived environments resonated with my experience. I also became conscious that in my regular use of isolating headphones I was masking a key entanglement, severing the connection between the time of the audience's visual environment and the time of the recorded sound also ignored the time of their immediate sonic environment. To address this in the next work *Only Expansion* I reached back to audio technologies I had previously used (but

abandoned) with which I could explore this entanglement (specifically augmented audio systems that allowed me to combine recorded sound with manipulated live microphone input from the audience's surroundings). This line of enquiry also led to an exploration and proposition for how the temporal aspects of my practice resonated with contemporary ecological thinking as will be explored in Chapter 3.03.

The eclectic nature of this thesis may already be showing itself, so to assist in navigating its many threads I will outline the content of the three core chapters: context, methodology and time-space.

Chapter 1 - Context

This chapter traces connections in my work to the artistic practice of Allan Kaprow, exploring the role of indeterminacy in blurring the edges between the work and the world. It then places my practice within the more contemporary fields of augmented reality and mobile audio experiences. Relevant concepts of time from philosophy and musicology are explained before time and space are finally combined in an overview of time geography. The final section of the chapter presents a rapid journey through contemporary critical thinking around cultural responses to climate collapse.

Chapter 2 - Methodology

Here my practice as research framework is outlined alongside an explanation of my iterative cyclic methodology. The individual methods of creation, analysis and reflection used are detailed at length with examples of how they were applied. The chapter then continues with a descriptive overview of the two major artworks created through the research before summarising my approaches to their sonic aesthetics.

Chapter 3 - Timespace

This chapter is divided into three core sections. The first*, Chronos*, focuses on the variety of temporal compositional approaches taken in the works and presents the results of analysing their impact. The second section, *Kairos,* explores the complexity of participants' subjective experiences of time in the

work, further revealing the complexity of the interactions in the quaternary framework. These interactions are then considered through the lens of critical ecological thinking in the final section ‘Entanglement’.

Over the course of the thesis the research moves towards an argument that audio augmented reality experiences have an entangled quaternary framework. It demonstrates how methods drawn from time geography can play a key role in the analysis and creation of these works and points to approaches for scoring compositions. While the practice here is focused on a very particular form, the methodology and compositional framework offer a contribution to a wider field. The notation systems and theories drawn from time geography offer innovative approaches to composing and analysing locative media works and creative practices that involve participants moving through physical environments. The propositions for an ecocritical appraisal of augmented reality are of relevance to artists, anthropologists, geographers and environmental theorists.

The proliferation of augmented reality functionality within mass market consumer products and the increasing popularity of audio led content (most conspicuous in podcasts, pod plays etc) suggest that shared methods for creating are necessary. The knowledge developed here offers useable methods for artists and researchers in this expanding field, suggesting directions for further research and contributions within critical ecology.

1 CONTEXTUAL REVIEW

This chapter establishes the fields that this research is situated in and the theoretical frameworks it builds upon. Given the hybrid form of the practice and the nature of my research questions, this contextual review navigates a complex set of diverse concepts. To make this journey clearer for the reader, it has been divided into four sections. The first, 'Indeterminacy', introduces a historical context of experimental performance and musical composition. 'Augmenting Reality' then establishes the contemporary form of the practice and concepts relating to mobile sound that I draw upon. The third section, 'Timespace', moves from exploring theories of time to the spatial concerns of locative media before describing the framework of time geography, which I apply and explore as a means through which to create and analyse my compositions. The final section, 'Ecocritical', gives a brief overview of contemporary ecological discourses that have resonated with this research. Over the course of these four sections, I attempt to draw a line that highlights and connects multiple forms of entangled temporalities. Within this review certain key concepts and terms will emerge that are elements of the quaternary framework for composition that I am proposing.

> *A note on language: in the exploration of these varied fields the expanding (and often technical) lexicon risks becoming unwieldy for a reader not specialised in all of the relevant areas. In light of this a glossary is provided at the end of the thesis for reference in the rest of the thesis, and will outline my specific understanding of the definition of the terms. Terms available in the glossary will be presented in* ***bold type*** *the first time they are introduced, and when deemed useful the glossary definition will be presented in footnotes.*

1.1 INDETERMINACY

At the core of this research is an artistic practice that involves shaping an audience's experience in uncontrolled environments, leading to a continuous blurring of any edges that might exist between the work and the world. While the work utilises various media and contemporary technologies, I want to place it on a longer historical arc that leads back to the work of Allan Kaprow and John Cage in the 1960s.

Kaprow is best known for the *happenings* he created. Influenced by the writings of Jon Dewey, he struggled with the question of "what is an authentic experience?" (Kaprow, 2003, p.xvi). The form of the happenings evolved over time, but they often involved sets of performative instructions for people to follow. Sometimes these instructions were intended to be carried out in remote landscapes, or across multiple sites that were out of touch with each other (Kaprow, 2003) and through this the defining boundaries of terms such as audience or performer became more indistinct. The essence of Kaprow's works that retains significance for my own practice is that despite its ephemerality, they often used time based scores of instructions, not for an audience to contemplate, "but to force them into active intervention" (Berghaus, 1995, p.352).

An example of a key work is *Self-service* (1967) which took place over 4 months in Boston, New York and Los Angeles. Participants were offered an extensive set of possible activities:

> 'People stand on bridges, on street corner, watch cars pass. After 200 red ones, they leave'
> 'People shout in subway just before getting off, leave immediately.'
> 'Couples kiss in the midst of the world, go on'
> (Kaprow, 1967)

The everyday qualities of the actions indicate Kaprow's intention to break the wall that he felt separated art from life, allowing us "to participate in its unfolding in the reality of our existence" (Berghaus, 1995, p.352). While participants could select whichever actions they preferred, Kaprow created a temporal frame for the piece in the form of composed time pattern and number of events for each city (Figure 2)

	June	July	August	September
Boston	8	6	3	7
New York	9	1	5	3
Los Angeles	24	12	18	21

Figure 2 - Self Service: temporal score for the work where each box represents how often an event should occur (Kaprow, 1967)

Even though designed for uncontrolled environments, this scoring method creates a boundary to the work. It is composed within an authorial frame, one whose structure is almost entirely guided by temporality. As Kaprow himself explains, “time or pacing will acquire an order that is determined more by the character of movements within environments than by a fixed concept of regular development and conclusion.” (Kaprow, 1995, p.237). The compartmentalised nature of happenings can be likened to the connections between a series of photographs or the movements in a symphony, and here time becomes “variable and discontinuous” (Kaprow, 1995, p.237). Importantly, while still describing these works as compositions, he emphasises the fact that they are not a self-sufficient form, but more an “operation dependent upon the materials” (Kaprow, 1995, p.241). I understand the materials here to be the participants, the environment they are operating within and the temporal structure.

Michael Kirby (1995) describes this kind of work as non-matrixed, in opposition to traditional theatre where performers create and function within an “artificial and imaginary interlocking structure” (Kirby, 1995, p.7). The traditional theatre form is a matrix of time, place and character, separate to that of the audience. If you were to see a stagehand move a prop during an interval this would be non-matrixed. This incorporation of the uncontrolled environment was part of Kaprow’s search for a “heightened experience of the everyday, in which those involved as either spectators or participants were formally fused with the space-time of the performance and lost their identity as an audience” (Bishop, 2012, p.102).

These concepts of the non-matrixed and an audience's loss of identity speak to how my practice positions the audience as an active element within a matrix of composed content and uncontrolled environments. The interdependency between these elements also highlights the indeterminacy, as it is impossible to foresee all the interactions, structuring the limits of this indeterminacy is important for my work. John Cage initially defined indeterminacy as "the ability of a piece to be performed in substantially different ways" (Pritchett, 1996, p.182) and this holds true for the work under investigation.[5] Like Kaprow's happenings, frames are created but the impact of the uncontrolled environment and the agency offered to audiences leaves the specificity of events open to substantial change. Cage described "coincidences of free events with structural time points" as having a "special luminous character", and indeed as we will later see the connections between elements of the uncontrolled environments and the mediated content in work resonate deeply with audiences.

What is more pertinent in Cage's thinking is his elevation of time as the primary mode of sound composition. In defining the characteristics of sound as pitch, timbre, loudness and duration he asserts that it is "only duration which involves sound and silence" (Cage, 1968, p.63) formally fused with the space-time of the performance . Later Cage went on to disavow the existence of silence, most famously in his work *4'33s* (1952), where the score instructs a performer to not play an instrument for three movements over the eponymous period of time. Part of this work could be said to be acknowledging the value of sounds in a composition not made by the instrument, but I would highlight that it was also a durational boundary around an uncontrolled environment. This approach of using durational boundaries exists in my practice, but within them are not just the uncontrolled environments and recorded sounds, but like Kaprow I also incorporate the audiences' free responses to the instructions. These all exist in one singular continuum of experience that is demarcated in time.

[5] It is useful to note that when Cage describes a 'piece' he is usually referring to a musical composition, that will eventually be performed by a musician following a score. In my practice we cannot make a direct analogy to this as even if we consider an audience member as a performer only certain aspects of the score are revealed to them. In any musical score there is some level of indeterminacy due to the fact that score can never represent every aspect of the final presentation of a work.

In ‘The Poetics of The Open Work’ (1962), Umberto Eco explores indeterminacy in relation to 20th century music compositions where a greater autonomy was being given to performers interpreting a score. Composers such as Karlheinz Stockhausen and Henri Pouesser were creating compositions that encouraged “acts of conscious freedom on the part of the performer” (Eco, 1962, p.23).

Eco acknowledges that any work of art “demands a free, inventive response” (p.21), but highlights the shift from artists submitting to openness as an “inescapable element of artistic interpretation, but rather making it a positive aspect of the production” (p.23). What becomes increasingly relevant to my current enquiry is his more restricted classification of “works in movement” that consist of “unplanned or physically incomplete structural units” (p.30). We find ourselves looking again at compositions that are not self-sufficient. Certain elements are fixed, but the work’s final shape is dependent on the actions and impact of audiences. Eco describes the author as offering a work to be completed, the form is the authors form that has gone through a process of organisation, but it is the offer that remains crucial. The invitation to make the work together creates a structural vitality that would not exist if it were merely a set of presented components. Kaprow’s scores of structural elements coalesce into a singular piece, but they may have been “assembled by an outside party in a particular way he could not have foreseen” (Eco, 1962, p.36).

In Eco’s description of the open work this outside party is a performer, but this definition is not as clear when we look at Kaprow’s happenings or my own contemporary field of practice. The blurred category encompassing performer or audience is a connecting line in all of the work described so far and introduces the difficulty of how we might define those who engage with my own practice. For the rest of this thesis, I will be using the term participants, this is partly an echo of Kaprow’s desire for audiences to participate in an artwork’s unfolding in the reality of our existence, but also to signify that while the audience may not be directly collaborating or interacting with the author, they are participating in the completion of a work.

Having established some historic groundwork for these indeterminate non-matrixed experiences, and a temporally led approach to scoring them, we can now look at the specific types of content and approaches found in their more contemporary offspring.

1.2 AUGMENTING REALITY

To retain the emphasis on the entanglement of the work and the world that exists in its non-matrixed quality, I place my practice within the field of augmented reality (AR).[6] Krevelen and Poelman's extensive survey of AR (2010) offers three criteria for an AR system:

> - combines real and virtual objects in a real environment.
> - registers (aligns) real and virtual objects with each other.
> - runs interactively, in three dimensions, and in real time.
>
> (Van Krevelen and Poelman, 2010, p.1)

Relating these criteria to the research at hand is achieved primarily through the role of the digital audio systems used and the situating of the participants in uncontrolled physical (real) environments. I understand virtual objects as the sonic content delivered to participants in a *real* uncontrolled environment. The term virtual tends to be associated with the immateriality of digital media, and to consider sound as virtual opens up a set of ontological complexities. When Frances Dyson explores the relationship between sound and immersion she reminds us that "being neither visible nor tangible, sound is never quite an object, never a full guarantor of knowledge" (Dyson, 2009, p.6).

To consider some sounds (but not all) as part of the virtual continuum I am framing them through a gentle simplification of composer Pierre Schaeffer's concept of the ***sound object***. I understand the sound object to be the perception of a sound, it takes place at the site of the listener, combining a physical reception of sound with a cognitive interpretation. As Schaeffer explains "The sound object is the coming together of an acoustic action and a listening intention" (Schaeffer, 2017, p.213). When we hear a door slam, an acoustic action has led to the sound object we *might* identify as a door slamming. The acoustic action is what the acoustic ecologist R. Murray Schafer terms the ***sound event***, an event being something that happens at a certain point in time-space. So, for augmented reality, all the *sound objects* occur at the point of the listener, but the *sound events* that create them occur

[6] The earliest use of the term is generally credited to Caudell, T.P., Mizell. D., 1992..

in two places. Some are created *outside* the composed content of the work (a passing car or pedestrian) and these are the *real objects* within the AR criteria. Others are created by a digital system that manages the content of the work (i.e. sound events that are occurring only in the headphones). It is these *sound events* that create the virtual *sound objects*. The distinction between events and objects will have key significance for certain aspects of this research, but for simplicity of reading I will use the singular term *sound* to describe the perceived *sound objects* unless further distinction is required. These sound objects (along with the printed material) form the *content* element of the quaternary framework.

For the remaining criteria, geo-locative technology, realtime audio processing and/or contextual prompts *align* the sound with the physical world. Through the same means there is an *interaction* that occurs, commonly between participants' physical movement and the content that it triggers/affects, which occurs over three dimensions and in real time throughout the experience. Importantly these criteria are not limited to visually-based systems, yet despite this audio-visual agnosticism the spread of AR into consumer electronics in recent years[7] has found the term being more commonly associated with visual media. It is for this reason that I use the specificity of *audio augmented reality* (AAR) in describing the work.[8] Nicholas Mariette has called AAR "simply the introduction of artificial sound material into the real world" where "mobile transistor radios or early portable tape players with headphones could both be understood as presenting an augmented reality" (Mariette, 2013, p.12). The suggestion of the need for mobility or portability here leads us to a more specific positioning of my practice.

[7] Pokémon Go has been the most high profile application of consumer AR, and tools created by companies such as Snapchat, Google (ARcore), Apple (ARkit) have all been focused on visual application.

[8] This term is also been used by the BBC, Bose, and various press articles - see "Audio augmented reality: a new platform for information" – Marketplace, "Audio for Augmented Reality: Gimmick or True Opportunity for Communicators?" - Ubermetrics Technologies, "Audio Augmented Reality - Developing "Please Confirm You are not a Robot" - BBC R&D.

1.2.1 WALKING SOUND

The emphasis on spatial movement in my practice makes the term soundwalk a relevant sub-category within AAR. While soundwalk has been used to describe a variety of forms, here I am using Frauke Behrendt's definition of "mobile listening practices where walkers wear headphones to listen to or engage with sound from media devices" (Behrendt, 2018 p.251). It is this mobility that forms the *spatial movement* element of the quaternary framework.

This form is found in the functional and factual audio guides presented at many museums, the collaged oral histories presented by Graeme Miller in *Linked* (2003)[9], the fictional film noir-esque narratives of Janet Cardiff's *Her Long Black Hair* (2004)[10] and the wordless textures of walks curated by SoundtrackCity in the Netherlands (2009).[11] Though across this extensive range of work there is a commonality to be found in the alignment of the real and the virtual, the site and the sound, placing *Dark By Then* or *Only Expansion* in this field is not a simple proposition, the reasons for this are outlined below.

Dark By Then combines printed textual narratives that are designed to co-exist with the soundtrack, not a common technique in soundwalks, but it has been carried out before by some artists. Key references here include *Someone Else* (Hampton, 2015), *The Quiet Volume* (Etchells & Hampton 2016) and *I Swear To Tell the Truth* (Anagram, 2017)[12], as rare examples of interplay between text and audio in a soundwalk. *Dark By Then* combines a rich music score and narration akin to works like *And While London Burns* (Platform, 2007)[13] but its use of GPS technology aligns it more closely to

[9] *Linked* is a radio work that has broadcast continuously over 5 miles of East London since 2003, designed to be listened to on a portable receiver while walking the site. It transmits the speech of former residents of homes destroyed for the building of a motorway.
[10] *Her Long Black Hair* is a soundwalk for Central Park that takes audiences on a 35 minute tightly choreographed walk. They hear factual and fictitious narrative alongside collages of music. Additionally audiences are given a set of photographs to view at certain points in the walk.
[11] *Soundtrack City* have been curating soundwalks by various artists in the Netherlands since 2009, often collages of processed field recordings.
[12] *The Quiet Volume* is an experience for two audience members where a voice in headphones guides them through the pages of a book. Each or the pair receives a unique set of instructions giving them different ways to physically engage with the book. *'Someone Else'* is a soundwalk that incorporates a written diary which is also heard spoken on headphones. *'I Swear To Tell the Truth'* combines a printed pamphlet of instructions and contextual information with a soundwalk guiding the audience around a venue.
[13] *And while London Burns* is a part-fact, part-fiction operatic soundwalk that guides audiences on a prescribed journey through London's financial district.

locative media works like *Into the Light of the Night* (2010) by plan-b Performance and Els Viaene where oral testimonies are triggered by software that responds to the audience's geographic location[14]. In an alternative approach, Only *Expansion* incorporates a **transparent audio system[15]**, where DSP software not only blends the audience's live sound environment with pre-recorded media but can manipulate it in realtime. This approach has precedents in Krzysztof Wodiczko's *Personal Instrument* (1969), Maebayashi's *Sonic Interface* (1999), Noah Vawter's *Ambient Addition* (2006) and *RjDj* (2008)[16], although none of these used composed music, field recordings or any clearly articulated temporal structure.

Importantly, where my practice also diverges from the majority of soundwalks is that it is not site-specific, and so connects more directly to the open work of Kaprow's happenings. In a description that echoes Kaprow's desires, Drever says sound walking is a limbo activity, where the "relationship between participant and everyday life is conspicuously porous" (Drever, 2009, p.169).

The interaction between sound and site and the transformation of space is eloquently described in this epiphanic moment from the director of Antenna Theatre Chris Hardman:

> I bought my first Walkman stereo cassette player just before embarking on Antenna's 1980 European tour of Vacuum. I bought it to replace listening to airplane muzak. I also hoped it would amuse during queue-ups and fill the pompous silences that engulf museums and cathedrals. It performed these tricks miraculously. While others were draped in reverence, bewilderment, or boredom, I was in rapture combining Wagner with Koln's cathedral and baroque trumpets with Parisian streets. I inspected Europe while privately-electronically- stereophonically listening to its musical heir (Hardman, 1983)

[14] *'Into the light of the night'* uses GPS technology to deliver audio and video content to audience members on a mobile device while they explore the city of Kortrijk.
[15] Auditory headsets that are "capable of actively or passively intermixing both real and virtual sounds are in-part acoustically transparent" (McGill, 2020).
[16] All of these works are headphone based experiences capable of manipulating sound being picked up from the audiences' surroundings. Most were conceptual experiments built on bespoke platforms apart from RjDj which was an iOS application. The software library developed for RjDj was used extensively in the creation of *Only Expansion.*

Hardman's experience led to him creating many works using mobile cassette players from the early 1980s onwards. These often involve audience members listening to narrative works that guided them through physical locations, sometimes encountering live performers.[17] What he describes experiencing is defined by Jean Paul Thibaud as the ***visiophonic knot****,* where there is a "convergence point between the audible and visible" (Thibaud, 2005, p.337). While Hardman's experience and Thibaud's concept are both referring to accidental convergences, it is the purposeful deployment of this technique that is the foundation of my own practice. Often grounded in his proposition that "listening on headphones establishes strange connections between the visual and musical landscape, undoubtedly largely influenced by stereotypes found in film and television productions" (p.336), Thibaud also described the convergence of different sonic spaces as the ***interphonic knot****,* where "user is situated between two simultaneous sonic worlds" (p.335). This combination of virtual and real sonic content is exploited in *Only Expansion,* but in many soundwalks (including *Dark By Then*) the mediated content is delivered on headphones that block out the listeners sound environment.

While the full range of social and physiological issues involved in mobile audio experience are beyond the scope of this study, there are some key concerns related to my exploration of composing structured experiences using this technology. Michael Bull's extended studies of mobile audio listening (2000) and iPod culture (2007) critique the sense of dislocation and disconnection with our environments that it can create (primarily when using headphones that block external sound). He placed the concepts of proximate and inclusive 'warmth' against the distant and exclusive 'chilly', as we warm up our personal private space "the chillier the urban environment becomes" (Bull, 2007, p.9).

In Bull's research we find some pointers towards the impact of sound on a participant's temporal experience. Although embedded within the polyrhythms of urban life, he proposes the iPod user creates a mono-rhythmic approach, making the "city what it is for users - rather than the city as inhabited by embodied 'others'" (2007, p.9). In much of my practice, I have

[17] See 'High School' (1981) and 'Jump' (1980)

sought to address this disconnect with our urban environment by making audio content that actively draws the mobile listeners attention to their surroundings, both physical and social. I have sought to attain a mode of mobile listening that also “connects the user with her environment, integrating and assimilating her into the world, [yet] in a transcendent manner whereby her everyday experience is transformed through the medium of sound” (Bull, 2012, p.153). This assimilation offers the possibility to use the mono-rhythmic approach to fuse together the multiple timelines of the world within a participant’s perception. It is in this attending to the surrounding environment that Bull offers a version of the visiophonic knot. Echoing Thibaud, he asserts that the impact of the music on the aesthetic and mood of our visual surroundings is akin to the way it dominates in film, and “our media experience in the home is reproduced in our apprehension of the urban street” (Bull, 2012, p.153).

Bull describes this as the *auditory gaze,* where an individual’s looking is “enthused by their listening” (2007, p.156). He articulates two different forms of cinematic experience. The first being where the listener may think of their gaze as that of a camera, their looking frames the action that forms a narrative they have created (Bull, 2007, p.176). His other form is based on responses from mobile listeners who describe their everyday moments as “appearing to be like a film” (p.178), this tending to arise from *alignment*s between the music they hear and things in the environment creating something reminiscent of a scene they know from a film or just simply filmic in atmosphere. It is in this shaping and controlling of the world through sound that enables the creation of possible micro-narratives that interweave with those we are already embedded in. While mobile listening can be seen to have many cinematic qualities, the key difference is that of the participant’s agency, as they choose how and where to move. As the knots are entirely of their making, we need to consider that the sound will influence their decisions.

The relationship between the private sound world of the participant and their engagement with an external environment can be framed using Kristine Jørgensen’s concept of the **transdiegetic** in game studies (2007). The cinematic qualities of mobile sound remain relevant here as Jørgensen developed this term from the concepts of diegetic and **extra-diegetic** sound.

The term diegetic comes from diegesis, a form of storytelling where events are recounted rather than enacted (Bordwell and Thompson, 2001). Characters within the story only experience what is part of the diegesis as, in film, diegetic sound is considered to be sounds that are part of that fictional world. So for example a character in a film may hear the diegetic sound of a car passing them, but they would not hear the music soundtrack or a narrators voice-over.[18] The music and voice-over, heard by the viewer, is considered as extra diegetic (Branigan, 1992, p.86) and, in this way, the listening space becomes divided between the two forms. If we apply this idea to the cinematic experience of walking *Dark By Then* the division becomes more complex. Describing the visual experience as cinematic would suggest that the sound heard in the audience's headphones is extra-diegetic, as it is not heard by the passers-by who become *characters* in the *city-screen.* Yet the listening audience member shares the same physical environment while hearing these sounds, so their presence is diegetic and part of the story of their experience.[19] Equally the narration that guides the audience member is extra-diegetic to the surrounding events and environment, but if the listener physically moves in response then this extra-diegetic sound impacts the diegetic space. Jørgensen's studies of sound in computer games offers a way of describing this complexity through the concept of transdiegesis.

To understand the connection between Jørgensen's research and my practice we must first examine the sound world of a typical computer game. In many games, players control an on-screen avatar that exists in a fictional world. There are sounds in the game that are part of that diegesis, the avatars footsteps, gunfire etc, that would all be considered as diegetic. In addition, there may be extra-diegetic music scores and narrated voices (sometimes appearing to be the avatars internal monologue). This extra-diegetic sound will sometimes pre-figure narrative events in the game so, for example, the music might "suddenly change from subtle to dramatic and fast-paced when the player's character enters a fight, or a special jingle may be played when the character enters a room of certain importance" (Jørgensen, 2007, p.110). Here the extra-diegetic space of the sound is brought into question because it is "affecting the behaviour of the avatar who acts

[18] This idea applies equally to non-fiction films, while the world portrayed is not fictional it is still a form of recounting of events, and characters would not hear a voice over.
[19] In *Only Expansion* this will become more complex as the soundtrack actively uses sounds that are heard both in the audience's headphones *and* other individuals in the space.

according to information it could not have gotten within the fictional world" (p.110) of the diegesis. This can be compared to a soundwalk where the extra-diegetic narration asks a participant to move to a certain location, thereby impacting events in the diegesis of the uncontrolled environment. Jørgensen calls these transdiegetic sounds, as they move from being purely extra-diegetic to being able to communicate "to characters or address features internal to the diegesis". As the participant's location in the diegesis is impacted by the sound, so too is the temporal structure of the experience. It affects when a participant arrives at a location and so creates specific visiophonic or interphonic knots. Here we begin to see the expanding relationship of time and space and their importance in the composition of augmented experiences. This thesis is fundamentally an attempt to codify the composition of the interplay between transdiegetic content and temporal structure.

1.3 TIME AND SPACE

To articulate the role of time and space in this research I will first highlight the lack of temporal research in my field and introduce my framework for understanding temporality. I will then position the work within the field of locative media, before finally introducing the concept of time geography and its relevance to my research.

1.3.1 WALKING TIME

While there is a wealth of critical study of soundwalks (Lavery, 2005; Butler, 2006; Myers, 2010; Gallagher, 2015 et al) the majority concentrates on questions of layering and spatiality within a present moment, of complex relationships between the real and the virtual.[20] Considering the importance of time *and* space to the act of walking, and the fact that sound is itself an inherently temporal medium, there is a distinct lack of research that considers the temporal structure of soundwalks, i.e. how their constituent elements are *sequenced in time-space.*

[20] Many pieces of research also relate soundwalks to Walter Benjamin's flaneur and the derivés of the Situationist International, while having some relevance these peripheral fields will not be addressed as the focus here is on the temporal and experiential interplay created through sound rather than the complexities of the participants' role in the urban environment.

Across performance studies, sound studies and critical geography we find numerous explorations of how time becomes layered and displaced.
Toby Butler describes experiencing an oral history sound walk where he "sat on a cushion and listened to the recorded Eve, from a year ago," where his "senses were delivering information from one place in two times" (Butler, 2006, p.18) but there is no description of how long he sat on that cushion and listened, of what *changed over time.* In Brandon LaBelle's *Background Noise* there is extensive reflection on how headphone listeners are situated "inside the actual and the virtual, the live and the recorded" (LaBelle, 2006, p. 225) but the reference to time is simply that it is "agitated through the overlapping and intersecting of different presences" (p. 226).

In Misha Myers' 'Walk with me, talk with me' (2010) there is a clear exposition of the temporal patterns in a mediated sound walk. She describes Graeme Miller's *Linked* (2003) as "staccato rhythm of stops and starts, between which the percipient can move at their own pace in time with their own corporeal rhythms, emotions and thoughts" (Myers, 2010, p.66). It is an acknowledgement of the impact of structuring time and how it can lead to movement that is "adagio or perhaps larghetto, melancholic". She continues that "the pace of the musicality of the soundscape and its use of repetition encourage a slower, more contemplative walk". When Myers discusses his guided walks with Tim Brennan,[21] there is also a more detailed consideration of temporal sequencing. She articulates moments that create temporal structures, such as a "deliberate delay occurs in the reading of a text related to a particular 'recitation point' at the next place along the route." Acknowledging the compositional craft here she notes that "Brennan ascribes this 'scoring' or 'skewing' of the text as contributing to its musicality" (Myers, 2010, p.66). The articulation of time through music offers possibilities for shaping a soundwalk's temporal structure.
In many mediated soundwalks the content is presented as a simple pre-recorded audio file that plays continuously. In this form the author has full control over the temporal structure, of the sequence and transitions. Where an audience is being guided this leads to a need for considering their capability to *keep up,* their ability to reach the required location in sync with

[21] Tim Brennan's walks were in fact an early *Dark By Then* inspiration. As I worked with Tineke De Meyer we thought about how his choosing of locations at which to read to the audience created a tension, and we wondered how we might achieve this when participants had to choose their own sites for reading.

the audio. One common technique used by Janet Cardiff and Platform is to incorporate the sound of walking feet into the content, asking the audience to walk in time with these virtual steps in an effort to control the temporal flow. As location aware mobile technology became available it became possible to have content play in response to an audience's geographic position, addressing the problems of them *keeping up,* but simultaneously introducing complexities through its indeterminate temporality. Offering the audience agency on *when* or *how fast* to go to a location simply means the author no longer knows how long the experience might last, both in total and for journeys between locations.

I am investigating what level of indeterminacy I accept as an author. Can we compose with durational boundaries if the participant has agency to walk at any speed they desire? This combination of temporal and spatial concerns requires a more holistic understanding of how they interact. The need to think time-space rather than time and space has been argued for by many including Nigel Thrift (2003) and Doreen Massey (1994). Thrift points to a tendency from the 1990s onwards to draw upon a language of space and place, location and position in writings on subjectivity, which exacerbates a Cartesian split of space from time. Massey encourages us to "overcome…the very formulation of space/time in terms of this dichotomy, and to recognise instead that space and time are inextricably interwoven" (Massey, 1994, p. 260-1). The interweaving occurs not just between time and space, but also in the "numerous and often incompatible if not contradictory senses of time, so we always need to remember that none stand in isolation "(p.5). It is in these multiplicities of time (within time-space) that my research is centred, therefore I continue with an account of the approaches to time that my research has drawn upon.

1.3.2 WHAT TIME IS IT?

As alluded to in the introduction, conceptual enquiries into time are well beyond the scope of this research and my interchangeable use, so far, of the terms temporality, duration and time already highlights the complexity. Philosophical suggestions of the unreality of time are not always useful for artists and makers, as such my research uses a clarification of terminology

that can be easily applied within my practice. The term *time* can be used to describe both that which we measure with clocks *or* a sense of time that we experience, while *temporality* is an overall framing term for both of these. . For greater clarity, I will be describing temporality using the Greek concepts of chronos (measurable time) and kairos (perceived time) to articulate the tension I am exploring; namely how as a composer do I align the measurable time of digital audio files and spatial movement with our subjective experience of time? It is for this reason that the proposed quaternary framework separates chronos and kairos from the content, allowing an unpacking of their different relationships to spatial movement.

Hans Rämö (1999) points out that chronos and kairos should not be treated as dichotomous oppositions, but rather as complementary aspects of how we understand time. John E. Smith's analysis of time in Greek philosophy tells us that chronos is "time as measure, the quantity of duration, the length of periodicity"(Smith, 1969, p.2) while kairos is a qualitative character of time, the significance and purpose of events. It can also be defined as "the special position of an event or action, the best time for something" (p.4), which will become important in the analysis of the relationship between the two in my practice.[22]

This separation of the measured and the experienced was key to J.M.E McTaggart's proposition for the fallacy of time (1921) which has been a springboard for much philosophical enquiry into time since. McTaggart version of kairos was A-series time, where events shift their categorisation from being in the future, to the present and then to the past, while chronos was B-series time where events have an unchanging place in a chronology, (e.g. your parents were born before you were). Taggart argued that these two forms were incompatible and thus time was unreal. Sidestepping a complex unpicking of this proposition, want to argue that *both* types do indeed exist simultaneously, and it is the management and structuring of their relationship that will form one core of this research (see Chap 3.)

[22] Here the term **duration** is connected to measurable time, and it will be used in this way for the rest of the thesis; as such it should not be confused with Bergson's concept of the experiential durée.

1.3.3 HOW SOON IS NOW?

In my consideration of kairos I am not seeking to investigate the phenomenological and physiological complexity of how humans *perceive* time, rather I am exploring kairos as a participant's experience of time that they can articulate, and how its impact can be externally observed. Despite this I will briefly introduce Edmund Husserl's concepts of temporal perception as aspects of it will be used as a way to view aspects of my compositional structures. Husserl's *On the Phenomenology of the Consciousness of Internal Time 1893-1917* (1992) describes time-consciousness *as* how time appears to us. A simplified summary of Husserl's position can be found in asking: *when we look at an object in motion how do we see it as having continuous momentum rather than as a series of individual positions?* Husserl's suggested answer was that we hold onto impressions of a previous state (a retention) and anticipate its coming state (a protention). These are what he called temporal modes of appearance, different from memories or predictions they are horizons on an extended present, components of what our consciousness considers *now*. As successive *now* moments appear, previous ones can be thought of as fading or attenuating into diminished but still present retentions. This diagram (Figure 3) presents the idea visually, where a *now* moment (A) recedes (A' to A'') in our perception as an anticipated coming moment (C'') approaches our perception of the present (C'' to C').

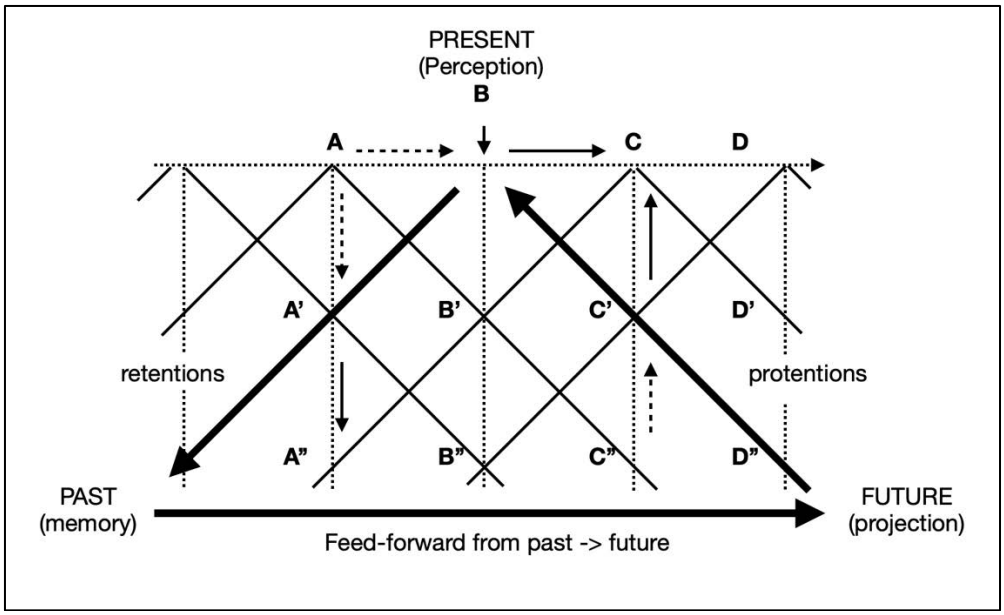


Figure 3 - How protentions and retentions approach and recede from our perception of a 'now' moment

Protentions can be considered as the same in reverse, increasing in strength as they move from the edge of our consciousness's *temporal horizon* to the now. Alfred Gell understands protentions not as anticipations of other moments, but as "projections of the subsequent evolution of this one" (Gell, 1992, p.228). It is this concept of expanding temporal horizons that will be adapted when considering kairos within the compositional structures of my practice, though the importance of summarising Husserl here is also to allow the presentation of Mark Fell's critique.

In following the example of his teacher Bretano, Husserl often uses music as an example of time-consciousness. Drawing both on our experience of continuous tone from instruments (e.g. how do we hear a 4 second long note from an oboe as a single continuous event?), but also in the structure of melodies. For example, in a sequence of notes one will finish but "When the new tone is sounding, the preceding tone has not disappeared without a trace. If it had, we would be quite incapable of noticing the relations among the successive tones." (Husserl, 1992, p.11).

In a study of temporality in his own audio-visual work, Mark Fell points out that Husserl's argument does not just use music as an example, but "that it is fundamentally formed in reference to music" (Fell, 2013, p.56). Relevant to the thesis at hand, Fell points out that music "serves as a framework within which our experience and understanding of temporality is constructed", so Husserl is asking us to think about time "by comparing time to something that is already a way of thinking about of time." (p.58).

Similar to conversations about temporality, discussing concepts (and definitions) of music releases its own suite of complexities and contradictions. Susanne Langer notes that the question of *what is music* "cannot be answered by research into the ingredients out of which musical works are made. For the elements of music are not tones of such and such pitch, duration and loudness, nor chords and measured beats; they are, like all artistic elements, something virtual, created only for perception."(Langer, 1953, p.105). For the purposes of this research, I will make one simple distinction; the music in the work is the sounds I organise with *musical intention*, e.g. when I intentionally draw from the tonality and rhythm of

instrumental technique. This allows it to be considered separately from the spoken voice and the field recordings in the structural design of the works. While I of course do make temporal and tonal considerations when editing the field recordings, I consider my intention to be the representation or rendering of sequences of *sound events* that occurred without musical intention. More importantly, Langer argues that music "suspends ordinary time and offers itself as an ideal substitute and equivalent… It creates an image of time measured by the motion of forms that seem to give it substance, yet a substance that consists entirely of sound, so it is transitoriness itself. Music makes time audible, and its form and continuity sensible" (p.110). Here I interpret *ordinary time* as the chronos of the work, while it is the musical (and other sonic) content that shapes the kairos. As will be demonstrated this relationship is reciprocal and entangled as each element of the quaternary framework affects the others.

1.3.4 ARE WE THERE YET?

The notion of music offering itself as a substitute for time also brings us back to John Cage's elevation of duration as the *correct* compositional method. To articulate the chronos of duration in my practice I will be using the composer Curtis Roads' categorisations of temporal scale (Roads, 2001), primarily the **supra, macro, meso and sound event** (Figure 4). While Roads' research concentrates on the blurring of durational boundaries at the microsound scale, his articulation of larger scales provides useful temporal distinctions.

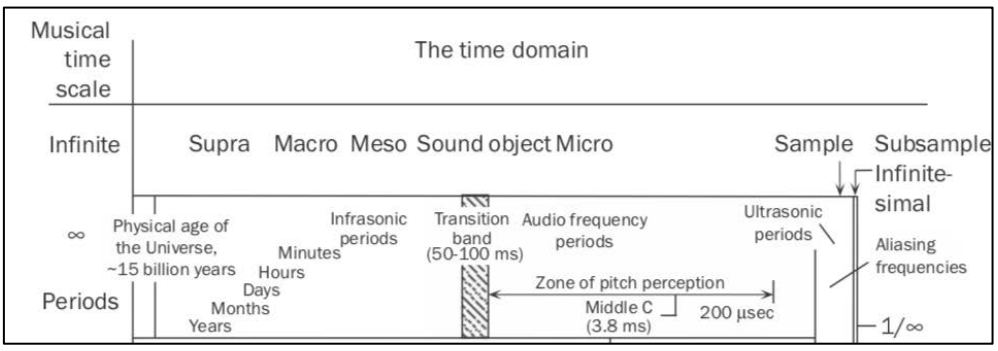


Figure 4 - Roads' temporal scales

As shown in the diagram, the macro scale covers the compositional structure of the experience I am authoring, often from the moment a participant puts the headphones on and presses go to the moment the mediated content stops (or the participant ends the work through a software interaction). The supra scale is the period that extends ahead and behind this experience, incorporating everything from the duration of a festival the work might be in, to the lifespan of the participant and outwards to planetary timescales. The meso structure is a blurrier definition; in Roads' categories it could be thought of as a musical phrase or passage, for this research I am considering it as the scale of distinct components or sections of the work that combine to create the macro scale structure. So, for example, a section of *Dark By Then* which involves a participant walking from one location to another while listening to a pre-recorded audio file would be a meso scale component. In both *Dark By Then* and *Only Expansion* each chapter of the printed book demarcates a meso scale component. While the majority of the analysis in this thesis will concentrate on these three scales there will be some consideration of the sound object scale. Roads often defines this as a 'note', the elementary unit of composition lasting from 100ms to several seconds, but drawing on Pierre Schaeffer's use of the term allows it to encompass any sound from any source. This level of structure will become relevant in examining the relationship between the printed material and field recordings presented in *Dark By Then* and the use of the live audio feed in *Only Expansion*.

It is important to emphasise that the relationship between the meso and macro scales of the work is how I attempt to create a continuity of experience. If the work is an attempt to frame a time period through the audio content it becomes an unbroken flow of meso scale compositions that do not leave any caesura un-articulated within the macro scale. The continuity of this frame will be used to demonstrate that everything within it becomes part of the participant's experience of the work.

1.3.5 TIME AND MUSIC

In my consideration of how chronos and kairos are articulated from a musical perspective I will be drawing on the work of Jonathan Kramer. In *The Time of Music* (1988) Kramer expresses a belief that "Just as time does not exist apart from experience, so musical time does not exist apart from music. As we listen to music, the time we experience is a special kind. We simultaneously experience musical time and ordinary, or absolute time" (p.5). Here I interpret *musical time* as being the kairos*,* relative to the chronos of *ordinary absolute* time, and both are not just simultaneous but entangled together in our experience of listening to music.

At the core of Kramer's work is the presentation of overlapping categories of linear and non-linear musical time. It is possible to summarise Kramer's meaning of linear as the "determination of some characteristics of music in accordance with implications that arise from earlier in the piece" (p.20). Kramer's determination is centred around ideas of harmonic progression, therefore an initial issue with this is its partial dependence on cultural understanding or learned experience of music. There is some form of assumption that a listener expects a piece of music to progress in a certain way, for example to resolve to its tonic, or to repeat a chorus.[23]

I follow the composer Elliot Carter's position that any moment of a composition can only be understood in the context of the preceding and succeeding sections, "while every moment is a fascinating and beautiful thing in itself, still what's much more fascinating is the continuity, the way each moment is being led up to and led away from" (as cited in Edwards, 1971, p.90). Whatever happens in the soundtrack of my work, the participant has heard what has come before it, and it is due to this that a repetition of sound might have impact. It is also how changes (or lack of them) in audio content can be perceived and then potentially used to shape the participant's experience. Here we touch on a somewhat phenomenological perspective,

[23] This is all based on what we expect something to do, and whether our expectations are satisfied. In David Huron's detailed study of expectation in music he begins with the question 'why do these techniques work?', but adds that "an ethnomusicologist might ask 'why do they often fail to work in listeners too familiar with western music?' And an experienced film composer might ask 'why do they sometimes fail to work, even for those who are familiar with western music?" (Huron, 2018, p.2). The feel and form of a piece of music might indeed be part of a cultural understanding, and I acknowledge that just as my own field of practice is rooted in a Western European understanding, the participants I am presenting the work to for analysis share this background.

as the sound artist Justin Bennett argues “our perception of these events modulates our experience of duration, the flux of time itself” (Bennett, 2003, p.84). For a western listener a musical element repeated 4 times before something changes or another is added creates a very different impact to one repeated 100 times[24]. A gradual change in volume or a climatic burst of sound are linear elements due to when they happen and what has happened before and after them, even if musical tradition/understanding might imbue them with different meanings. In this way the meso scale structures in my work with a fixed duration can be classified as *linear.* I propose that regardless of harmonic rules, their use of repetition and the progressive introduction/removal of sonic elements (e.g. a violin or drums gradually appearing or disappearing) gives a sense of linearity and progression for the listener. This form of linearity can be considered as *goal directed,* where as a composer I want the music to progress linearly towards a specific state.

Alternate to this linear progression is Kramer’s description of non-linearity, defined as characteristics that “arise from tendencies governing an entire piece or section” (Kramer, 1988, p.20). One example he gives is of a string quartet, the non-linear quality being the fact it is performed by four string instruments. If a brass section were to appear this would be a non-linear quality that has been revealed but did not develop from earlier tendencies. With this understanding of non-linearity, Kramer defines moment form as an application of non-linear time in music. Drawing from Stockhausen, Kramer describes moment form compositions as not containing normal developmental structure, no shift towards a climax, or transitional states. They are immediately intensive and “are in a state of always having already commenced, which could go on as they are for eternity” (p.201) and may “break off without tonal closure” (p.203).[25] Where linear goal directed form is about relationships between *successive* events, moment form is often concerned with “unchanging relationships between ever present layers”

[24] A useful exposition of non-western perceptions around time and repetition can be found in TenHouten, W. D. (1999) Text and Temporality: Patterned---Cyclical and Ordinary---Linear Forms of Time---Consciousness, Inferred from a Corpus of Australian Aboriginal and Euro---Australian Life---Historical Interviews. Symbolic Interaction. [Online] 22 (2), 121–137.

[25] Again this description is very tied up with western music, and specifically the canon of classical music. As my compositional style also draws from contemporary electronic music, experimental rock and ambient experimentation, the classical music scholar may consider parts of my music to have very little developmental structure. Elements of sound may suddenly appear or fade away with little regard for the ‘rules’ of harmony, simplistic pulses may repeat ad infinitum, abruptly stopping with only a reverb tail for a cadence. While Kramer’s definition would suggest these are moment form, I would posit authored duration gives them a linear form.

(p.56) where there “is no substantial contrast, change, motion, or surprise within sections” (p.54).

My intention here is not to provide a deep unpacking of compositional form, but rather a demarcation of intent. This allows me to differentiate between my *linear goal directed form* compositions (henceforth referred to as *linear form*) that progress towards an intended state and *moment form* compositions that seek to diffuse suggestions of direction or progression. The application of these two forms in my practice will be examined fully in Chapter 3.1.4.

The multiple threads of temporality described in the preceding sections are extensive, and as Kramer reminds us concepts of time are too complex to be “explicated solely by a linear argument” (Kramer, 1988, xiii). For clarity as we move forwards, the core ideas I draw on can be summarised as follows: time will be considered through a lens of either chronos (measurable and absolute time) or kairos (subjective, perceived time). The measurable durations of chronos in the work will be considered as existing in a temporal hierarchy of macro scale (the duration of the entire work), meso scale (sections within the work), supra (beyond the duration of the work itself) and sound event (individual sounds). Perception of these scales will be understood through Husserl’s *temporal horizon,* where our present is made up of increasing protentions of future moments and fading retentions of past ones. Finally time in music will be understood through Kramer’s notion of having either goal directed progression (linear directed form) or vertical continuous statis (moment form).

In my analysis of the work in Chapter 3, I will be considering how I utilise moment form in combination with linear form to shape and influence the macro/meso scales, and how the nature of the open work can lead to a linearity authored collaboratively by the author and participant. The meso and macro structures of the work do not exist solely within the audible content though, it is the relationship between the temporality of the content *and* the spatial movement that complete the work. To examine the role of the spatial, I will now explore the field of locative media.

1.3.6 LOCATIVE LEGACIES

As the practice under consideration relies on media delivered through mobile devices and is relevant to the location of the audience in some way, the history and associated discourse around *locative media* should be considered as useful context. The term itself has come to represent a body of work created at the beginning of the 21st century that used geo-located technologies.[26] In Andrea Zeffiro's extensive genealogy of the term (2012) she usefully rejects the idea that it is a single form, arguing instead that "it is a field of cultural production that is perpetually evolving and continuously reproduced vis-á-vis struggles between technological interpretation and different visions of future use" (p.1).

Within this field, I want to specifically look at work that uses GPS data to trigger the presentation of digital content to a participant via a mobile device, for example where an audio file is played when the participant enters a **geofenced**[27] area. Malcolm McCullough (2008) has described this as urban markup[28], a form of site-specific storytelling, linking it to a historical tradition of durable inscriptions (such as those carved into buildings) or ephemeral ones, such as graffiti or transitory posters. McCullough situates locative media somewhere in the spectrum between these forms as "neither organised 'media' as the twentieth century knew them, nor random graffiti as all the ages have witnessed"(p.64). The references to visual mediums are unsurprising, across locative media's critical discourse there has often been a dominance of the visual. When surveying works in this field the use of audio is commonplace but by no means a de facto approach, and in much of the critical writing around locative practices the specifics of the sound are often a secondary consideration. Sutko and de Souza e Silva go as far as to describe location-aware mobile media as simply allowing "users to see their locations on a map on their mobile phone screens"(Sutko and de Souza e Silva, 2011, p.807). This dominance is not without its critics, as exemplified

[26] Karlis Kalnins first proposed the term, 'locative media'2 during the Art Communication Festival,16–17 May 2003, in Riga, Latvia (Tuters, 2004d, 2005; see also Bleeker and Knowlton, 2006; Hemment, 2004c; Russell, 2004). The word 'locative' is derived from the locative noun case in the Latvian language, which indicates location, and vaguely corresponds to the English prepositions 'in', 'on', 'at', 'by'.
[27] A **geofence** is a virtual perimeter for a geographic area. Often determined by software using latitude and longitude, (but also possible through proximity to devices such as Bluetooth beacons) it can be used to signal software events when a device enters or exits its boundaries.
[28] While there have been locative media works in non-urban locations, there has been an apparent dominance of urban based experiences.

by Drew Hemment in 2006, who recognises that “In place of the richness of embodied experience of the world, many projects offer the challenge of roaming the environment while squinting at a tiny screen and clunky menu, separated from the world by a barrier of bad usability”(Hemment, 2006, p.351). In my practice, screen interaction is either minimal or non-existent, the focus being on sonic content that allows participants enhanced engagement with their environment.

The role of sound in locative media has been addressed by Frauke Behrendt (2012) who proposed a taxonomy for *mobile sound* in locative media (Figure 5) which I will outline here.

Musical Instruments involves “(mis)using mobile phones as musical instruments” (Behrendt, 2015, p.12); this is based around using the inherent sonic capabilities (ringtones etc) of phones in co-ordinated compositions. *Sonified mobility* describes works where audience mobility is driving or the influencing the sound, often this incorporates some form of data sonification where GPS or movement data is being directly mapped or converted into audible media. *Sound Platforms* offer participants the chance to contribute and distribute sounds in geographic space (to be triggered by software), while *placed Sounds* denotes that the choice and placement of sounds is being curated by the artist. Both of these describe the association of a recorded sound with a geographic location (often using GPS), so that “the audience can only access the located content when they are physically present in their specific geographic location” (Behrendt, 2015, p.8).

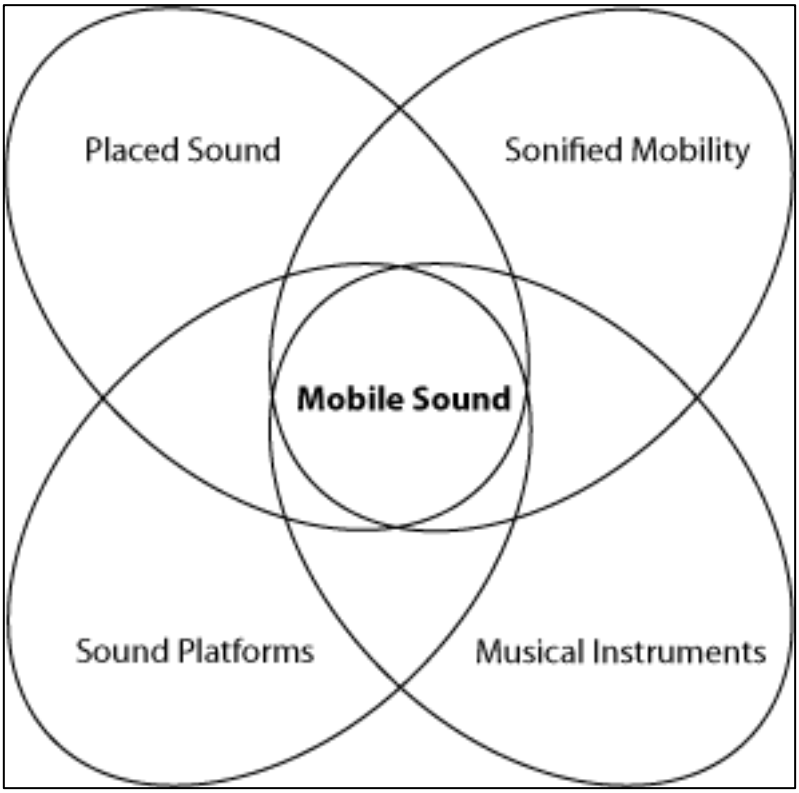


Figure 5 - Taxonomy of locative audio (Behrendt, 2015, p.6)

While this set of categories addresses dominant trends in locative media the practice here sits on the boundaries between them. *Dark By Then* allows the participant to place the geo-fenced regions but they do not contribute sonic content, and more crucially they are not explicitly told the regions they place will trigger sound later in the work. Due to this the work sits somewhere between the *placed sounds* and *sound platform* categories. *Only Expansion* does not use GPS technologies or data sonification, but the movement of the participant directly influences the sonic content. Equally the audio processing software creates musical output from external sounds it picks up. As such this work could be understood as being in the categories of both *sonified mobility* and *musical instrument.*

What is still absent in the work of Behrendt and others is a consideration of the temporal composition of locative works that develops ideas of temporal sequencing.[29] Peacock's detailed consideration of locative media's performative aspects builds an analytical language that captures elements

[29] The possibility of non-linear sequencing is referred to but little consideration of how this non-linearity might affect the arc of an experience.

such as the thin and thick qualities of experience (Peacock, 2005). For example, a GPS triggered sequence of events (thin) versus the constant engagement with a changing space (thick), the coding of resonant and coincident events or the difference between augmenting and replacing, yet nowhere do we find something that considers the temporal sequence of physically *moving through* the *urban markup.* Even Behrendt's commitment to promoting the abilities of the sonic to help us understand the "temporal, situated and embodied" (2012, p.282) provides little analysis of the actual *experience over time* involved in a sonic locative experience. Associating media with a location immediately separates it geographically from others similarly associated to different locations. This means there is also a temporal separation because (without the use of a teleportation device) it simply *takes time* for a human to get from one location to another.[30] Often I have found locative experiences to be structured as singular pieces of content triggered by a set of distinct locations with little consideration for the temporal gaps between them.

In my practice, I consider the macro scale of a work to be a sequence of meso scale elements framed by durational boundaries, and I will argue that understanding (and using) the caesuras between locations should be an integral part of the compositional process. If we do not compose in those gaps, then we are only constructing the point to point navigation of a *traveller*, when the audience is in fact a *wayfarer,* continuously engaged with the environment they are moving through. Whether or not the content acknowledges this can be an active decision of the author.

This difference between travelling and wayfaring is identified by Tim Ingold in *Lines* (2007)*,* and was drawn upon by Benford and Giannachi in their study of Blast Theory's mixed-reality-performances (Benford and Giannachi, 2008; Benford *et al.*, 2009). It forms the basis for their proposal of *trajectories* and is some of the only detailed research exploring temporal composition in this field from a craft perspective. Their research offers some key elements that this thesis builds upon and so it requires describing here.

[30] This physical separation can be considered in opposition to network space, where we instantly jump between locations using hyperlinks for example.

The work by Blast Theory under examination, *Day of the Figurines* (2006), involves online networked content and staged performers. It bleeds into the everyday life of its audience, with experiential arcs that last for many days. It is connected to my practice through the idea that their audiences undertake a singular journey. This journey may involve passage through many different "places, times, roles and interfaces" which "maintain an overall sense of coherence; of being part of a connected whole" (Benford *et al.*, 2009, p.712). It is this notion of "continuous trajectories through the structures of a user experience" (p.712) that resonates with my ideas of composing in the gaps. It acknowledges that when embedding digital media into a physical space and requiring audiences to travel through it, the journey is experienced continuously regardless of when or how interaction with mediated or located content takes place. They contrast it with the paradigm of hypermedia where traversal of hyperlinks is near instantaneous, out on the streets the "unfolding journey through space and time is a primary aspect of the experience" (p.712).

The *trajectories* in their proposition are a way to describe the route of these journeys and identify the practical challenges of maintaining continuity. The key forms categorised are the *canonical trajectory,* to describe the author's intended route; and the *participant trajectory* to describe a participant's actual route. So, for example, the *canonical trajectory* may expect a participant to walk directly from one location to another, while the *participant trajectory* may involve them stopping to talk to a friend they pass en route. This echoes Cage's coincidences of free events, where despite a canonical frame, the piece can be performed in different ways. Of importance to my practice is their proposition that there are also *temporal trajectories* which express a mapping between *story time* and *clock time.*

Here, *story time* refers to the "fictional time in an underlying story universe". Drawn from literature studies, *story time* is determined by the author and "describes the timespan defining the narrative outline of the story"(Benford and Giannachi, 2008, p.75). This might involve the historical epoch a story is set, or key events. *Clock time* is taken to be the idea of time which can be measure using a clock in the physical world[31], analogous to *chronos.* In "Day

[31] This division between clock time and story time has a resonance with the difference between chronos and kairos that will be discussed later in this chapter.

of the Figurines" the temporal structure maps 24 hours of story time onto 24 clock days. Unsurprisingly, the composition of an experience like this has to contend with the opening hours of exhibiting institutions and the day to day schedules of audience members.

Having identified the need for a *temporal trajectory* that navigates the *hybrid time* structure they break it apart further into the following definitions:

> *Story time* - the temporal structure of the underlying fictional universe as conceived by its author
>
> *Plot time* - defines the order and timing of a particular narration of events from the story universe
>
> *Schedule time* - defines when the above two aspects are actually made available to participants
>
> *Interaction time* - when participants are willing/able to interact with these.
>
> *Perceived time* - how participants reconstruct an overall sense of the timing of the story.

In some ways these interacting definitions of time may seem focused around a specific set of complexities that happen within Blast Theory's projects, but what is important is that they identify the continuous interaction and interdependency between these varied temporal trajectories. *Schedule time* and *Interaction time* can be understood as existing within the chronos of the work, while the rest exist more as kairos. While this exposition of the relationship between the categories is clearly important in plotting logistics of work in hybrid space and time, my research will address two ideas that I consider absent. Firstly the impact of media content on the chronos and kairos, and secondly the relationship of these temporal trajectories to the spatial experience. To approach analysing the temporal and spatial dimensions cohesively I turned to Torsten Hägerstrand's work in developing *time geography.*

1.3.7 TIME GEOGRAPHY

Time geography is not considered a subject area in itself, but rather an ontological framework and visual language where space and time are the basis of analysis of dynamic processes (Lenntorp, 1999). Here, I will outline its history and fundamental concepts before describing the analysis and notation methods that I apply in my research.

Time geography arose from Torsten Hägerstrand's studies of population movements in Sweden, and can be understood as being a physicalist approach that considers space and time as *resources* (Thrift, 1977), so just as we allocate portions of space to particular uses we must allocate time intervals the same way. Kajsa Ellegård describes Hägerstrand's approach as providing "a multidimensional and abstract view of the world in terms of processes in the time-space by following individuals from different kinds of populations through events and processes at various places" (Ellegård and Svedin, 2012, p.20). As a methodology it has been used in transport research (Ellegård & Svedin, 2012) and healthcare (Vrotsou *et al.*, 2017), in modelling animal behaviour (Baer and Butler, 2000) and anthropology (Kwan, 2004) but *not notably in arts practice*.

In my research, I am drawing on a number of its approaches, and although isolating them from some of Hägerstrand's political motivations I want to first outline some of its basic assumptions of time and space. Hägerstrand's presents his understanding as "[T]ime does not admit escape for the individual. […] As long as he is alive at all, he has to pass every point on the time-scale" (Hägerstrand, 1970, p.10). Time geography assumes that time exists and can be measured, and so in its notation methods (see below) time is used objectively. As Ellegård describes, this creates "a common ground for investigating pro- cesses over time, in a similar way as the conventional map is utilized to show the geographic location of places" and importantly "can be used as a starting point for an individual reflecting on her subjective experiences of an event or process" (Ellegård, 2018, p.13). In my practice, I use it both to unpick a participant's subjective response to an experience and understand potential structures of the experiences I create.
Time is understood here as being continuous and with a constant pace "irrespective of human wants and wills" (Ellegård, 2018 p.13). This viewpoint

is the *chronos* of time, it carries on regardless of how fast a human is moving or what they are experiencing, and equally it cannot be halted or re-sequenced, events cannot change their position in the time dimension. In time geography, space is the geographical dimension and place is used to denote specific locations based on “a map constructed from agreed upon conventions” (p.17).

Moving through this time-space is the *individual.* Here the individual is understood to be any existents in time-space, which could be human, plant or any material thing. Regardless of type, time geography’s understanding of the individual is that it is an undivided entity, a continuant, which is born, produced, or created, and it exists for a time period and thereafter dies, is destroyed or dissolved. The movement of an *individual* through *time-space* is called the ***path*** and is best represented through time geography’s time-space cube notation system.

Figure 6 is an example of a time-space cube, where an individual’s *path* (the solid black line) moves through geographic (horizontal plane) and temporal (vertical plane) space. Here the idea of a *path* is akin to the *trajectories* described by Benford et al.(2010). Specific places that an individual moves through (e.g. work->home in diagram 2) are referred to as ***stations***.

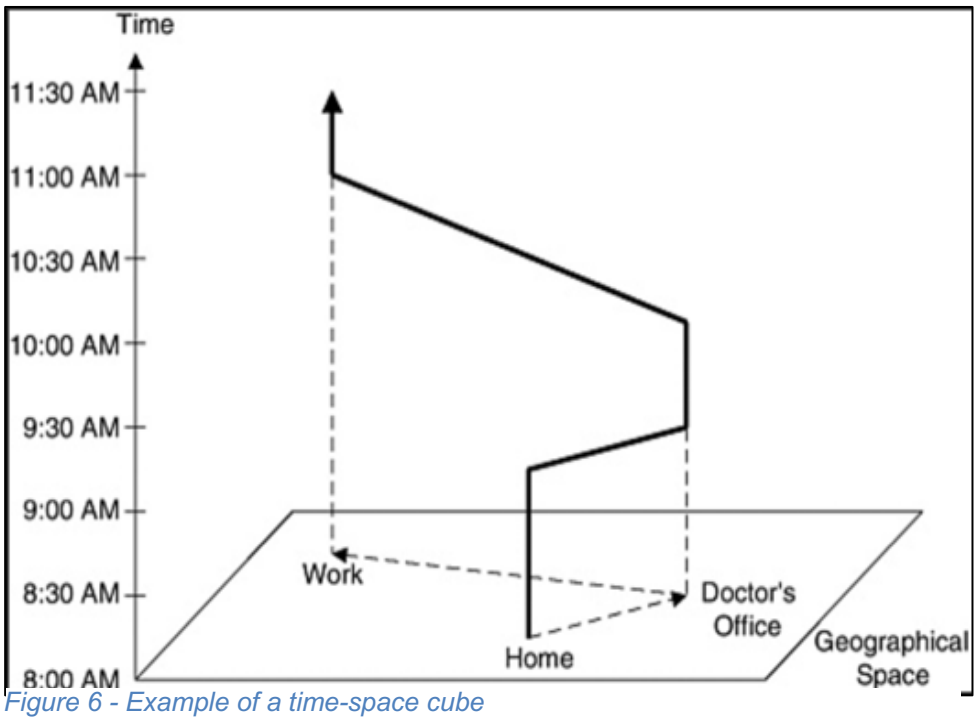


Figure 6 - Example of a time-space cube

As a way of addressing the Cartesian dichotomy of time and space that Thrift and Massey highlighted, Hägerstrand's goal was to "place human activity within a single place of experience" (Speed, 2011, p.240), creating a notation system that kept track of both spatial and temporal dimensions simultaneously.

The second set of concepts I draw from are those of prisms and constraints. In tracking an individual's time-space path, time geography appreciates the "biophysical, ecological and locational realities that impose constraints on the performance of the social system" (Thrift, 1977, p.5). While Hägerstrand admits "it would be impossible to offer a comprehensive taxonomy of constraints seen as time-space phenomena" he "tentatively described" (Hägerstrand, 1970, p.21) three important classes of constraints: *capability, coupling and authority.*

> *Capability constraints* can limit an individual's actions through biological make up (e.g. how fast they can walk) or capacity of tools (e.g. speed of a car).
>
> *Coupling constraints* are when individuals, tools and locations must be at given places at given times (e.g. to catch a train one needs to be at a station when the train is scheduled).
>
> *Authority constraints* are determined by hierarchies of accessibility, such as needing permission to enter private property.

In defining how "individuals, groups, and institutions navigate through time–space and every- day life" (Sui,2012 p.6), these constraints are equally applicable to understanding the *time-space* of my compositional structures and the *every-day* of the uncontrolled environments they take place in.

The concept of the *prism* was developed in time geography by Bo Lenntorp and is designed to capture the future possible locations of an individual. So for example the capacity constraint of a person's walking speed will limit the geographic distance they can move in a specified period of time. Figure 8 represents a prism in two dimensions, visualising opportunities that exist within constraints and the assumption that time moves continuously forward.

Figure 7 shows the concept in the timecube format, demonstrating the limits of an individual's time-space path.

All of these concepts will be expanded on and applied to audio augmented experiences in chapter 3. What should be taken into account here is that time geography was ostensibly about *studying* existing situations, as Lenntorp points out, to "reveal revelations, the nature of which escape researchers as

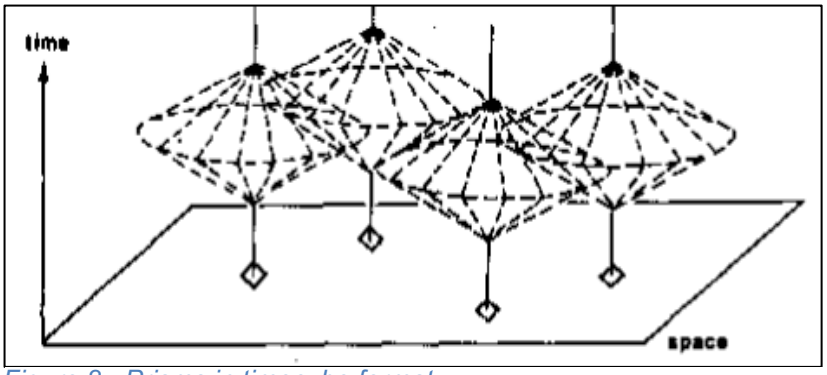


Figure 8 - Prisms in timecube format

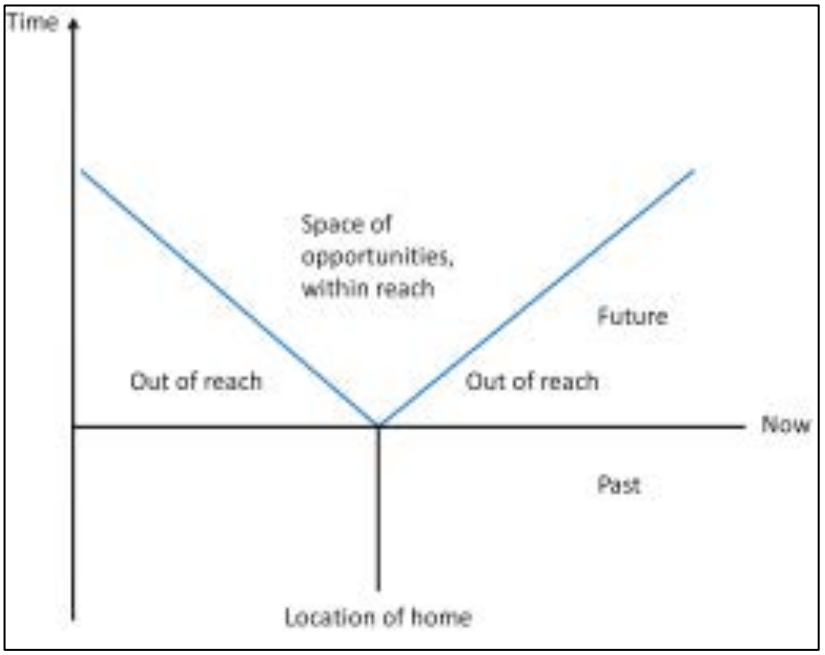


Figure 7 - Prisms in 2 dimensions, where x-axis is distance

soon as the object of research is separated from its given environment in order to study it in isolation" (Lenntorp, 1999, p.155). Time geography is not without its critics, humanists argue that it is inherently reductionist and carries the baggage of physicalism. As geographer Daniel Sui argues, Hägerstrand himself struggled to "balance comprehensive models with the need to simplify" (Sui, 2012, p.6), and in this simplification of humans into paths in

time-space others have alleged that time geography has been reduced to little more than a graphic exercise.

In this research time geographic methods are used for both the analysis *and creation* of experiences. Although they only strictly document the chronos and spatial movement in an experience, I will demonstrate how they begin to reveal the interdependence of the elements in my compositional framework. As Hägerstrand himself states:

> "What is briefly alluded to here is a 4-dimensional world of forms. This cannot be completely graphically depicted. On the other hand one ought to be able to imagine it with sufficient clarity for it to be of guidance in empirical and theoretical research."
>
> (Hägerstrand, 2004, p. 323)

In his later writing Hägerstrand made consistent efforts to emphasise the fact that people are embedded as part of, not apart from, nature, arguing that ‘‘... it is an illusion to believe that human society can isolate itself from nature. The best we can hope for is a reasonably safe co-evo-lution” (1995, p.35). I highlight this as one of the key findings in my research has been how the interplay of content, chronos, kairos and spatial movement can create a form of ecological entanglement.

1.4 BEING ECOCRITICAL

In Chapter 3 I will argue that in the authoring of temporal and spatial shifts there is a resonance with contemporary ecological theory. As such I describe the practice as being ecocritical. In this final section of this chapter I will outline my reasoning for this through three themes: time-space in the **Anthropocene**, ecological entanglements and environmental sound art.

1.4.1 TIMESPACE AND THE ANTHROPOCENE

My use of the term ecocritical is directly drawn from ecocriticism, broadly understood as "the study of the relationship between literature and the physical environment" (Glotfelty and Fromm, 1996, p.xix). Greg Garrad's extensive survey of the field offers an even wider definition as "the study of the relationship of the human and the non-human" (2012, p. 4). Ursula Heise clarifies the ecocritical as being an "attempt to think beyond conceptual dichotomies that modernity, the Enlightenment and science were thought to have imposed on Western culture" (2016, p. 506). It is from this apparent openness that I choose to expand the form of work the term covers, though the existing literary focus of the field will necessitate a continuous remapping of its critical perspectives on to the practice I am investigating here. There are many strands of literary ecocriticism, but of key relevance to my practice are its approaches to the multiple scales of time and space in the Anthropocene.

The Anthropocene, coined by Paul Crutzen in 2000,[32] is generally considered to describe a new geological epoch of significant human impact on the earth. Its geological specification and categorisation are still widely debated, but despite this it has become a pervasive cultural concept. I use the term here as a form of shorthand, rather than the specificity of the geological epoch. It is used as a way to frame contemporary ecological perspectives about human impact, to speak towards climate breakdown and broad notions of environmental crisis. The term Anthropocene itself can be problematic, especially in its homogenising of the human species. This species thinking risks erasing the societal differences that dictate "who produces and who

[32] IGBP's Global Change newsletter 41

suffers" (Heise, 2019, p.278), as AM Kanngieser reminds us "the Anthropocene is predicated on exploitation, colonialism, slavery, and genocide, and any claim to an equitably responsible humanity subjugates these structural brutalities" (2015, p.2). Despite these important critiques, as an artist presenting work to wide audiences I find myself drawn to Jamie Lorimer's point that "the planetary scale and elasticity of geological time implied by the term permits a more heterogeneous and speculative popular engagement." (2017, p.21). In this way, I use the term both as a provocation and shorthand for the human/non-human relationships that ecocriticism explores. In my research of the multiple temporal qualities within AAR I find a constant dialogue with how investigation of the Anthropocene repeatedly reconsiders time.

Ada Smailbegović specifically calls the Anthropocene a way of framing time, and that if we are to understand it, and to feel its temporality as more than just an abstract theory, then we require "a careful attunement to the variegated kind of change" (Smailbegović, 2015, p. 97) that composes it. Smailbegović identifies that humans only understand a restricted range of rhythms, and that many of the timescales of the Anthropocene exist outside of these. From the hydraulic slowness of starfish migration to decaying nuclear fuel waste that must be managed far beyond our individual lifespans, our contemporary existence is the uncanny sense of existing on more than one scale at once.

The historian Julia Adeney Thomas (2014) argues that we are faced with "clashing scales of geological time, of the microbes and bacteria that make up part of our human bodies, and of the chemical flows of nutrients and toxins through organisms" (as cited in Heise, 2019, p. 277. A rethinking of scale not only leads towards "reconceptualisations of human individuality and collectivity (p. 277) but also creates challenges for cultural responses.

1.4.2 ECOLOGICAL ENTANGLEMENTS

In 'Science Fiction and The Time Scales of the Anthropocene' (2019), Ursula Heise summarises the often-voiced concern that the extended temporal scale of these ecological narratives of structures are limited by existing cultural story templates. The focus on telling human scale narratives is critiqued by Amitav Ghosh's in his notion that the "long durée is not the territory of the novel" (2016, p.59), and Trexler's demand that "climate criticism must develop new ways to describe the interpenetration between domestic and planetary scales" (2015, p.26). In response, Heise points towards science fiction writing as a field that has addressed the issue, and I will draw on this to frame temporality in my own practice in Chapter 3. Spatial scale is addressed by Heise in *Sense of Place, Sense of Planet* (2008) and informs my examination of expanding time-space within the work, following her argument for re-evaluating non-local knowledge to develop a more systemic sense of planet.

The call for different cultural responses is not just limited to challenges of scale, but also within the experiential form of the artworks themselves. In ecocritical writing, figurative language is often used to evoke different environments, but as Timothy Morton highlights the more writing tries to "show you what lies beyond the page, the more of the page I have" (2009, p.30). In *Ecology Without Nature* (2009), Morton describes the devices of these literary approaches as **ecomimesis**, where they attempt to suggest that the reality of nature is solid and independent of the writing process itself, that nature somehow exists *over there.*

He defines *strong* ecomimesis as purporting to evoke the here and now of writing. This is the mode of 'as I sit here writing this', whereas weak ecomimesis is trying to conjure the environment outside of the text "through detailed descriptions of locality, climate, time, and suchlike, to illustrate a direct link between writing and what it signifies" (Carducci, 2009, p.635). While focused on the literary, Morton's arguments have strong resonances with many aspects of my practice and I will be demonstrating where I think my practice addresses them, specifically in terms of how participants directly experience multiple timeframes in the work.

What is important to acknowledge at this stage is that he advocates for literary and sonic art works that produce heightened awareness of self and environments, arguing that the “self and the world are intertwined” (Morton, 2009, p. 69). This blur and bleed between the work and the world will also be framed through Mikhail Bakhtin’s concept of the chronotope, where the real and the represented world “are indissolubly tied up with each other and find themselves in mutual interaction” (Bakhtin, 1981, p. 84). Like Kaprow’s non-matrixed performances and Thibaud’s phonic knots, what appears is another form of entanglement, which will become key to the compositional framework I am proposing.

Entanglement is understood in the framework as describing the coexistence and co-dependency of content, spatial movement, chronos and kairos, following Karen Barad’s description as “not simply to be entwined with another, as in the joining of separate entities, but to lack an independent, self-contained existence.” (Barad, 2007, p.ix). Entanglement as a concept has been mobilised by a wide range of theorists seeking to “move beyond a worldview where the human is seen as exceptional” (Giraud, 2019, p.1). Donna Haraway argues that entanglement is not a new concept but simply the way things are, pointing out that “No species, not even our own arrogant one pretending to be good individuals in so-called modern Western scripts, acts alone; assemblages of organic species and of abiotic actors make history, the evolutionary kind and the other kinds too” (2015, p.159). Her entanglement leads to not an Anthropocene but a *Chthulucene “*that entangles myriad temporalities and spatialities” (p.160).

Jane Bennett approaches entanglement from a materialist position that allows the “vitality of non-human elements to be agents or forces with trajectories, propensities or tendencies of their own” (2010, loc. 56). Like others, Bennett’s drive comes partly from a desire to address the environmental impacts of anthropocentric subjectivity, stemming from her hunch “that the image of dead or thoroughly instrumentalist matter feeds human hubris and our earth-destroying fantasies of conquest and consumption” (2010, loc. 62).

Sympathetically critiquing post-humanist positions on entanglement, Eva Giraud in attempting to root its promise through action and activism, notes that just identifying the complexity of our entangled existence "can prove paralysing and disperse responsibilities in ways that undermine scope for political action" (Giraud, 2019, p.2). If everything is entangled and everything acts on everything else, it becomes difficult to point a finger of blame, or know what needs to be done to engender more responsible relationships.

Acknowledging the deeply rooted discourse around entanglement that has emerged from within the environmental humanities and, in particular, post-humanist theory, my intention here is not to rehearse their values and position but instead to point to how scholarship from within these fields has radically shifted our ontological viewpoint from the human, to a more-than-human perspective. It is an acceptance that "the very notion of objectivity has been totally subverted by the presence of humans in the phenomena to be described" (Latour, 2014, p.2). Despite Giraud's critique, I maintain that acknowledging the entanglements between the human and non-human is a move that fundamentally attempts to dethrone *nature* from a position of being something *other*.

1.4.3 ENVIRONMENTAL SOUND ART

The entanglement of timeframes in the practice is embodied in its use of sound's inherent temporality. In some way, one could argue that practitioners who work with sound have been doing entanglement for decades, if not millennia, such as the first humans that used caves as natural echo chambers. Despite this there are no explicit studies that look at the question of entanglement from a compositional point of view, particularly in relation to the temporal aspects of audio augmented reality, from both the composer's and the participant's point of view. While my work is not exclusively sonic it can be seen to exist within a wider body of ecological and environmental sound art. The field recording in my practice is connected to works by artists such as Els Viaene, Chris Watson, Francisco López and Jana Winderen, all of whom create detailed collages of recorded environmental sound. While the use of microphones transforms the spatial and materialistic qualities of the sound, it is editing that affects its' temporality, as López points out "the process begins with the decision to start and stop recording" (1998). While

the time-space of the listener is not often considered as part of the artist's work, I would argue that the act of listening to an 8 hour recording of a storm compressed into a 70 minute CD, as in Watson's *Weather Report* (2003), inherently collapses two timescales into the audience's listening environment. The entanglement generated by field recordings exists not just in this editing and layering, but also in the content. There is a tendency in environmental sound recordings to eliminate human made sounds, while in my own practice I actively include human presence through sounds of infrastructure, microphone fumbles, voices and footsteps, narrating a connection between "site and self and between recordist and the recorded' (Anderson and Rennie, 2016, p.226).

While the inseparability of recordist and recording is found in many environmental sound works, the soundscape of the listening audience is rarely an integral part of the composition. One key example is *Whispering in the Leaves* (2008) by Chris Watson, where recorded sounds of birds were played back from speakers mounted in the trees at Kew Gardens. The sounds had been recorded in the locations the plants and trees came from, activating a sense of audible biodiversity that merged with the existing sound environment. The sound theorist Salomé Voegelin argues that Watson's layering of soundscape "produces not a falsity but an augmentation, an expansion and extension of reality that is not unreal but more dense." (Voegelin, 2014, p.15). As will be seen in the development of *Only Expansion*[33] I actively draw on this idea of combining field recordings with the participant's environment. This approach is also partly in response to David Michael's advocacy for dark nature recording, highlighting not the wonders of the 'natural' world, but the more confronting and challenging situations that exist in the world. He explains that "If fantasy creates inappropriate distances between environment and us, perhaps a practice of dark nature recording could actually begin to reflect the totality of an ecology from which we are inseparable." (Michael, 2011, p.210).

It is in this lack of separation that an extended temporal entanglement occurs, as the timelines of human endeavour become just another sound within the complexities of networks that are contained in the recordings. This is

[33] Chapter 2.2.2

reflected in AM Kanngieser's propositions for sound and the geopolitics of the Anthropocene (2015), where she highlights how listening makes it "possible to discern obscured processes" (p.2), referencing recordings of increased biodiversity or noise pollution in India. Kanngieser proposes that listening is also about "becoming aware of registers that are unfamiliar, inaccessible and maybe even monstrous, registers that are wholly indifferent to the play of human drama". This undermining of human exceptionalism that Kanngieser alludes to will be returned to in Chapter 3, but there is a final aspect here that relates to the aesthetic approach taken within my practice. Kanngieser's 'monstrous' is related to the ambiguity of sound – "What am I hearing? Where is it coming from? What is making it?" (Gallagher, 2014).

In my attempts to embody this horror of the unknown in the sound of the work I draw influences from contemporary composers and sound artists whose work I find becomes ecocritical not through its use of field recordings but through its sheer viscerality. Eugene Thacker highlights the work of Keiji Haino as an articulation of there being "no nature for us, much less being on the side of nature" Thacker's description of Haino's album *So, Black is myself* suggests the performer "is dissolved into a network of tones, voice, space and instrument variously existing in consonance and dissonance with each other" (Thacker, 2011, p.21). I hear this same dissolving and dissonance more recently in the distant screams of Margaret Chardiet as Pharmakon (2014), in the rushing noise of the *World Eater* album by Blanck Mass (2017), and the dense landscapes of Lawrence English's *Cruel Optimism* (2016). In Vladislav Delay's *Rakka* (2020), he directly seeks to evoke the intensity and bleak expanse of the arctic tundra without drawing on field recordings, instead pummelling the listener's ears with layers of stop starting and collapsing rhythms that overwhelm the wisps of voice behind them.

Through an increased focused on texture, intensity and duration in my work, I explore what Robert MacFarlane calls "a darker ecological impulse, in which salvation and self-knowledge can no longer be found in a mountain peak or stooping falcon, and categories such as the picturesque or even the beautiful congeal into kitsch" (MacFarlane, 2016). Rory Gibb describes the work of Richard Skelton and Autumn Richardson as different from conventional eco-elegy, evoking "a more feral feeling of being stalked by ecosystemic memory" (Gibb, 2015). Their albums as The Inward Circles (2017) are derived from

physical processes that literally dig into extinct plant life and exhumed bodies. The sound is dark, minimal and enveloping, rich with mixtures of processed acoustic instrumental texture that defy separation, album titles evoking a world that is bigger and older than we know.

My research investigates how these multiple interwoven timescales might collapse into a singular artistic work, not just shown or discussed, but embedded within a visceral experience of extended pasts and onrushing futures composed in time-space.

EXIT

This chapter has detailed the fields of practice and critical theory that my research sits within. In doing so it has traced a thread of entanglement and indeterminacy. From Kaprow's non-matrixed performances and Thibaud's knots of mobile listening, to multiple timescales and Barad's entanglements. In creating artistic works that follow this thread I have shown a need to consider how we might compose with an awareness of the relationships that create the entanglements. The quaternary framework I will propose (Figure 9) offers a way of articulating this. The *content* being the sound objects and printed material drawing from eco-critical sound practices, music composition and the instructional approaches of the open work. The *spatial movement* drawing in a range of mobile listening and site-responsive practices, and finally chronos and kairos offering a way of understanding different concepts of temporality in a practical form designed for artists and makers. The next chapter outlines the methodological approaches that led to this framework.

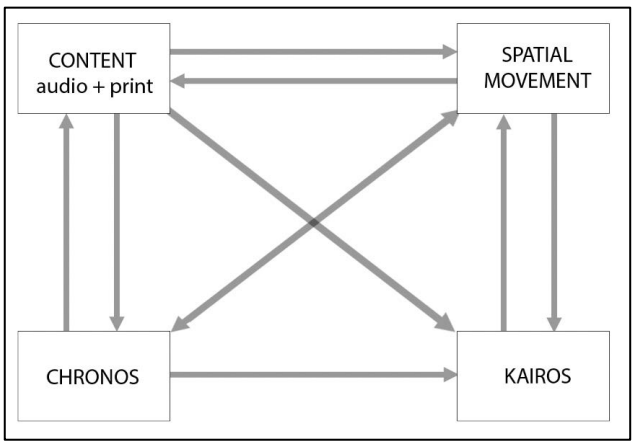


Figure 9 - The quaternary framework

2 METHODOLOGY

This chapter will present an overview of my research methodology that was designed to answer the question "*what approaches can be developed that support the understanding and adoption of time as a compositional element in audio augmented reality?"* and led to the extension of the enquiry into "*how augmented reality resonates with contemporary ecological theory?".* I will first outline the practice as research framework it is based in before detailing the specific approaches applied in my methodology. The second half of this chapter will then introduce the artistic works that were created as part of the research.

2.1 RESEARCH FRAMEWORK

Over the course of my artistic career, I have developed both intuitive knowledge and rigorous processes which have fed into the creation of my research methodology. The fact that I have often been dealing with emergent technologies and art forms means there has been little availability of formal guides or best practices, as such I have often been studying not about but *with* the work.

My research design for this study is based in Robin Nelson's model of practice as research (2013), in which existing intuitive skills (Know-How) are in dialogue with knowledge gained from critical reflection (Know-What) and existing critical theory and conceptual frameworks (Know-That). This diagram (Fig. 9) represents how the relationship between the three areas creates the arts praxis of theory imbricated with practice.

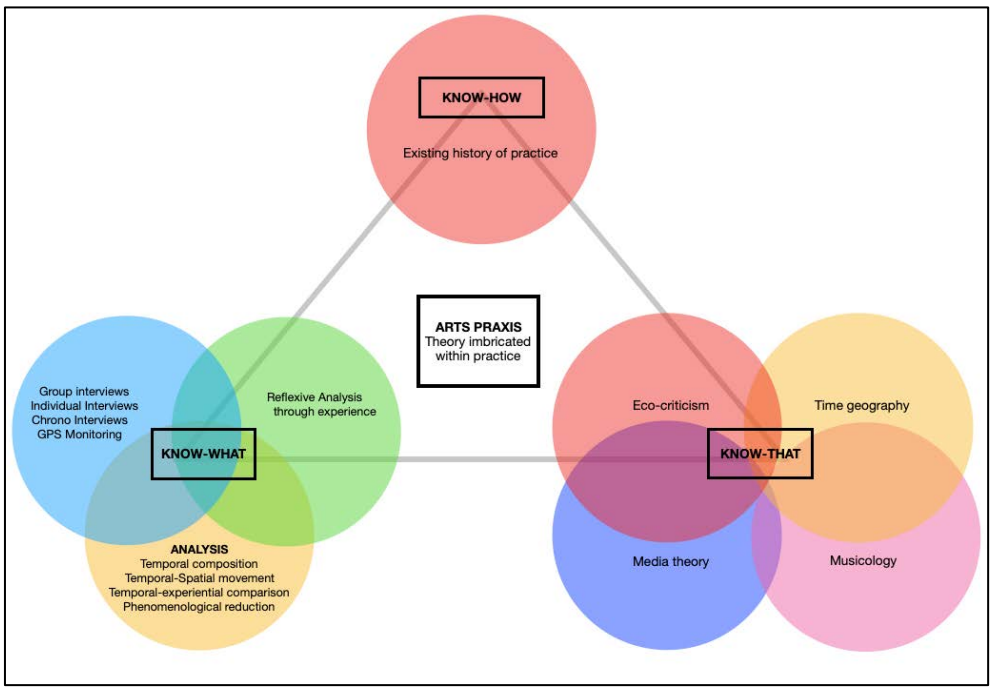


Figure 10 - Specifics of my research overlaid on to Nelson's model for arts praxis

The *know-how* consists of my experience of creating various forms of artwork that combine mediated sound and the spatial movement of audiences through uncontrolled environments. This knowledge brings with it a set of both compositional and analysis methods that will be described in this chapter and drawn on throughout this research. The critical reflection within the *know-what* is formed through a combination of self-reflection and analysis of audience engagement with my practice outputs. The practice outputs in this study being two major art works, *Dark By Then* and *Only Expansion*.

As the works themselves utilise combinations of music composition, locative technology and participant agency the critical underpinning of the *know-that* draws from the diverse set of fields detailed in Chapter 01. Concepts of time are too varied to be "explicated solely by a linear argument" (Kramer, 1988, p.xiii) and as such my methodology pulls together threads of qualitative and quantitative data collection, auto-ethnographic reflection, critical geography, phenomenology and eco-criticism.

A note on documentation: *As both of the works in this study are inherently experiential and performative and rely on participant agency in uncontrolled environments, there is no object that can be easily documented. The evidence in this written thesis deemed a necessary compliment for substantiating practice as research is centred not around the works themselves, but focuses rather on the compositional process and analysis of participant experiences. This is partly to avoid fruitless attempts to create "representations of representations", that become "something other"* (Phelan, 1993, p.146)*, but also to emphasise that it is in the experiencing of the work that key knowledge generated by practice is revealed.*

While this triangle describes the practice as research model my research is grounded in, the specifics of my methodology involve a rigorous iterative and cyclic process that is used to *both create and analyse* the artworks themselves. A diagram representing this process can be seen on the following page (Fig.10). This iterative cyclic approach is derived from my existing practice but incorporates a set of analysis methods and theoretical input specifically designed for this research. As will be expanded below, the validity of this method is found both in the way it offers a comparison of the chronos and kairos within the practice, and in its allowance of a continual refining of the artworks themselves. My artworks are never truly *finished but* can be considered as *active* and hot or coolly *passive*. While *active* there is great diversity in results of participant analysis and my own reflexive responses, so the developments at these points are radical. Once some level of consistency begins to appear in the analysis the activity level cools until the piece reaches a *passive* state, where I may continue to make small changes to details of the work. Budget and time often become the only real demarcation which lead to development ceasing.

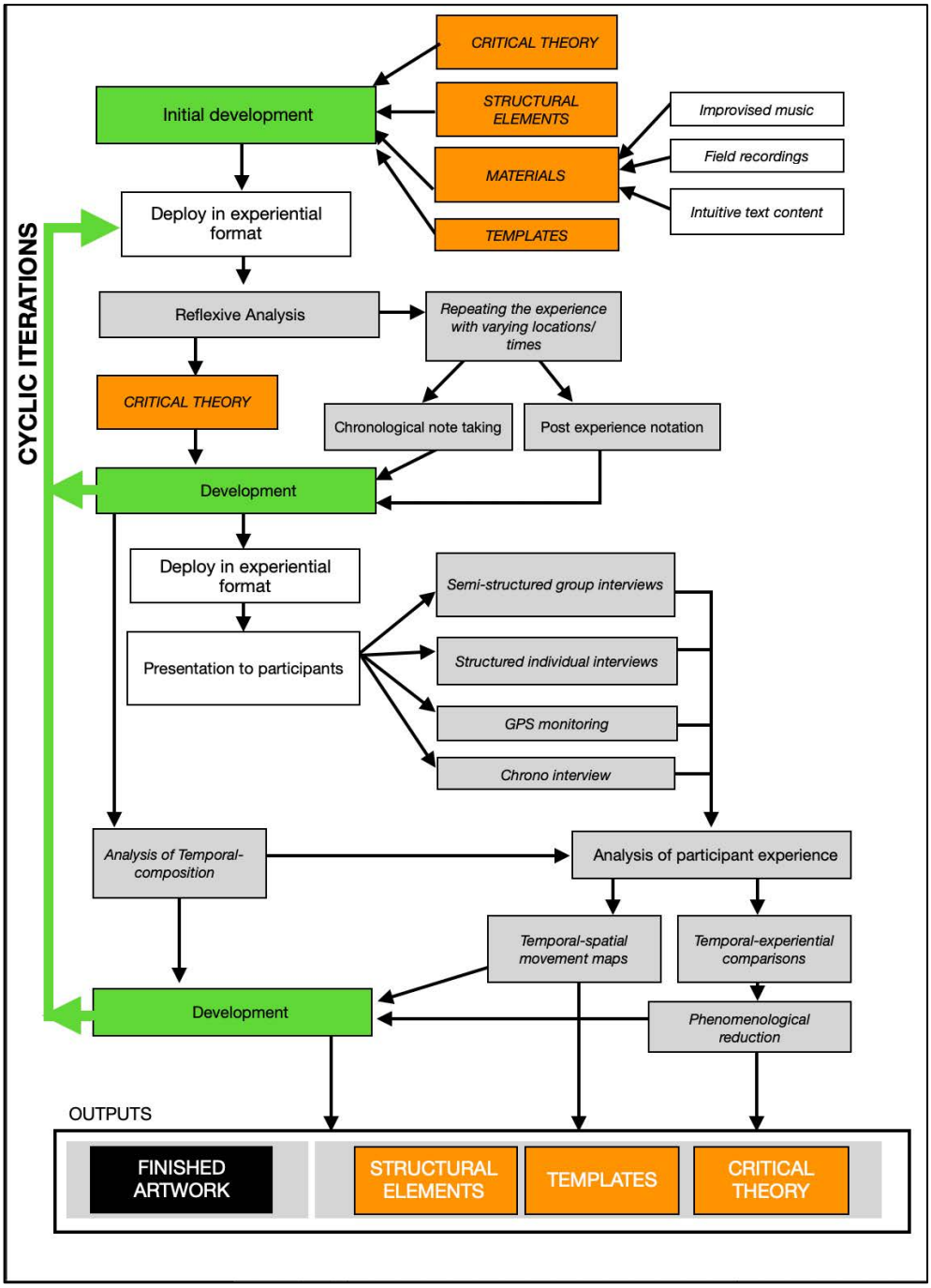


Figure 11 – My iterative cycle of development and analysis

Before detailing the individual stages, it is important to highlight the separation between the composition (in green in Fig.10) and analysis process (in grey). The composition process begins with existing material (field recordings, text drafts, music improvisations), templates (macro scale structural forms) and elements (meso scale structural forms), intuition and feeling are heavily used but not overtly analysed so as not to risk draining

them of artistic impetus. The materials, along with critical theory, are marked in orange in the diagram as both are developed by the iterative process. The analysis methodology is designed to provide new templates and elements that could be applied in the following cycles of the ongoing process or in the creation of entirely new works. While some elements are adapted to meet the emergent needs of a specific artwork the 5 core aspects of the cyclic process that will be described are:

- Initial material development

- Reflexive analysis

- Development based on analysis

- Presentation to participants

- Participant experience analysis

2.1.1 INITIAL MATERIAL DEVELOPMENT

While this initial development exists outside of the cycle it is the starting point for the work, and can be built from the outputs of previous cycles. At the beginning of this research the templates and structural elements were given a pair of limitations to accelerate the creative process and provide focus to the research. The limitations were as follows:

1. The works will be built around mediated audio delivered by mobile digital devices: This limitation is primarily derived from the form of work I have most experience in making and addresses the lack of temporal research in an existing field. It means that the research process is not focused on inventing but rather on refining and offering insights to existing makers. This restriction also covers the type of mediated audio and, here, this involves the use of pre-recorded audio and of realtime **digital signal processing (DSP)**.[34]

2. They will take place in non-site specific uncontrolled urban environments that participants will move through: This limitation was derived from multiple considerations. Firstly it again drew from my history of practice but was developed more in response to the thematics of the first piece of practice *Dark By Then*. With its initial themes of disappearance and memory it was important for me that participants experienced the work in their everyday environment, so I wanted it to be site-responsive and able to work in multiple locations.[35] This site-responsiveness also allowed the research question around participant agency to be addressed by leaving the spatial composition more open. As will be discussed later I considered *Only Expansion* to be a parallel work that responded to *Dark By Then*, and as such the site-responsive approach was maintained. The decision that the works should *ideally* be experienced in urban locations was twofold. Firstly both works were addressing themes of human/non-human relationships, and I wanted a vibrant *human* filled environment to be part of the

[34] Digital signal processing is the mathematical manipulation of an information signal, such as audio, temperature, voice, and video to modify them in some way. In this thesis it refers to audio signals.
[35] The solution to this drew from an earlier piece of work 'always something somewhere else' see App. 4

> visiophonic knot. Secondly it offered contrast with the types of remote environment alluded to in the works content (forests, desert etc.), and as will be explored in Chap 3. the cityscape offers resonances with contested ideas of human/nature, of nature's wilderness and civilisation's 'pristine other'.

These limitations essentially make up the first basic *template* for the work. Once the core inspiration or *critical theory* underlying the work had been solidified, I begin by creating sonic and textual *materials*. These are immediately placed within a medium that allows me to experience them outside of a controlled studio context. As the field of works I am researching engage participants with uncontrolled environments, I consider it essential at every stage to experience the material in situ. This may involve simply walking the city while listening to recorded text or music, or it may incorporate basic software systems to test responsive systems. Although this draft material is created rapidly, it often draws on intuitive choices that stem from my body of artistic experience. Sonic material might be created from improvised musical sketches or found field recordings, or the text may be drawn from found material or free form creative writing. These materials are placed into the *template* of the work by creating a series of *structural elements.* These are techniques I have developed in my previous practice and each is a combination of sonic[36] and/or instructional material designed to create specific shifts, effects or moments in a participant's experience. Techniques might include *Settling* (where the sound is used to transition the participant from being in the world to in the work), *shifting focus* (introducing sound elements that cause a participant's focus of attention to change) or *isolation* (placing the participant in an intimate environment where they are likely to be alone). These structural elements are named through my personal taxonomy and a full summary of them is included in Appendix 07. Where they are referred to in the text, their full description will be provided as a footnote.

[36] Previously I built them primarily around music compositions rather than field recordings or sound processing, see App.07 for further description of techniques.

What is key to the *initial material development* is the rapid deployment of the work into an uncontrolled environment, so that decisions on how it develops are informed through my *experience.* For example I have learnt through my practice that the duration I sense while listening to a recorded musical sketch changes greatly depending on the listening environment and my physical actions. For this reason I am consciously open to mistakes and unexpected outcomes in all steps.

Once a set of sketch material has been collated into a format for deployment, I repeatedly experience it myself under various conditions to allow for the reflexive analysis. Depending on the nature of the format this may for example involve repeating the experience in the same location at different times or undertaking it in various locations.

2.1.2 REFLEXIVE ANALYSIS

The second step involves a self-reflexive analysis of my experience of the sketch material. To achieve this a number of different approaches are used depending on the nature of the artwork under investigation or the outcomes of previous iterations of this process cycle. On the first cycle this analysis usually involves taking written or verbal notes while I experience the work or immediately afterwards. Notes taken during the experience have the beneficial option of being timestamped, where I write how long into the experience something happened, offering an insight into the chronos of the work. So for example if I am listening to a scored/pre-recorded piece of content I can compare in detail my experiential note from 11’21s (Fig. 11).

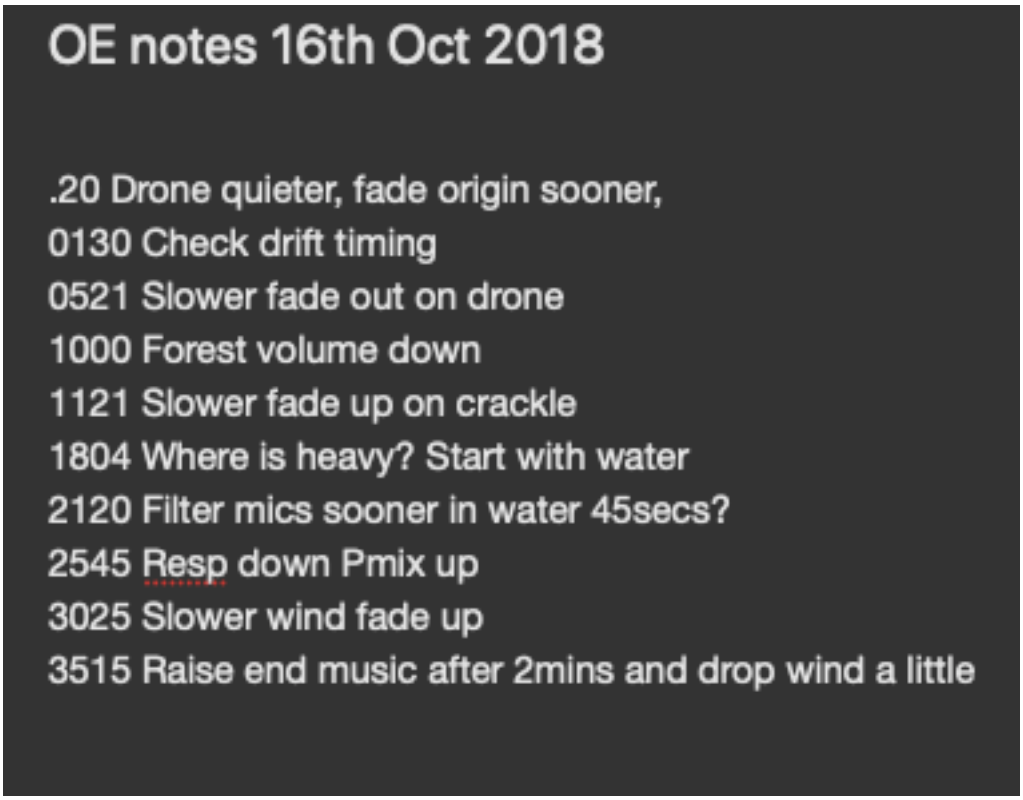


Figure 12 - Notes taken on sound mix during experience

The issue with this approach is that it interrupts the flow of the experience, making it difficult to reflect on my durational perception and kairos, and also potentially missing moments as I take notes. Duration, as Voegelin describes, "postpones the moment when the sensorial encounter meets language and thus problematises their relationship" *(*Voegelin, 2010, p.28*).* As such I alternate my realtime note taking with an approach of only making notes directly *after* completing the test. These notes tend to offer a better overview reflection, and sometimes insights into moments that stretch out over extended time periods.

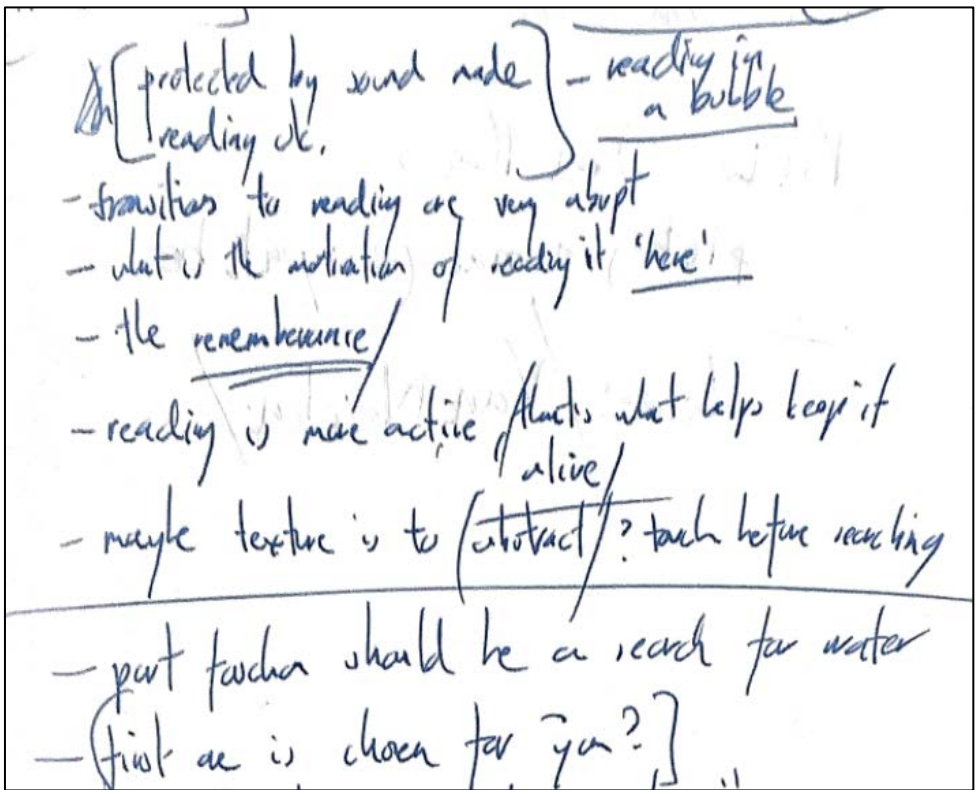


Figure 13 - Reflective notes made after experience

The openness to error and unpredictability in the first step means that these reflective notes often document outcomes. These eventually become core elements of the final work that I could not have conceived in advance. For example, in an early test of using randomly generated GPS locations I was unable to reach one of them because it was inside a building I had no access to, the frustration of digital content clashing with the limits of the physical environment. The way I had to rethink my exploration of the space became a key influence on part of the final work (see Section 2.02.01).

2.1.3 DEVELOPMENT BASED ON ANALYSIS

The third step is an opportunity to shape the material based on my reflexive analysis. This may involve simple modifications (e.g. if I felt a section was too short in duration I extend it) or replacement (e.g. if I felt some detail in a piece of text was unclear I may rewrite it.) At this stage, the decisions are made both on an intuitive level and in relation to my *structural elements.* So, for example if I feel the change in sonic texture is not strong enough for *shifting focus* I may replace something. This is also the stage where new critical theory is applied to the development of the work. This will be

demonstrated through the use of concepts from time geography for the structural composition and ecocritical thinking in the approaches to sonic aesthetics.

2.1.4 PRESENTATION TO PARTICIPANTS

Having worked through this self-reflexive process to bring the work under investigation to a form that can be experienced, I then stage presentations of it for participants with associated data capture. The participant groups are sourced through a mixture of public advertisement and private invitation. This allows me to test the work with a mixture of participants who have either experienced this kind of work before or are coming to it fresh but with an element of interest or intrigue.

These presentations are undertaken to test aspects of the work while continuing to remain open to error and unpredictable outcomes. The data capture techniques combined elements of both quantitative and qualitative methods. As the research is seeking to understand the experiential impact of temporal elements, this involves addressing a participant's cognitive processes, in which quantitative methods are lacking. Comparing quantitative data measurement with qualitative participant responses offers an insight into the tensions between chronos and kairos at the heart of this study. Equally, it is important for the researcher to be aware that because the qualitative methods involve participants reporting on their own experiences it is second-hand information based on their interpretation. As such, the study is of the participants' 'interpretation of their own experiences, not a study of their actual experiences' (Jørgensen, 2014). The testing is also often more about functionality than any interrogation of meaning, although it is not uncommon for new concepts to appear through this process (akin to the experience of spatial frustration described earlier). The four methods used for data capture are *Semi-structured group interviews, Structured individual interviews, GPS monitoring* and *Chrono interviews*:

Semi-structured group interview

This form of test is undertaken on early development cycles. It is the most open form of testing. The interview is framed by a single question 'Can you describe your experience?' and it develops from

there. This mode of using a form of narrative enquiry to build a description of the work as experienced by all the participants.[37] As the interview develops, I discuss the intentions of the work in response to relevant comments from participants. These intentions are not revealed within the interview until later stages, as if introduced at the start they risk forcing the participants to reflect on aspects they had not thought about, potentially leading to them to "interpret the concept through the ideas of the researcher" (Jørgensen, 2014).

Structured individual interviews

This form is undertaken in later cycles of development. Here, there is a focus on whether continued development of the work has addressed questions and issues that arose from self-reflection and group interviews in the initial cycles. The questions in these interviews are a combination of open experiential questions ('what themes did the experience bring to mind?'), time focused questions ('did any sections feel especially long or short'), and functionality/usability questions. These interviews also include specific points about interaction with the material (e.g. text size in a book, screen resolution) drawn from comments previously made by other participants in both group and individual interviews in earlier iterative cycles. Often this is not about seeking the 'perfect interface' but more commonly 'did it work?', e.g. did all the screen interfaces function as intended, were specific sounds or instructions audible and/or intelligible?

GPS monitoring

To be able to analyse participants' spatial movement I track the GPS movements of participants while they experience the work. This is designed to reveal temporal patterns across multiple participants' movement separate from their cognitive experience. It is not an attempt to reduce the nature of experience to aggregate numbers

[37] As an artist I am happy to be visible within the research and as such I will be using elements of narrative enquiry methods. It captures personal and human dimensions of experience over time. The emphasis is on co-creation of meaning between the researcher and participants. Including myself in the conversation and construction of meaning helps to reflect on the narrative structure of the experience.

that attempt to say something about a participant's experience, rather it is looking for commonalities across participants' physical journeys through the piece that may not be revealed in their individual interpretation of their experience. This method is useful for works where the duration of the piece is so long that it would make chrono-interviews (below) an uncomfortable experience for the participant (and potentially risk having a major impact on their feedback/interview/recall).

Chrono interviews (plus GPS)

This final form is designed to capture the chronos and chronology of a participant's experience and is an attempt to get *inside* their experience. It is an attempt to address the issue with the interviews being a participant's interpretation of their experience, and stems from the tension between my research question and the form of work under investigation. To begin to understand the temporal qualities of the work an approach was needed that would allow comparison of a participant's experiential perception with fixed clock time. While one option would have been to give participants a sound recording device and ask them to describe their experience *while* it was happening, this would not have allowed them to experience the sonic qualities of the work as intended by the composition. The structured interviews after the work produce a participant's recollection of moments described from their memory, often creating a non-linear description that could not be correlated with specific parts of the content. To address this I devised a method that combined the semi structured interview with GPS monitoring and fixed chronology.[38] Participants undertook the work while wearing a small video camera discreetly on their person. Rather than documenting the participant themselves this was mounted so as to capture the walk from their perspective. Not entirely a point of view shot, but a reference of their location and actions. In addition, the mobile device was adapted so that the audio headphone feed (as heard by the participants) was recorded. At the end of experiencing

[38] This technique was adapted by Kristine Jørgensen in studies of computer game players, with the intention of 'allowing the player informant to play the game uninterrupted in the same was as he would do under normal circumstances'. (Jørgensen, 2014).

the artwork the video and sound recording was played back to the participant and they were asked to describe what they were experiencing and/or thinking/feeling at each moment they recognised in the footage or soundtrack. This allowed for capturing the participants' interpretation of their experiences that were linked to their GPS location and the fixed chronology of the work.

2.1.5 PARTICIPANT EXPERIENCE ANALYSIS

The analysis of the data captured was designed to expose and evaluate the tensions between kairos, chronos and spatial movement in a participant's experience of the work. Described here are the fundamental methods for analysing the data are the *Temporal Scores, Timespace maps and Temporal-experiential comparisons*.

Temporal Composition

Before analysis of data from the experience of the artwork (both from participants and my reflexive notes) is undertaken documents of the temporal structure (chronos) of the work are created. These can be considered a form of score that describes the potential of what could happen. As will be seen in the second half of this chapter the two works involved differing approaches to indeterminacy, and as such required different forms of score. The full development of these scores will be covered in the Timespace chapter but they are briefly introduced here as a key part of the methodology. As the scores are too large to be displayed usefully within standard thesis page dimensions the full files are available within an associated data folder and catalogued in Appendix 03.

The score for It Must Have Been *Dark By Then* had to account for a mixture of sections where the duration was either authored (fixed) or controlled by the participant (open), as such it does not used a consistent reference to absolute time. Figure (14) shows a detail of the score where time is on the horizontal axis (progressing to the right) and the visual dimensions of fixed sections are scaled relative

to each other (e.g. 2 mins is half the length of 4 mins), and open sections do not have a time reference. The rows represent summaries of content and compositional approach.

TIME	OPEN	FIXED 3mins	OPEN	OPEN	OPEN	OPEN	FIXED 3min
SOUND	MUSIC/NARRATION	MUSIC / NARRATION	MUSIC	FIELD COLLAGE	MUSIC	FIELD COLLAGE	MUSIC / NARRATION
FORM	MOMENT	LINEAR	MOMENT	MOMENT	MOMENT	MOMENT	LINEAR
STRUCTURAL ELEMENT	SETTLING	SHIFTING SPACE		TEMPORAL ARTICULATION		TEMPORAL ARTICULATION	SHIFTING FOCUS
CHAPTER	intro/chapter 01			MARCIS		ZILUPE	
INSTRUCTION	READ / WAIT	DRIFT	FIND HOMES	READ	FIND CREATED REGION	READ	DRIFT

Figure 14 - Extract of Dark By Then score, note that 'moment' sections (orange) do not have specified durations, see Chapter 3.1.1 for further explanation)

Only Expansion used an entirely fixed timeline and as such the score was able to use a consistent time reference. Figure 15 shows a detail of the score where time progresses downwards on the vertical axis, each column represents absolute time durations of sound file playback or realtime audio processing.

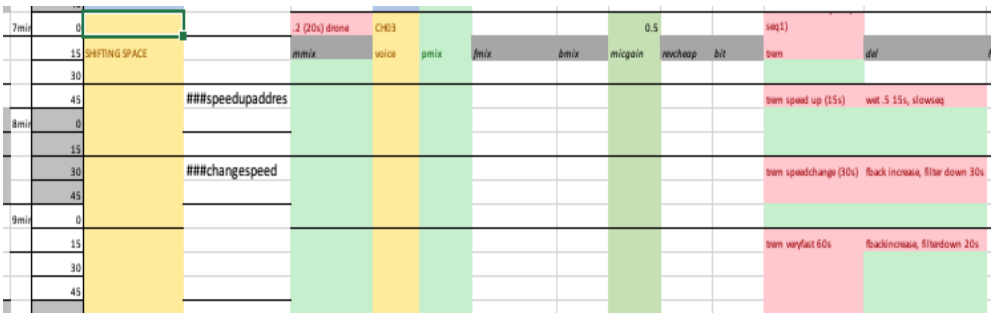


Figure 15 - Detail of structure of Only Expansion, time represented vertically, each column is either an audio process or pre-recorded material (see Chapter 3.1.4 for further explanation)

A key function of this format allowed for observations of patterns and ratios that may have been created through intuitive processes. It also addresses the problem of self-reflection modified by repeatedly experiencing the work. In those cases I progressively learn the work, so my apprehension of events and experience of duration becomes built not simply from my linear experience, but

from knowing what happens next. In documenting the clock time of a piece I can also study ratios of duration over the course of the piece, something that is problematic to experience because I have observed (through comparing my notes against time measurements) that my perception of duration changes over the course of experiencing the work. Combining these scores with the qualitative interview material (see below) allows for examination of the difference “between the time a piece takes and the time the piece presents or evokes” (Clifton, 1983, p. 81).

Timespace maps

The field of artistic practice under consideration combines spatial movement of the participant with the temporal structure of the audio content, and yet there are no widely used methods for documenting or analysing it. In light of this my analysis method draws from Hägerstrand’s time geography notation methods, specifically the timecube format. The GPS location of participants was tracked over the course of their engagement with the work. Using plotting software the data was mapped into a 3D space where spatial position (measured in metres from starting location) is on the horizontal plane and time progresses up the vertical axis (measured in seconds). The coloured lines in this image (Fig.16) represent 8 different participants routes in 4 different cities. This visualisation method was fundamental in comparing how multiple participants created relationships between spatial movement and temporal structure within an indeterminate work. By rotating the model, it became possible to observe convergence and divergence in the chronos of the macro structure. Comparing the side view (Fig. 17) with the top down perspective (Fig.18) allows for separate observations of a participant’s temporal and spatial path.

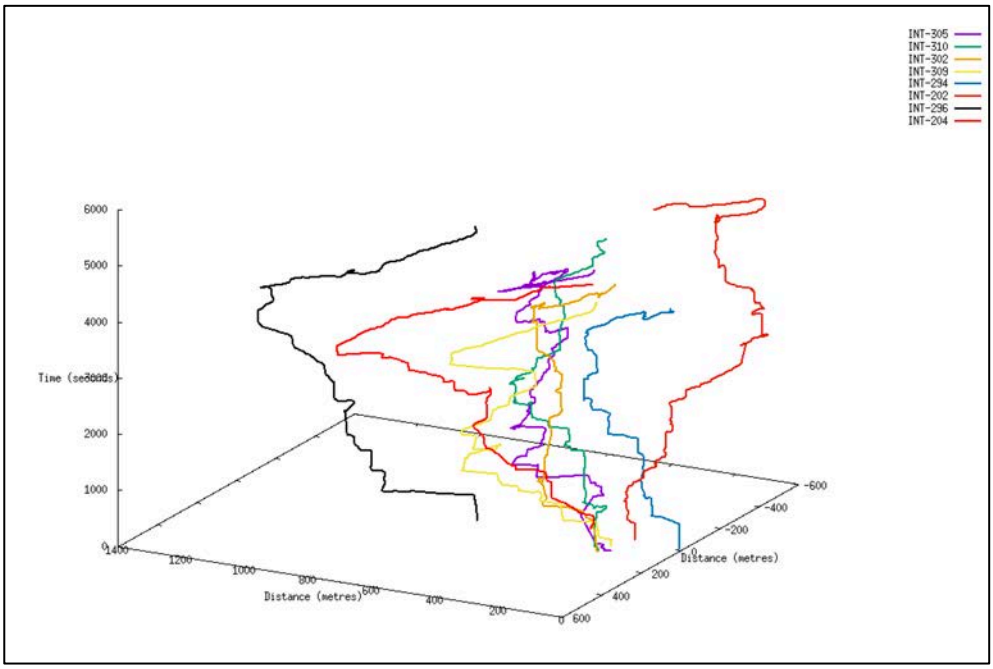


Figure 16 - Timecube representation of Dark By Then participants

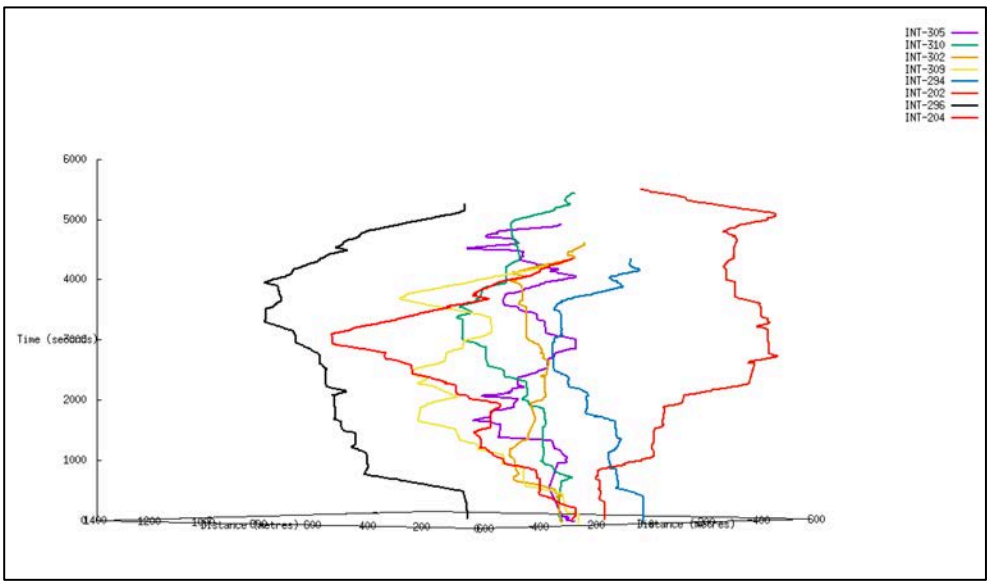


Figure 17 - Timecube rotated so time of paths (vertical axis) can be compared

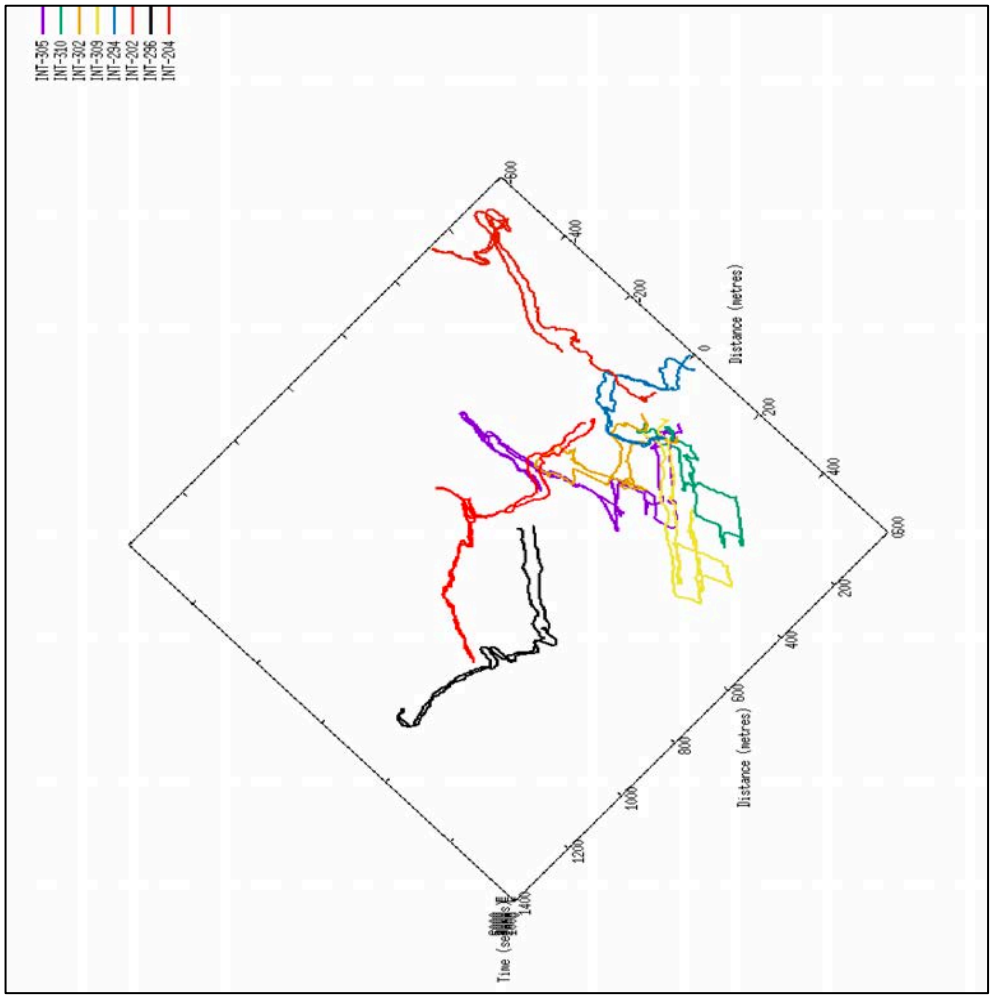


Figure 18 - Timecube top-down view so geographic route of paths can be compared

Temporal-experiential comparison

This process involves mapping transcripts from multiple participant interviews on to a singular clock time. Transcriptions from the chrono interviews are laid out to allow comparison of different participants responses at correlated moments (Fig.19). Responses from auto-ethnographic reflections, group and individual interviews were collated based on their description of correlating compositional moments (e.g. chapter beginnings, textual prompts). This form of analysis can then be used in conjunction with GPS data to make connections with aspects of spatial movement (Fig.20). These transcripts also reveal some of time geography's concept of *constraints.* In descriptions of being unable to access certain buildings we find *authority constraints,* in descriptions of people considering their walking speed they come up against *capacity constraints,* and in their desire to reach certain locations in time we see the *coupling constraints* of time and space on an individual's path. In Chapter 3 these constraints will be used to show how the concept of *prisms* (future possible locations of an individual) was applied to the composition.

	al relative;			
18.00	" "			because I was into it in this space, as I walked back I got a bit frustrated, it was a bit ugly,
18.30	" do I got to a car park or anything, but because I knew the time, that it was going to be 5 or 10 mins inbetween, that I wouldn,Äôt be able to get there.			I thougt I'm not going to make it to the high point, I thought it would be good to have a view
19.00	" at this point I knew that I was a lot higher than where I was, and I couldn,Äôt think of anywhere I could get to within the timeframe"	I seem to be seeking out passageways rather than vistas, along here I was looking up quite lot, and looking at the top of buildings, there was an insurance building here that said fire, accident, marine;		I find that bit that we're coming up to really ugly, I was sad to leave my weird crow tree stumps
19.30	" "			at that point I started to feel a bit tired, but ir eally enjoyed the sound of the water,
20.00	" I was trying to find a vantage point, so I could picture what it would look like with the water below me"	I was feeling stressed that I hadn,Äôt found my vantage point;		I started enjoyign thinking about you recording the sound of water
20.30	" walking through the city at this level it,Äôs hard to picture it"	I was beginning to think I reckon I,Äôm going to have to turn around soon;		I was thinking about it all flooded, and that this is all low ground, that it is all fucked
21.00	" this is when it started getting really wet actually, quite good timing"	when it said head back to your quiet place, I thought I don,Äôt think I,Äôm going to make it;		a few people passed me and eyed me a bitm I wondered if they could se the fluffy bits, I enjoyed that sense of being separate, secret, different
21.30	" as I walking to this point I was conscious of would that be underwater, would that be underwater, I made that noise .. in my head if I get to point that,Äôs higher am I then going			was looking in these windows, about their day, what it would be like to return to the same place every day.

Figure 19 - Extract of chrono interview layout, each column o represents an interview with a different participant, allows for comparison of similar responses at same chronological point in experience. The full collection of chrono interviews is available in Appendix: 04.02

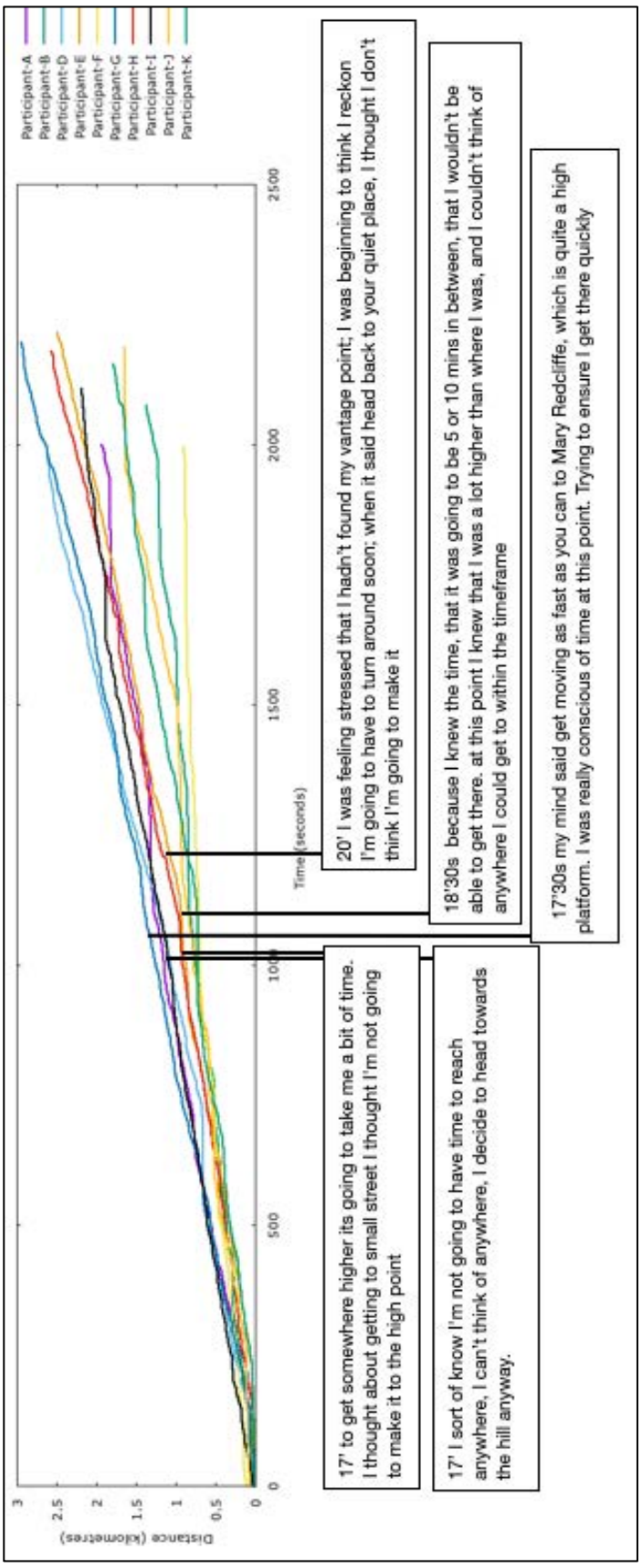


Figure 20 - *Interview extracts connected to specific moments on graph of time plotted against distance travelled for each participant*

2.2 PRACTICE

> It matters, there is a burden, because unless I can tell what I know, there is a suggestion and to myself as well! that I do not know. But I do-what I see is that pointing to the object!. But for that to communicate, you have to see it too. Describing one's experience of art is itself a form of art; the burden of describing it is like the burden of producing it. (Cavell, 1979,p.192)

The set of methods that have been described so far constantly address the relationship between chronos and kairos. Fundamentally though, they are imbricated within the practice of creating the artworks. It is the continual iterative process informed through participant experience and self-reflection that lets the work develop, feeding back into each iterative cycle.

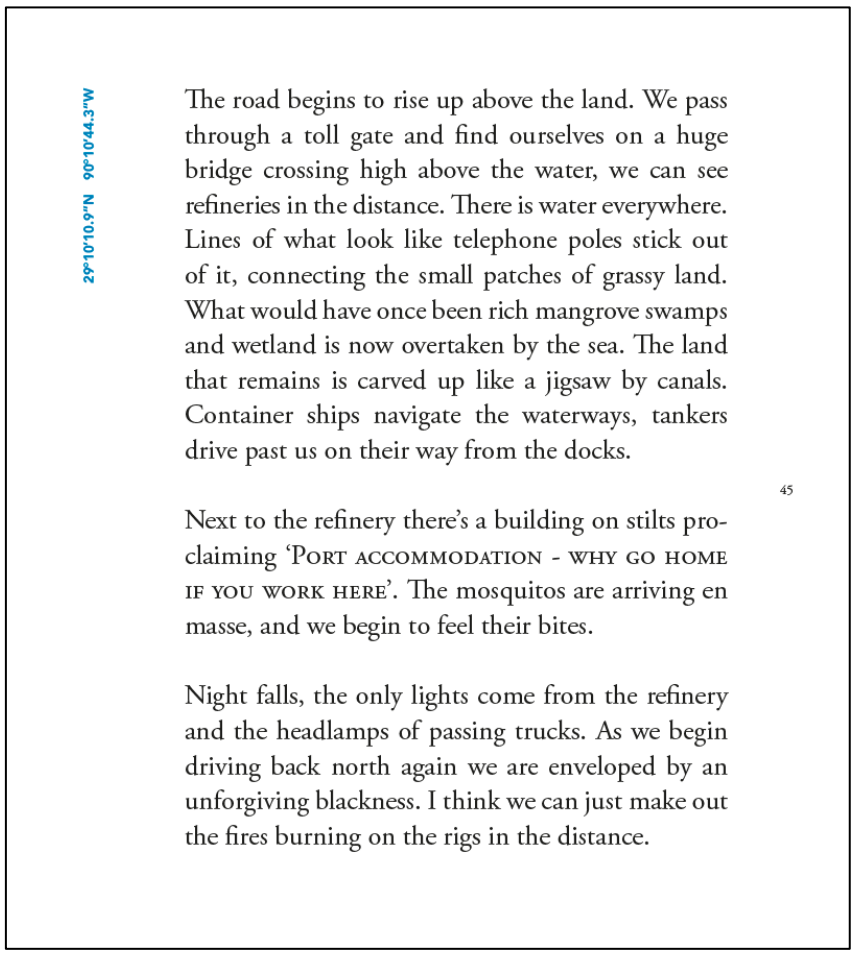
While the *actual experience* of *Dark By Then* and *Only Expansion* is an essential research output, the next sections will provide descriptions of each for the sake of documentation, highlighting specific aspects relevant to the research. It will then conclude with a reflection on the methodology used in creating the sonic aesthetic of the two works. As both works were created and presented in public commissioned contexts, the production process was extensive and involved numerous contributors (App.01). It Must Have Been *Dark By Then* was created over a period of 7 months with initial research and prototyping taking place between Oct - Dec 2016 and with field trips to Tunisia, Latvia and North America occurring in Jan - Feb 2017. Interview data was collected from 34 participants at the British Library in London, 5 participants in Ghent (Belgium) and 2 participants in Antwerp Belgium. The GPS data was sourced from 10 participants who engaged with the completed work.

Only Expansion was developed in various stages between October 2018 - Oct 2019. Early prototyping took place in Bergen October 2018, and additional research and developing in Bradford April 2018. Field trips in the

UK and California were made between June - August 2018 and the majority of software/hardware development and composition occurred June - September 2018 with initial public presentations later October 2018. For both projects, participant analysis and data collection took place at various points in the development process. Participant interviews and data collection was carried out in group interviews in Bristol (25 participants) and Ghent (6 participants) during the development stages and chrono-interviews were carried out with 10 participants in Bristol who engaged with the version of the work as of October 2018. Appendices are provided that provide further detail background information on the field trips (App.06) and software development (App.05) for both projects.

2.2.1 IT MUST HAVE BEEN DARK BY THEN

This work was designed to investigate the tension between canonical and participant trajectories in a soundwalk. I wanted to explore how authorship can be exerted over the temporal structure while still offering participant agency. The early thematics for the work were based around disappearance, and over the course of its production shifted towards ideas of climate collapse. The fundamental principle of the work is that a participant travels through their everyday environment while being presented with remote stories that intersect with their own experience. By allowing them to choose their own route and geographic locations it was possible for participants to make it personally relevant. This basic format of letting participants create geo-located markers to be returned to would act as the initial *template* within my methodology. Leaving the participants' path in the work open to temporal fluctuation while still relying on the chronos of digital audio files created a tension that speaks directly to my research questions.



29°10'10.9"N 90°10'44.3"W

The road begins to rise up above the land. We pass through a toll gate and find ourselves on a huge bridge crossing high above the water, we can see refineries in the distance. There is water everywhere. Lines of what look like telephone poles stick out of it, connecting the small patches of grassy land. What would have once been rich mangrove swamps and wetland is now overtaken by the sea. The land that remains is carved up like a jigsaw by canals. Container ships navigate the waterways, tankers drive past us on their way from the docks.

45

Next to the refinery there's a building on stilts proclaiming 'PORT ACCOMMODATION - WHY GO HOME IF YOU WORK HERE'. The mosquitos are arriving en masse, and we begin to feel their bites.

Night falls, the only lights come from the refinery and the headlamps of passing trucks. As we begin driving back north again we are enveloped by an unforgiving blackness. I think we can just make out the fires burning on the rigs in the distance.

Figure 21 - Extract from Port Fourchon chapter of Dark By Then book

To create this piece I travelled to the edge of the Sahara in Tunisia, through disappearing villages in Latvia and the oil refineries and swamps of Louisiana in North America (App. 06). In each of these sites I collected stories and field recordings that would become the remote content in the work. In the final work there are no photographs of the sites as I felt that if you can *see* what a place looks like the contrast between *here* and *there* becomes more explicit, whereas text and sound might allow for more imaginative leaps and connections for the participant. Placing the text in a physical book also brought another form of temporality into the work, as I would argue that a physical object has time embedded within it. Its point of origin is a form of temporal marker, what it contains was created at the time of making, fixing its historical context.

The writing in the book took the form of a travelogue, intended to be explicitly from the viewpoint of the author as opposed to some form of factual account or explanation for the situations witnessed (Fig.21). The doubt expressed in the title of the work emphasises this personal narrative. Multiple geographic locations are narratively tethered to a single walk made by a participant. A 3000km international journey in the narrative becomes a 100m localised walk, the disregard for relative scale or positioning conflates the multiplicity of the other into a tool for reflecting on the singular present.

FINAL FORM

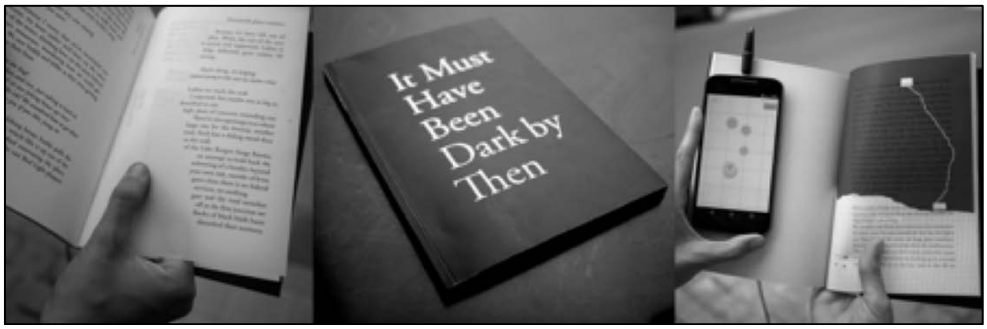


Figure 22 - Book and photo of mobile device running software

At the start of the experience participants are given acoustically isolating headphones, a smartphone running the audio software and a printed book (Fig. 22). The interface for the software is a blank grid with a dot showing the participant's location but no other geographic markings (Fig.23), and, at moments software buttons or text instructions appear over the map[39]. A recorded voice invites them to find somewhere to sit and begin reading the Introduction[40] in the book. The software on their smartphone offers a button to press when they have finished reading the first chapter of the book. Once they press the button a recorded voice gives them a task that involves finding a type of location in the vicinity (e.g. the first instruction invites them to find a house). As they walk and search a musical score (sometimes with a reflective spoken narrative plays) in the headphones. When they find a location they feel is suitable they tap a button in the software to confirm they have selected it. This creates a grey circular marker on the map at their current position (a geofenced region) and triggers a spoken narration that invites them to read

[39] Design and specifications of software detailed in App. 5.
[40] While the sections of the printed book are demarcated with chapter numbers, to avoid confusion with this thesis they will be referred to by the names of the chapters.

a specific chapter in the book. While reading they hear field recordings from the location described in the printed text. The chapter in the book is often a short vignette. The intention was that the words act as a kind of open map, describing a detailed moment in a remote place, but allowing resonances with the unknown site the final work is experienced in.[41] So for example if the participant has been invited to find a road junction, when they get there they read a short narrative of my experience at a road junction in Tunisia.

Figure 23 - Primary software interface at beginning of experience

These are the two primary modes of experience in the work; the *head-up* while they are walking and hearing a musical score, and the *head-down* while they are reading and hearing field recordings. In the first part of the work, the *outward journey* this pattern of searching and stopping and reading repeats a number of times with two key variations. At two points the participant is invited to just travel with nothing to specifically search for, then the narrator asks them to stop where they are and read a chapter in the book. At two other points the software creates locations itself some distance from the participant (Fig.24.). These new locations are created based on the participant's past movements. In the diagram the left hand image shows the

[41] The design of the book is not a fundamental part of the research questions here. Though it is useful to acknowledge that both in *Dark By Then* and *Only Expansion* the design used multiple transparent pages to echo and visually reinforced the layering of time occurring in the experience (see Chapter 3.2).

screen interface after the participant has selected two locations (the blue dot represents their current position), the right hand image shows a new location created by the software which the spoken narration then tasks the participant with reaching.

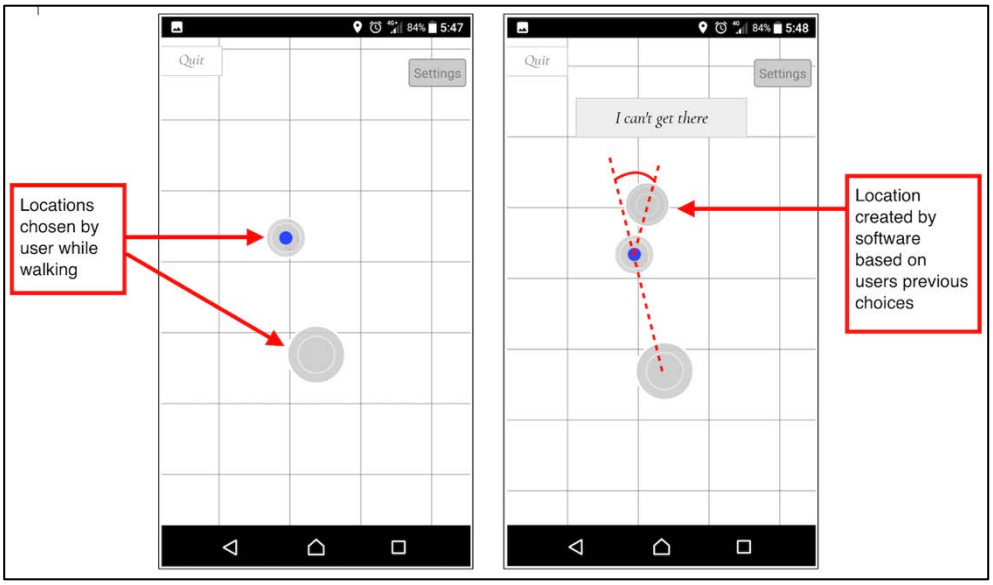


Figure 24 - Software creating geofenced regions: Left image shows two regions created by participant. Dotted red line in right image shows participant's trajectory as approximated by software, and new region automatically created at 45º bearing from trajectory at distance of 70metres.

The software has no awareness of the physical environment, so the generated location may be inside a wall or in a river. If the participant is physically unable to reach the location it is possible to press an 'I can't get there' button on the screen. Here the idealism of maps is brought into sharp focus when a participant is unable to access digital content because of an actual wall.

> *"you don't want to give up.. I felt a bit guilty pressing 'I can't get there', you really get confronted with boundaries," (App.04.01, C)*

After ten locations have been selected (either by the participant or software) the spoken narration asks the participant to retrace their steps, revisiting all the of the locations as they travel back to their starting point; this is the *return journey* (Fig.25). As they walk they hear a music score and as they pass through each of the locations the software triggers recordings of interviews

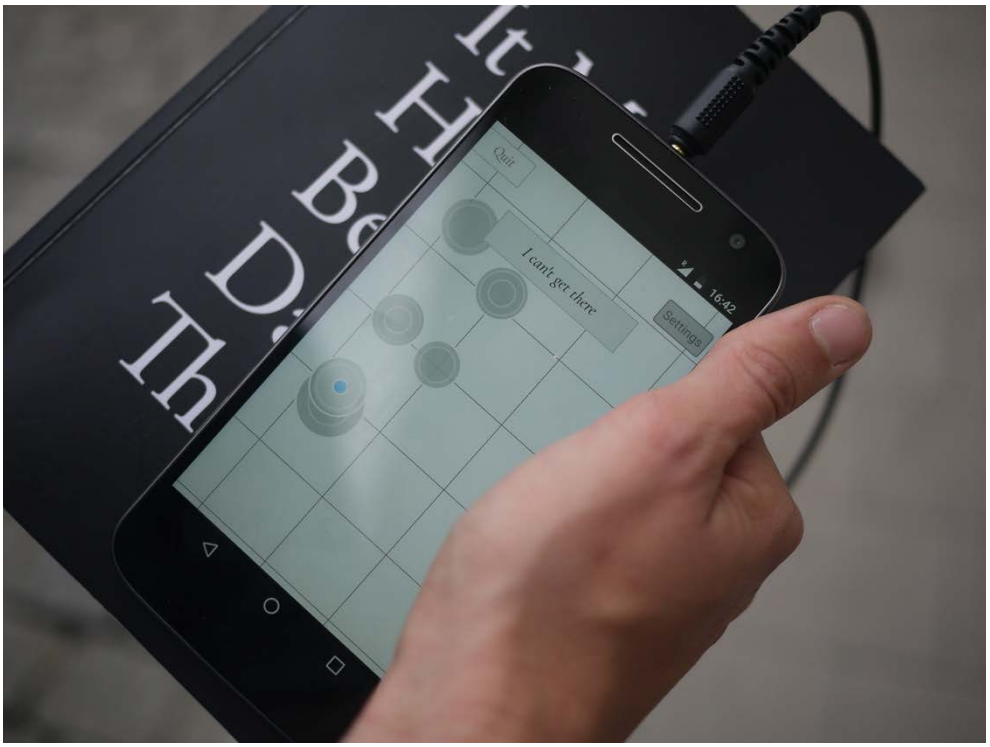


Figure 25 - Multiple locations that the participant has chosen are seen on screen represented by grey circles. No other cartographic markings are used

These interviews are related to the book chapter the participant read at that location on the *outward journey,* so, for example, when they reach the place they read about a building in Latvia they hear people from that building speaking. Often some of the words they hear are in the printed stories, giving audible presence to the silent characters they have only read about. The intention here is to create a layering of memory, so as they walk through a site they hear words they might remember having read, which might trigger a memory of being there themselves earlier in the experience (Fig. 26). An audible palimpsest of multiple temporalities collapses into one moment.

When the participant eventually reaches their starting point the data of all the locations is erased and they are explicitly notified of this. At this moment, the work shifts into an ephemeral state of existence. The printed material remains but the map of locations that connects the remote to the local is now held only within the memory of that participant.

Figure 26 - Participant experiencing Dark By Then in Stavanger, ScreenCity Festival

2.2.2 ONLY EXPANSION

When I started developing ideas for *Dark By Then* I was primarily interested in themes of disappearance. As I was creating a work to research temporal composition, I decided to frame it around a thematic that had its own inherent sense of time. While investigating possible sites for collecting the remote content I kept finding areas that were disappearing during to climate change. Even though I had this concept in mind when I began the fieldwork it was not until I reached Louisiana that the scale of climate related change really hit me. Travelling over long concrete bridges that connected the oil distribution networks around Port Fourchon I came face to face with humanity's capacity to shape the landscape, burst levees and freshwater plants dying out because of encroaching seawater. Then in Tunisia I met engineers on the edge of a dying oasis sourcing water to be channelled to the northern coastal tourist hotels. As the piece took shape I trod carefully though, knowing that a set of short research trips did not equip me to espouse the deep and complex reasons and ramifications of these changes. What I decided to report was my experience, a first-hand account, personal observations rather than explicitly politicised messages or detailed facts. At this stage I hadn't even

really thought about the word Anthropocene, until one participant testing a nearly finished version of the piece described it as 'an evocation of the Anthropocene'. As I moved on to creating *Only Expansion,* I wanted to push these themes of climate collapse and facing the Anthropocene. This led to shifts in my approach to both the content and form of the work. As will be detailed over the rest of the thesis, *Only Expansion* moved away from human scale narratives, and instead concentrated on a visceral entangling of remote and immediate sound worlds (Fig. 27).

It's the autumn of 2017, I'm in the first stages of building my own new augmented audio project 'Only Expansion'. I'm standing high up on a rooftop in Bergen at night, I can just make out the shape of the mountains, below me are the lights of boats and buildings, they mark out the edges of the black surface of the harbour water. I'm wearing a pair of headphones with binaural microphones attached to the outside, they feed in and out of a small, embedded computing device. The microphones let me hear cars on the streets below and the faint cries of revellers, blending them in the headphones with any pre-recorded material I have. I begin playing a recording of desert wind from Tunisia through the device, the recorded and the live are mixed together in my ears. Even though I know what it looked like I do not picture the edge of the Sahara where it was recorded, instead it just becomes a new sound of weather around me and I can only see the harbour. Then slowly the wind from the sea picks up and I can feel it against my face.

Figure 27 - Personal reflection during Only Expansion early development

I do not consider *Only Expansion* as a progression from *Dark By Then*, but rather an alternative approach to similar themes. As such I chose to use a similar form (with an *outward* and *return journey)* where the participant was free to choose their geographic route. While leaving this geographic indeterminacy in place I decided to exert much greater authorship of the temporal structure, creating a fixed timeline for the experience. This was due partly to the results of analysing *Dark By Then* (Chapter 3.01.03), but also due to the shift in technologies used. As I wanted to incorporate the sound

environment of the participant into the work, I built a transparent audio system that allowed both pre-recorded sounds and the participant's sound environment to be heard in the headphones, and realtime digital signal processing (DSP) that could manipulate the incoming sounds[42]. This system meant that the sonic content of the work would become much more unpredictable, so I shifted closer to Cage's idea of composing with duration and ensured that no matter the sonic content, I would be authoring the temporal boundaries.

The decision to incorporate the sound environment is linked to the other key change from *Dark By Then*, the reduction of language use. While I felt that *Dark By Then*'s specific narratives did offer an experience of living within planetary wide networks, I wanted the field recordings to become more ambiguous, not to represent a specific place, but to express something not so easily articulated in words, the overwhelming horrors of onrushing climate collapse.

The field work for this involved audio recordings made around the eroding shorelines of Norfolk, Suffolk and Devon and the forest fires occurring on the west coast of America at the time.[43] The coastal recordings yielded a rich but unsurprising collection of crumbling earth tones and rumbling hydrophone recordings. The experience of recording in California provided a uniquely different experience; that of extreme quiet. Practical safety measures made it impossible to get too close to active fires and, so, recordings were more commonly distant crackling and the hoses of fire crews. What was possible was to walk through the burnt-out housing estates and forests left after the Carr fire (App.06). This desolate lunar-like landscape stretched as far as the eye could see, dark burnt earth pot marked by white ash where trees had once stood. Aside from a handful of deer searching for un-charred foliage there was nothing to hear.; no birds or people, no leaves to rustle in the wind. It was one of the most extreme experience of silence I'd ever had.
Despite numerous approaches, I could not find a way to replicate this feeling of complete silence in the experience of the work. Instead I decided to work with breakdown and viscerality.[44] Sometimes I would degrade the audio

[42] Development of technical system detailed in App.05
[43] See App.06 for documentation of field work.
[44] See Chapter 2.3 for approaches to sonic aesthetics across all the practice.

signal to give the impression of the system failing, of being unable to reproduce sound, only revealing itself as a technology. As Caleb Kelly describes, in recorded media “the sound of silence is actually extremely noisy, full of hum, hiss and the cracks and sparks of static” (2009, p.299). At other moments I leaned into layers of crushing noise, silencing the rest of the world by simply drowning it out. If I could not place participants in the quiet after the fire, maybe I could place them in its burning centre.

FINAL FORM

Only Expansion is presented as an audio augmented reality soundwalk for active urban environments. Participants are given a printed booklet, a small custom-built unit (containing a raspberry pi computer, sound interface and microphone pre-amps). They wear isolating headphones that have binaural microphones attached to the outside (Fig.28).

Figure 28 - Physical components of the work, the audio processing device (top left) and headphones with attached microphones (top right) and guidebook

An usher (or in some exhibition contexts a recorded introduction heard in the headphones) explains to the participant that the only spoken words they will hear in the soundtrack are chapter titles, and that when they hear them they should read that section of the printed book.

Each of the chapters in the book presents a simple prompt, for example ‘to find the quietest place’ or ‘a vantage point’ (Fig.29). The prompts are printed on semi-transparent paper and the partially visible page underneath adds ambiguous contextual information in the form of unlabelled graphs, quotes or photographs. There is no interaction required from the participant when they choose a suitable location, the next chapter prompt occurs at intervals controlled entirely by the software following a composed sequence.

Figure 29 - Example prompt in book (note this book design was original version, but was refined for final work to ease handling)

As the participant moves through the experience the sound in the headphones shifts between pre-recorded music, field recordings, live microphone input and processed microphone input. The transitions are most often gradual, slowly revealing themselves so the participant is not always fully conscious of when the transition happens. At some moments, the music is designed to block out the surroundings, creating the visiophonic knot of the city screen. At other moments, the participant simply hears the microphone input, giving them a heightened experience of their acoustic

surroundings (through the inherent filtering and amplification produced by the microphones). In certain sections, collages of field recordings are played, for example while they are asked to find the quietest place they hear a combination of the live microphone input and multiple recordings of forests from various international locations. The realtime processing of the sound is sometimes used to give the real sound environment musical or rhythmic qualities (enforcing temporal structure on the uncontrolled microphone input) and at other times it is used to evoke or simulate the conditions of the field recordings. For example while underwater field recordings are played the microphone input is filtered and echoed to simulate the participant's environment being flooded.[45]

Similar to *Dark By Then* there is an outward journey, where the prompts in the book give the participant five different situations to seek out (some are just ways of moving). The sixth prompt invites them to retrace their steps, walking back through all the locations they had selected. The final prompt asks them to stop somewhere in sight of their starting location and the soundtrack eventually falls to silence sometime after this.

Through the ambiguous nature of the field recordings and the live audio processing *Only Expansion* seeks to evoke not so much remote places as remote times. While the soundtrack and transparent listening pull the participant's attention towards the now, other moments use visceral sonics to push towards imagined futures of the immediate environment.

Figure 30 - Participant experiencing Only Expansion in Bristol.

[45] The full list of audio processes created and used is available in App.05.

2.3 SONIC AESTHETICS

As discussed in the introduction, my primary concern with temporal structure concerns the participant's path through time-space. If we accept that this path is continuous and unbroken, how do we ensure that the sonic composition is equally consistent, especially when using location responsive software triggers for sound playback? The compositional tools used to shape temporality in the works will be fully analysed in Chapter 3, here I conclude this chapter by introducing the methods employed to develop the sonic aesthetic in the practice.

In *Dark By Then* the incorporation of continuity in the composition process started before the field trips were made. I created a 40min recording of a metronomic electronic pulse with shifting timbre but in a consistent key. The violinist Sarah Anderson was then invited to record an improvisation against this. I then carried this recording throughout the field trips, listening to it during car journeys, playing it from speakers into sites, walking with it on headphones. The first intention was to subtly shape my intuitive decisions during the field trips, so that when making decisions about field recordings to make, or routes to explore, my experience was regularly framed by the same soundtrack (App. 02.01).

This recording was then used as the core of later music composition processes. Collaborating with Sean McGhee and Sarah Anderson, we began writing by improvising while listening to field recordings from sites and the original 40min recording (App. 02.02, 02.03). As we were always responding to the same tonality and temporality it would be easier to combine and overlay different moments of the recorded improvisations in a cohesive way. This was designed to allow for compositionally satisfying overlaps that might occur at indeterminate moments created through the software responding to the participant's agency. The field recordings were edited and collaged in such a way as to echo the narratives in the printed text. As will be discussed in Chapter 3 this led to a collision between the inherent forward motion in time of the sound and the unbound temporality of printed text. These connections between the sound and the text sought to work with the inherent

ambiguity of sound that Kanngieser describes (2015), the text giving context for the source of the sound. This articulation worked in both directions through, and the sound's impact on reading can be related to Michael Chion's concept of materialising sound indices. In describing the use of sound in film these indices are the details of the sound that cause us to "feel the material conditions of the sound source" (Chion, 1994, p. 184). They might give us information about what is making the sound or how it is produced, for example if we see someone knocking on a door in a film the textural qualities of the sound might tell us something about the material of the door. Here they work to give the printed text both materiality and temporality since sound is the product of a dynamic event. Through my method of sequencing separated music and field recording sections (*head-up* and *head-down*), *Dark By Then* primarily uses sound as way of differentiating the remote from the present in time-space. The distant past location of the primary listener that the field recordings embody alternates with the visiophonic knot that the music creates in the here and now.

My secondary question around the ecocritical led to a consideration of the inherently entangled nature of sound and listening. The core compositional approach in *Only Expansion* was to create the kind of viscerality that I felt was missing in *Dark By Then*. I wanted to create something that addressed the feeling of facing something bigger than comprehension, something that addressed the ravaging potential of climate collapse and resonated ideas of de-centring the human. This was partly inspired by AM Kanngieser's idea of sounds ability to make us aware of the unfamiliar and the monstrous (2015), but also by Salomé Voegelin's notion that when listening we do not only "observe but generate, and we are always part of the soundscape we are listening to" (2014, p. 24). I believe our interaction and interdependency with sound offers sensual experience of Barad's entanglement, and is echoed by Voegelin's further proposition that "we do not hear entities but relationships, the commingling of things which generate a sonic world." (p. 162). The shift from isolating headphones to a transparent audio system made this possible, the microphones picking up the participant's own sounds as much as those from their surroundings, weaving them together with the pre-recorded sound into a singular sonic world.

The challenge was in how this sense of entanglement might be approached in the pre-recorded compositions. To address this I began the process by 're-worlding' the existing field recordings. This process involves playing back the recordings into a new acoustic space and recording the outcome and these new recordings captured the peripheral and incidental sounds of my making process, multiple time-spaces collapsed into one recording. I then responded to these new sounds by combining them with instrumental passages and repeating the process. Gradually I built a palette of sonic textures that became the basis for all of the musical compositions, pushing them through more and more extreme processing to move towards the harshness and viscerality I sought (App. 02.04, 02.05). Incorporating this re-worlding process into the recorded compositions not only echoes the realtime audio in the final piece, but also speaks to the composer Barry Truax's idea of composing "through sound" (Truax, 1992, p. 40), where he argues that the dominant trend in electroacoustic composition is simply to 'use' the sounds, but if this is reversed and the artist is being used by rather than using, he proposes that we can '(re)create a more balanced relationship between ourselves and the environment' (p.40).

EXIT

This chapter has documented the methodological approach for both the creation and analysis of practice in my research. While many of the elements are drawn from existing practices, I believe that the application of time geography to the study of augmented reality soundwalks is one of the unique contributions in my research. The description of the experiences themselves highlights the complex mixture of activity and content in the work, and points to the multiple facets of time that a compositional method needs to account for. In the next chapter I will examine the temporal qualities of the practice through these multiple perspectives and methods.

3 TIMESPACE

INTRODUCTION

This chapter will demonstrate how the methods and form in the practice address the research question as restated here:

> *What approaches can be developed that support the understanding and adoption of time as a compositional element in audio augmented reality?*

The primary enquiries explore participant agency, compositional methods and the tensions between chronos and kairos. The first part of the chapter begins by addressing the measurable chronos of both works, documenting my compositional approaches and analysis. Within this the differing utilisation of participant agency between the two works is revealed. In *It Must Have Been Dark By Then* participant agency affects both the duration of audio playback and spatial movement while not changing the sonic *content* of the digital material. In *Only Expansion* the participant shapes both the spatial qualities and sonic content while having no impact on the duration of sections in the work. In both works there is a tension between the participant and canonical trajectories, specifically what I as an author am willing to hand over to participants. A participant dictates *their own path* through time-space, but how this path might be shaped by or co-authored is one of the key goals of this research. What is revealed is that this shaping occurs through a *continual interdependency* within a *quaternary framework of chronos, kairos, content and spatial movement*. The second section of this chapter concentrates on how this entanglement affects the experiential qualities of kairos for the participants. The blurred edges between the world and the work constantly reframe the participant's subjective position in time-space and lead to the final section of the chapter with its proposition for how *audio augmented reality resonates with contemporary ecological theory*. It will be shown that the interdependency of the framework creates an entangled experience for the participant and a heightened attending to their surroundings. In exploring these compositional methods throughout the chapter, the overall intention is not to define an explicit notation style for scoring an AAR experience, but rather to identify the relationships between

content, spatial movement, chronos and kairos that must be accounted for. In doing so I investigate how these entanglements might be given sequence or temporal structure. To begin, I re-visit the languages of temporality that I draw from both music theory and time geography.

3.1 CHRONOS

3.1.1 TEMPORAL HIERARCHY

To assist in articulating time in the works I am demarcating a temporal hierarchy in their structure. The hierarchy consists of the different scales defined by Curtis Roads (2001), the supra, macro, meso and sound event. Supra is the scale with a duration beyond the work itself, extending into and beyond the participant's lifespan and outwards into geological time. The macro scale is the duration of the work itself and consists of a sequence of meso scale sections. Roads would associate the meso scale here with a musical passage, a melody or phrase for example, but as my work incorporates multiple mediums I use meso to define a section of the work that has a specific function. In *Dark By Then* a meso scale section might be the period where a participant is reading the printed text, or it could be the section where they are searching for a barrier. Similarly, in *Only Expansion* a meso scale section might be the section where a participant is asked to find a quiet place. The meso scale is generally defined by the duration of a piece of recorded audio (be that a piece of music soundtrack or a field recording collage in *Dark By Then*) or a specific realtime audio process (for example a section in *Only Expansion* where the microphone input is reverberated). At the meso scale are the musical compositions that I will place within Kramer's definition of being *linear (*progress derived from earlier implications) or *moment form (*no developmental structure).

Within the meso scale is the sound event, Roads defines this as a 'note', the elementary unit of composition lasting from 100ms to several seconds, but drawing on Pierre Schaeffer's use of the term allows it to encompass any sound from any source. For the purposes of this research I consider the sound event level to be any constituent part of a meso scale section, this might include specific instrumental sounds or pieces of spoken text. It is the relationship between the meso and macro scales of the work that creates a continuity of experience. As the macro scale of the work frames a duration, I want it to become an unbroken flow of meso scale compositions that do not leave any caesura un-attended. It is the continuity of this frame in time-space that makes *everything within it part of the work.*

3.1.2 TIME GEOGRAPHY REDUX

Moving through this continuous time-space we find the participant, which can be understood as the *individual* in time geography. Importantly the individual is also understood, regardless of type, to be an undivided entity which is born, produced, or created, and it exists for a time period and thereafter dies, is destroyed or dissolved. The movement of a participant(individual) through *time-space* is called the *path*, a term that I will continue to use in this chapter. Time geography works with the principle that "every task has a duration" (Thrift, 1977, p. 7) and, in the work here I understand the tasks to be the actions that participants make in response to the prompts.

The work begins and the participant progresses through it until it ends, between these two points there are tasks (e.g. find this location, read this chapter) for them to complete. The ability for participants to complete these *tasks* is limited by the biophysical, ecological and locational realities that are framed through the concept of constraints which dictate how the *resources* of time and space are used. As outlined in Chap. 1.03 Hägerstrand identifies three types of *constraints* which can be applied within my analysis:

1. Capability Constraints – the limits on an individual's activity through biological make up and ability to use tools available.

If my participants are expected to experience the work on foot (or in a wheelchair or other mobility aid) there will be constraints on how fast they can move from one location to another. In *Dark By Then* the software generated geo-locations may be inaccessible due to a participant's biological inability to walk through a wall. Also as will be demonstrated, if participants in *Only Expansion* choose a location they would *like* to get to they often evaluate their own capacity get there in time (i.e. before they imagine the next section of the work will start).

2. Coupling constraints – the necessity that individuals, tools and materials are bound together at given times.

In a geographic study this might, for example, consider how in order to take a bus an individual must be at a bus stop at the time the bus is scheduled to depart. In my work this constraint is more often the relationship of audio content to specific sites. The use of GPS regions creates a form of coupling constraint where the participant would not hear a specific piece of content if they were not at the correct location. In *Dark By Then* this access is not dependent on the time they are at the location, but the time they arrive at the location does impact the overall temporal structure of the work. In *Only Expansion* the lack of GPS means that for the work to exist in the form I intend, the participant needs to be able to get back to their starting location within a certain time.

3. Authority constraints - Limitations and control of access.

This constraint reveals hierarchies of accessibility. For example a park may be closed after a certain time to the public, but still accessible by a groundskeeper. For the non-site-specific work created in this research these constraints are difficult to predict, and yet participants may come up against them repeatedly, for example in access to specific buildings. In highlighting the physical constraints of environments, the software generated geo-locations of *Dark By Then* also often reveal these *authority constraints* to participants in acute ways.

These constraints are applied to anything that extends into time and space, and that extension is their *path*. So a human being, animal or another other indivisible object has a *path* which moves through a set of time space locations. As Hägerstrand describes, the *"*concept of path (or trajectory) was introduced in order to help us appreciate the significance of continuity in the succession of situations" (Hägerstrand, 1988, p.323*).* It is the singularity and continuity of paths that makes them useful here. If the relationship between the canonical and participant trajectory in a work establishes the tension between authorial composition and participant agency, I consider the *path* to

be the singular and continuous experience that their entwined existence creates. In this way we must not ignore the fact that this path, in both notation and analysis, disguises the deep cognitive processes involved in a participant's actions and experience. Hägerstrand summarises this importance as follows:

> The fact that a human path in the geographic notation seems to represent nothing more than a point on the move should not lead us to forget that at its tip - as it we- in the persistent present stands a living body subject, endowed with memories, feelings, knowledge, imagination and goals […] in other words capabilities too rich for any symbolic representation but decisive for the directions of paths. People are not paths, but they cannot avoid drawing them in space time. (1988, p. 324)

The time space locations that a path moves through are called *stations* and are often represented as tubes, maintaining a fixed point in space but extending in time. In a classic time geography model a station might be an office or a bus stop, with an individual's *path* coming into contact with it under the influence of *constraints.* In both *It Must Have Been Dark By Then* and *Only Expansion* we can consider the *stations* as the sites chosen by the participants or by a software procedure. When these sites are chosen (in *Dark By Then* these sites are also marked by a geofenced region), they create markers in time-space whose relevance and role is articulated through both the content of the work and the participants' subjectivity.

The last piece of relevant vocabulary from time geography is that of *prisms*. These were developed to "depict the situational determinants of the individual's path through the environment using the stations as referents." (Thrift, 1977, p.17). The shape of the prism is determined by the speed of travel, so for example a human walking at a continual pace can only move a certain distance from a *station* in a given period of time and the capacity constraint of movement speed is unchanged (i.e. they don't start running or get in a car). The *prism* is symmetrical if the start and destination station is the same. In this two-dimensional representation of time and distance (Fig. 31) the prism marks out the possible range of distance a person could walk in 10mins, and how long they would need to return to the same point.

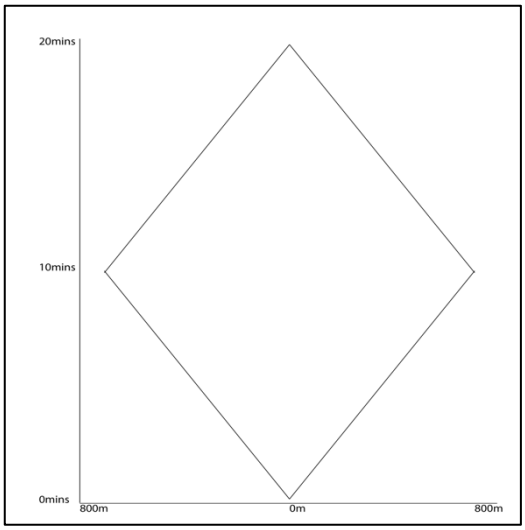


Figure 31 - Simple prism demonstrating possible distance that can be travelled over time at walking pace of 5km/hr.

It is important to acknowledge the temporal extension of both *paths* and *stations*. The *path* followed by an individual within the work does not begin and end in that time period, it extends from their birth to death. The work is placing a durational boundary around only one segment of it. When a participant chooses a building in *It Must Have Been Dark By Then* or a vantage point in *Only Expansion*, at that moment it becomes a *station* in the work, but this station also extends backwards and forwards in time outside the frame of the work (Fig.32). A participant's *path* may come into contact with this station again at some future point after experiencing the work, but equally they may be conscious that they already had encountered it in the past. So while *paths* and *stations* assist in plotting the *chronos* of the work they also begin to expose the multiple overlapping and intersecting timelines that can determine the shape of the *kairos* within the work.

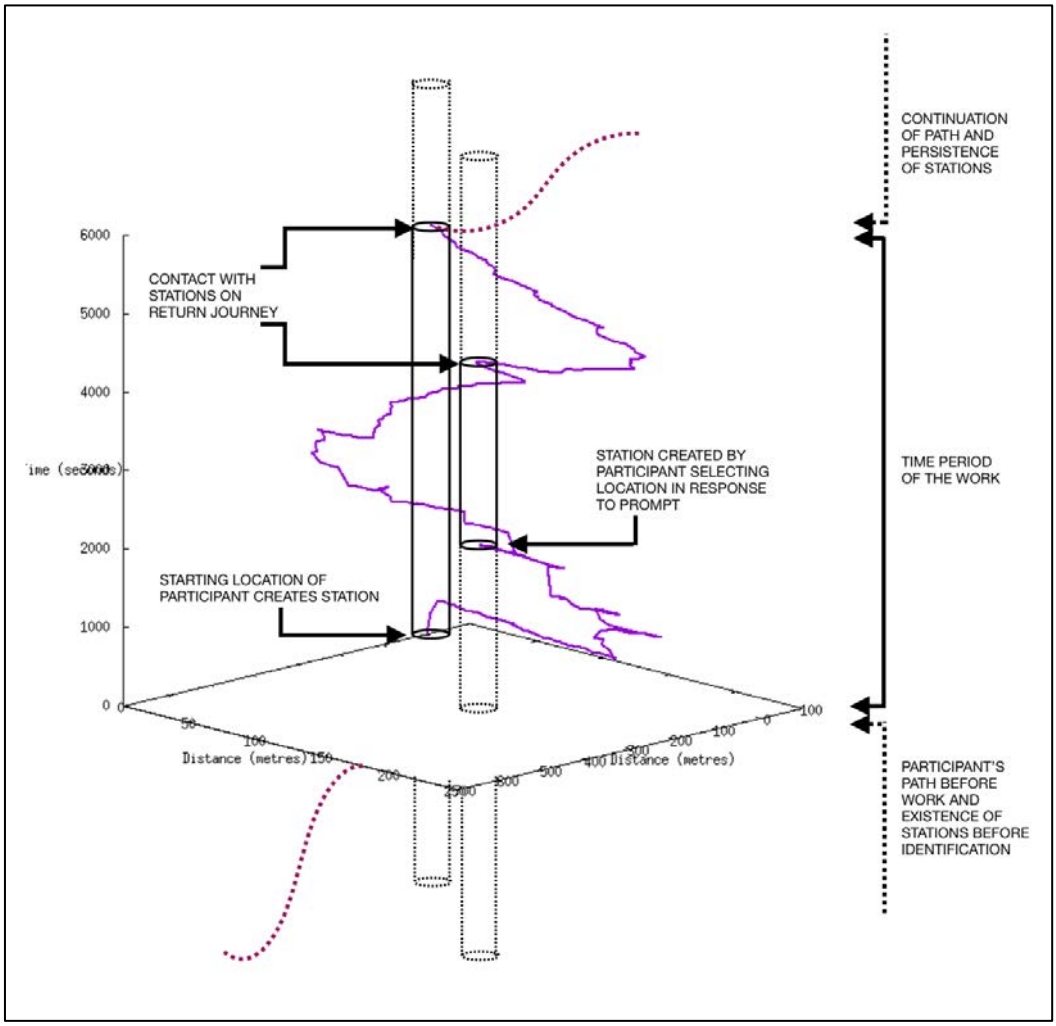


Figure 32 - Time cube representation of a participant's path through Dark By Then, vertical axis representing clock time and horizontal XY representing geographic position.

3.1.3 STRUCTURAL DESIGN

Having established the vocabularies of time geography and temporal hierarchies as they are used within the work, I now move to an analysis of the approaches applied in shaping a participant's path. To unpack the compositional methods the elements that make up the *content* first need to be identified.[46] I have broken these elements down into a set of non-hierarchical layers as follows:

Dark By Then **- content**	***Only Expansion*** **- content**
Pre-recorded music	Pre-recorded music
Field recordings (collaged)	Field recordings (collaged)
Printed text narratives	Printed text instructions
Spoken narration and instructions	Real-time audio processes

It is the combination of these layers that create the meso scale structures, and each has a specific role. In *Dark By Then* the spoken narration gives the participants instructions and exists as a transdiegetic sound, while not presented as part of the surrounding environment's diegesis it changes what is happening through a participant's interaction with the world. It never tells them what they should be experiencing or seeing as it can never know and doing so would be a falsehood quickly realised by the listener, creating an unnecessary tension. Instead it posits questions, suggesting possibilities not facts about the participant's surroundings, letting them collaborate in the creation of the open work.

> *"I felt like I was co-writing the story at points, and I thought that had been kind of designed-in really well, you know, with the questioning, like, you know, "What can you see here?" "What does this wood feel like?" (Dark By Then participant, App. 04.01, S16)*[47]

[46] While I do inherently consider the *uncontrolled environment* of the participant's surroundings part of the content, it is not included in this table as it cannot be *composed,* only framed by the elements presented here.

[47] All references to App.04 are quotes from participants. For ongoing readability, they will only be referenced by the appendix and identifier. The identifier is after the appendix reference (e.g. 301, S16) and denotes specific columns in a spreadsheet of collated transcriptions if applicable).

In *Only Expansion*, while not transdiegetic, the printed instructions fulfil a similar role, offering prompts, reflective commentary and sometimes contextual information. The use of text was minimal and the moments of reading a prompt or instruction was designed more as punctuation than as an experience mode (such as the *head-up* mode in *Dark By Then*), striating the continuous flow of the work. In both pieces this is key to creating an open work "assembled by an outside party" (Eco, 1962, p.36.) What is of key relevance to my research questions is how the content affects the chronos of the open work, and how in turn they interact with the spatial movement and kairos. The primary tool for this is the pre-recorded music which plays a number of roles. Fundamentally it is my personal emotional response to the material and themes of the work, but it is also intended to guide the eyes and bodies of participants and as a result their choice of *time-space path.*

> *"… I was being guided and the sound had a lot to do with that as well, the, yes, the composition, the sound composition really kind of like, like created a sort of bubble of- bubble's not the right word though, because I felt much more aware of my surroundings than I usually do" (App. 04.01, S16)*

The use of headphones leads to the music becoming the soundtrack for the participants' visual surroundings, creating visiophonic knots. Often the world is essentially silenced, and in its role as a "manager of sensory channels" (Thibaud, 2005, p.330) it changes participants' visual engagement with the world, creating Bull's *auditory gaze* (2007, p.156).

> *"but it was looking at individual people within the experience that it suddenly became very cinematic" (App. 04.03)*

> *"the sound might have driven me more, because the sound really influenced what I was thinking, and the sound really held me" (App. 04.01, S13)*

> *"I think it was as soon as I put the headphones on, and that first bit of music, and looking around in this rather busy, chaotic place outside the British Library. It was like one volume was turned down – the reality – and this new volume knob was turned up, where it's your inner world. That transition was very powerful, and then, of course, you get used to it. It was that first bit." (App. 04.01)*

This use of music blurs the separation between extra-diegetic reflective comment and transdiegetic shaping of a participant's actions and in turn the temporal structure. In *Only Expansion* parts of the diegetic sound from the

participants' surroundings are processed to take on this blurry musical role. Specifically in *Dark By Then*, the field recordings also have a role to play in this temporal shaping, as will be explored later. Initially, my focus is on the music, and the compositional approaches designed to give soft limits to the chronos of an open work.

3.1.4 SHAPING CHRONOS IN DARK BY THEN

While sketching initial structures for the *Dark By Then* it was not possible to know the durations of a participant's experience of each part of the work. How long would they look for a building, what was their reading speed? The earliest scores for the work consisted simply of a suggested sequence of the travel narratives (Fig.33) with no consideration of duration. As the score progressed, I began to include the emotional or reflective thematic I wanted each section to convey (Fig.34), and the lack of control over duration became a more pressing issue. Composing music for sections of unknown duration made it impossible to use linear progressive structures. I could not express anything through sound that developed over time as I did not know if the participant would hear it in full, or if it would end abruptly before they chose their station. The alternate approach was to compose music in *moment form* (no goal directed temporal development) so they could play on loop indefinitely. My reflections on the experience of using these in the work were unsurprisingly frustrating, some passages became annoyingly repetitive, others felt like just background music, saying nothing. I decided that while it would be impossible to control the entire temporal structure and still allow participants to shape their spatial journey, my response was to create some meso scale sections that have fixed durations. By alternating between periods of fixed and open durations I would not only be able to utilise sections of linear progression in the music, but also create a form of *underlying pulse* at the macro scale. At this stage, it was possible to create a score for the work that referenced the chronos of certain sections (Fig.35).

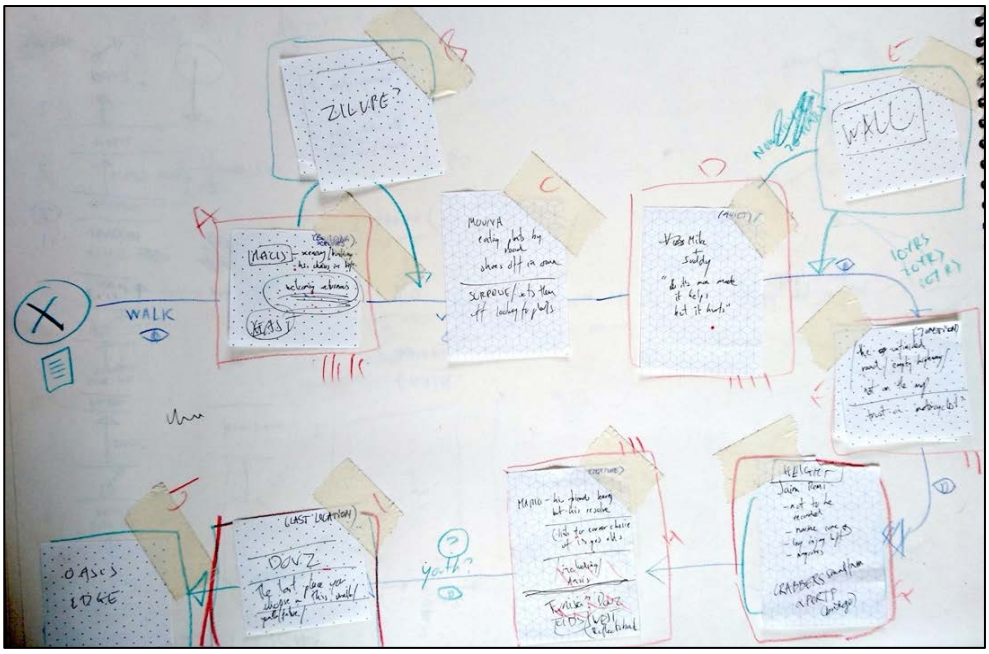


Figure 33 - Early score sequencing travel narratives

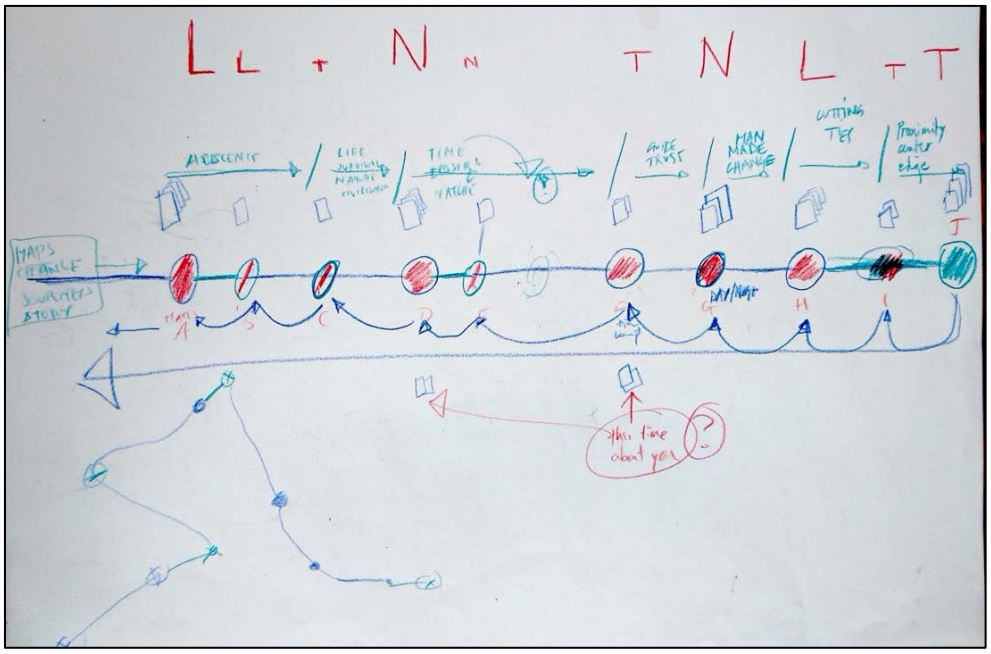


Figure 34 - Early score with preliminary shaping of thematics and dynamics

Figure 35 - Extract of score showing alternating fixed (yellow) and open (blue, green) durations in sequence of the work. Full version of this score in App. 03.01

Here it was possible to visualise the fixed duration sections (linearly directed) interspersing the open sections where the participant is either moving (moment form) or reading (field recordings).[48] While still not possible to capture the duration of the macro scale, it did allow a visualisation of the pulse of repeated fixed duration sections. The desire to create the pulse was an intuitive one, I felt that this implied rhythm might give the piece a sense of authored structure. This is the first example of the *content interacting with the chronos* of the work. Rather than simply an infinitely stretchable macro structure I was trying to give the elasticity some temporal tension.

This alternating pattern would seem to only be applicable in the *outward journey,* as in the *return journey* the participants were moving between stations whose location are unknown to me. Though if we apply the concept of *prisms* it shows us some limits to the temporal possibilities of the participant's time-space path.

An example of this can be shown between the sections 'Zilupe' and 'Mouna'. After they have read the Zilupe chapter in the book (and the software has stored this geofenced region) the participant is invited to walk, drifting with no clear intention. During this walk a piece of linearly directed music with fixed duration is played, at the end they are instructed to stop where they are and read the 'Mouna' chapter while the software stores the location of this new station. If we work with the assumption that their walking pace has a *capacity constraint* and does not vary drastically, then the time for them to walk from the Mouna station back to the Zilupe station should give a good indicator of the time period between the stations and associated triggering of audio file playback. This can be visualised in relation to spatial movement within the score (Fig.36) and as a prism (Fig.37).

[48] While the field recordings are not strictly moment form, at this stage I considered reading as a task with no fixed duration as it is so dependent on a participant's reading speed. Later considerations of this are addressed in Chapter 3.1.5 'Temporal Articulation'.

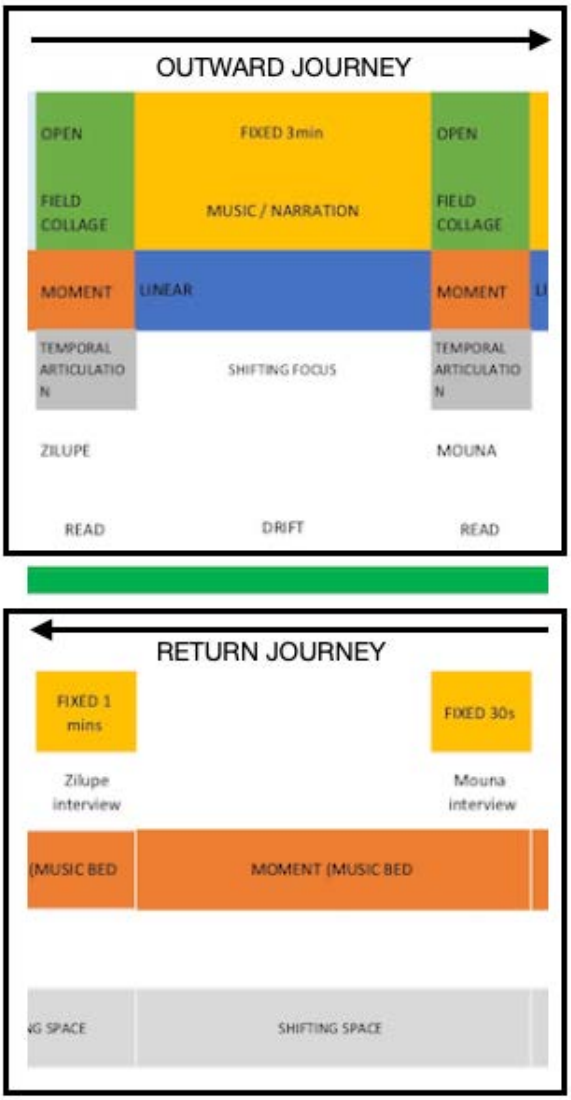


Figure 37 - Prism as applied in score. Duration of section on return journey (lower image) must account for fixed duration of outward journey (upper image)

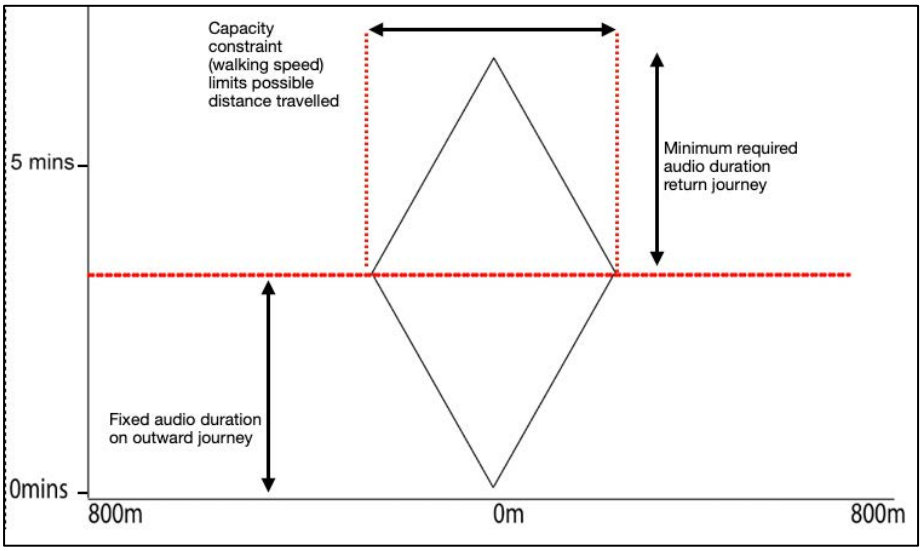


Figure 36 - Diagrammatic explanation of prism in relation to chronos of score and distance participant can travel

Due to this capacity constraint the interview material and associated music can be edited to fit this assumed duration. While the music here is still primarily moment form, there is a consideration of its dynamics in relation to the interview content. For example if the interview content was 30s in length, then the first 30s of music was lower in volume and intensity.[49]

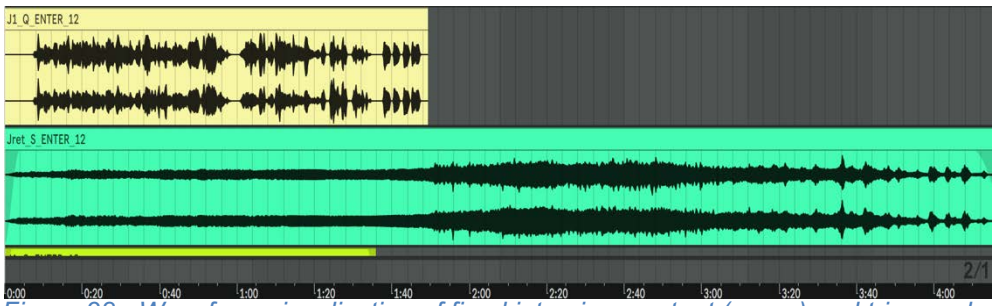


Figure 38 - Waveform visualization of fixed interview content (upper) and triggered music content (lower)

In Fig.38 the upper waveform is the interview content, and it is possible to see how the music in the lower waveform raises in volume at the end of the interview material (App. 02.06). The music then continues for an additional 1'20s longer than the file from the outward journey to accommodate variances in the participant's movement. If the participant has still not reached the next station by this point the software then plays a simple looping drone until the next music/interview content is triggered. This approach is of course not completely reliable, but in testing it was able to accommodate the large majority of situations. Of course many of the sections of the outward journey do not have fixed durations, making the associated durations between stations on the return journey much less predictable. This was addressed in two ways, the first being a technical solution.

It was compositionally important for me that participants heard the entirety of the interview content, i.e. it was not cut-off and replaced when their arrival at the next station triggered the next interview. For this reason, I implemented a playlist system in the software. This queued up audio files so if they entered a new region while still listening to previous content it would wait until each file was played in full before starting the next one. Attempting to do the same with the music was problematic, as the interviews were short but the music was designed to play for the entirety of the journey between the stations. Due to this the music in these sections was composed in moment form like the

[49] Ideally this would have been achieved by having the software duck the audio when the interview played but the 3rd party developers did not make this possible.

open sections in the outward journey, with little development or progress so it could be started/cut-off without drastically affecting any perceptible structure.

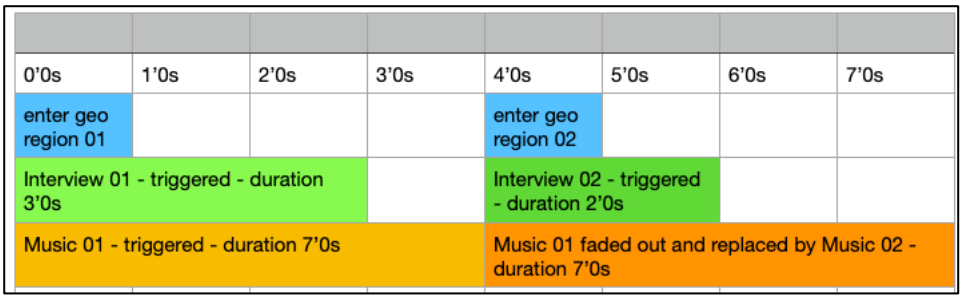


Figure 39 - Layers of audio files triggered by entering geofenced region

These diagrams show the results of the two different triggering situations. Fig.39 shows how the time between the participant entering the two regions is long enough to enable the interview material to play in full, and the music continues to play until they enter the second region.

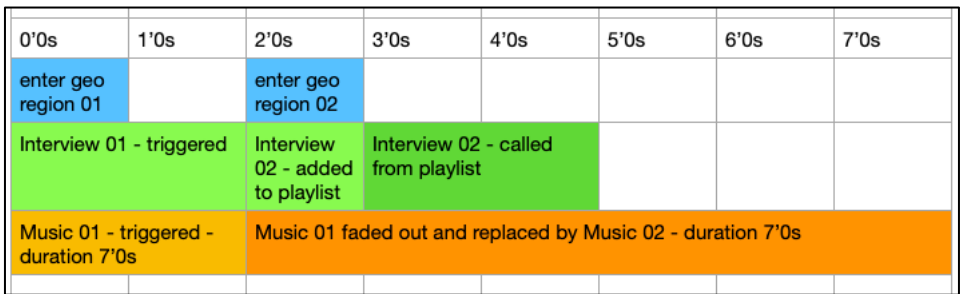


Figure 40 - Layers of audio files triggered by entering geofenced region, Interview 01 continues playing when Interview 02 is triggered

Fig.40 demonstrates a situation where the participant reaches the second region before the first interview material has finished playing. When they enter the second region the second interview material is added to the playlist and only played when the first interview has finished playing. Meanwhile the music shifts to a new file the moment they enter the second region. This form was designed so that there was still a relationship between a participant's physical location and the audio content regardless of the distance between regions. The interview material was directly related to what the participant had read in the book at that *station*, and if played back when they re-visited the location should make a connection to their memory of being there before.[50] The music was composed in relation to that interview and compositionally *should* play alongside it, though the queuing system meant

[50] Audio interview material is sometimes presented as a transcripted quote in the book.

there was a chance the interview would not play immediately. In this instance I still wanted a shift in the music texture to demarcate this re-visiting. While there might be no explicit memory association (they may not remember the music from that part of their outward journey), I hoped that by actively shifting the music when they returned it might be *felt,* even if subconsciously. The possibility that the music might have a subconscious effect on the participants also leads to the second approach I took in addressing the unpredictable duration of a participant's return journey.

In the *open* sections where participants were moving (as opposed to the reading sections which will be discussed later) I wanted to use the music to subtly suggest how long they should be searching for something. To accomplish this, I used shifts in the music from a sense of progression and movement to one of a more static and motionless presence. To echo the underlying pulse I had already incorporated using the fixed duration sections, I placed these shifts in the open sections after a similar duration.

In my previous research[51] I had failed to draw any conclusive results about the impact of musical tempo on walking speed. What I had established though was that clearly defined rhythms established a greater feeling of purpose in the participants' movements and softer drifting compositions allowed them to drift in a slower more exploratory manner. As one participant remarked in this study in relation to the opening section[52] of It Must Have Been *Dark By Then* "at the beginning I knew I was walking slower than I usually do" (App. 04.01, 306). Another describing the driving rhythms in the section between Mouna and Port Fourchon[53] commented on "how it was setting the rhythm of my walking, it felt propulsive, at various points, it gave me a sense of purpose in the way that I was walking" (App. 04.01, 296). Rather than an attempt to change the specific walking pace of participants, I was instead using these shifts in rhythmic emphasis[54] to create shifts in the feel of their movement, echoing Oliver Sacks idea that "rhythm turns listeners into participants" (Sacks, 2008, p.244). Here again is the idea of a *participant*

[51] My MRes dissertation 'Compositional Strategies For Structured Experiences' developed a number of methods for shaping participant experience, some outcomes documented in App.7. While there was some correlation between music tempo and walking speed it was found to be relational rather than specific (e.g. all participants would increase their speed at certain moments but only with respect to their previous speed)
[52] Audio example App.02.09
[53] Audio extract at App.02.10
[54] As described in Chapter 2 the different sections of music were all built around a long improvisation at a single tempo, but each one applied emphasis on different subdivisions of this tempo (or removed rhythm entirely) to create the shifts described.

as active, the music acting transdiegetically to offer them guidance in how to c*omplete the open work.*

In the audio examples it is possible to hear how in ‘building search music’ after 1’40s the pulsing synth line fade out, removing any clear or definite rhythm.[55] In the ‘junction_search_music’ after 1’45s of pulsing vocal hockets, synths and cymbal rhythms the music reduces to overlapping layers of droning viola.[56] The image below (Fig.41) shows the similarity of durations before the shift occurs.

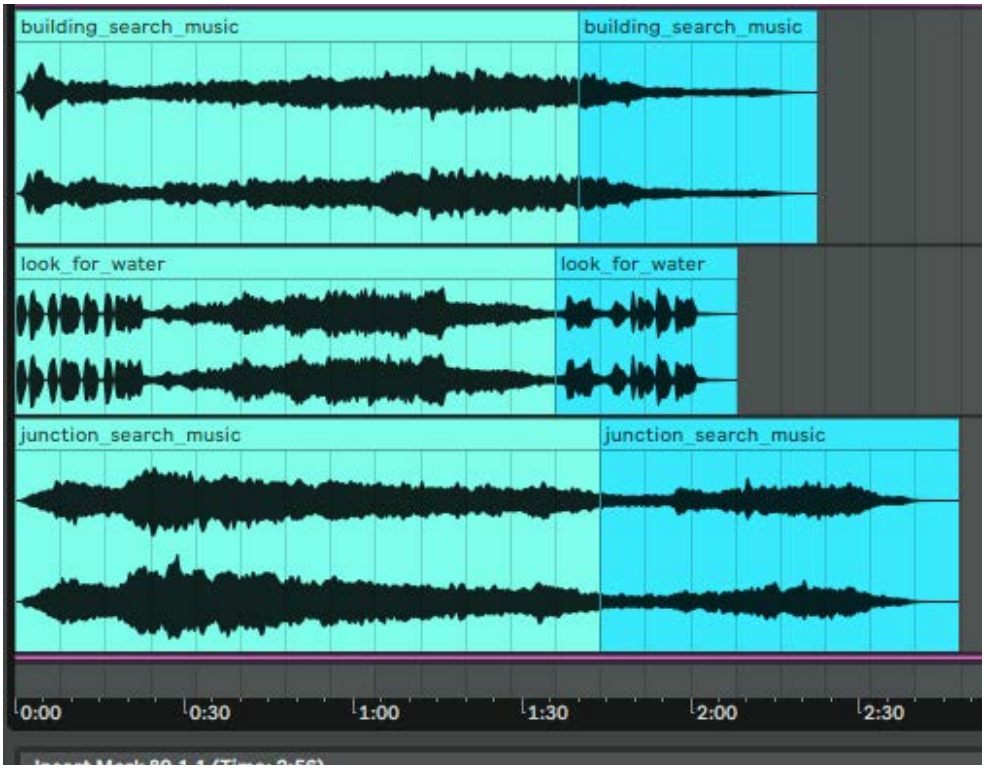


Figure 41 - Shifts in sense of musical 'progression' occurring after similar durations (blue sections are moment form)

The shift becomes one from *linear* to *moment* form, with the intention that the participant might *feel* that the work had stopped progressing and that it was time for them to make an active decision so it could continue into the next section.

> *What was happening there though, I noticed it was happening-- That did not happen elsewhere, was that I could detect the loop in the music. It felt like it was going, "Okay you're taking a bit too long, man." (App. 04.04)*

[55] Audio example at App. 02.07
[56] Audio example at App. 02.08

If we understand this to be shaping when the participant feels it is the *correct* moment, then we have an *interaction between the content and the kairos of the work*. As the participants choice creates a marker in time-space and progresses the piece to the next section, *the kairos also influences the chronos*.

So far, I have focused on these interactions between only the pre-recorded music element of the content and the spatial movement of the participant. Before I present an analysis of how these interactions impact the chronos of the work, we must consider the open duration sections where the participant reads the printed narratives.

3.1.5 TEMPORAL ARTICULATION

While the printed narratives offer their own complex articulation of time, it is difficult to use chronos to represent or predict the process of reading. There is no standard reading speed, and eyes scanning the expressive typography of the book may also speed it up or slow it down depending on a reader's cognitive processes. As another *open* duration in the work, it impacts the macro scale duration. So, similar to how the *open* sections of music were structured to shape the participants' choices, here I used the field recordings to try and shape the temporality of reading.

When the participant is invited to read a book chapter, a collage of field recordings from the environment described in the text is played. Sometimes the same events occur in the text and in the sound collage. For example in 'Marcis' the writing describes a road journey and entering a cafe, the sound collage begins with our car on snowy roads and then transitions to a recording from inside that café.[57] The intention here was to create some form of synchronicity between the page and the ear, so the participant may have a feeling they were reading *ahead* or *behind* in time depending on when they heard the sound. I use the sound not just as materialising indices for the stories, but also to infuse them with a sense of progressive time. The open-ended time period of reading is put under pressure by the continuous temporal flow of sound.

[57] Audio example at App.02.12

The actual experience of a participant following the texts at their own reading pace alongside the unchanging speed of the sound playback was not always easy. It was described by one participant as “too much an illustration of what I’m reading. I get too much information at the same time.” The impact of specific sounds or changes in audio environment linked with descriptions on the page meant that some participants could feel their reading being pushed and pulled in time.

> *“I became conscious when I was slightly out of sync with it..I was conscious that it was something I’d just heard that I was now reading” (App. 04.01)*

> *“The atmospheres seemed to shift faster than I was reading, when its moving from outside to inside.” (App. 04.01)*

For some participants the lack of synchronisation between eye and ear was not as problematic, and seemed to lean more towards Chion’s notion of the abstract and fluid qualities of unsynced film sound (1994):

> *“it was a space I could have dwelt in longer, there wasn’t always a synchronicity between what I was reading and hearing, but it was so evocative I wanted to relish it more” (App. 04.01)*

While this variety of experiences may be problematic in establishing a consistency in a participant’s temporal experience, I find the tension interesting. What was revealed to me was both the multiplicity and continual progression of time.

The temporal arcs described in the pages had already happened, they had been experienced by me and continued on their own trajectory regardless of the actions of the participant. This suggestion of the supra scale extends out from a participant’s immediate present. While walking their attention is clearly pushed towards a direct engagement with their surroundings, through both navigation and observation, framed and shaped by the music score. When the experience shifts to reading the book, their surroundings are pushed into the periphery, become part of a sensory ambience around the text. Each location the participant is asked to choose for a book chapter has some connection to the text, sometimes through materiality, sometimes conceptually, the immediate becomes a textural backdrop for an imagined remote environment. As the music is replaced by relevant field recordings

the audio in the ear shifts from being a frame of the uncontrolled and unexpected to being a temporal guide for the time-less print.

The additional complexity here is in the dual forms of linearity. So far *linear* has described the temporal structure of the soundtrack, created through the time period of its various sonic elements being heard in their entirety. If we retain the definition that linearity is a determination of some characteristics derived from earlier events then the text is also linear, its diary like form follows a logical order where each event described is related to the previous one. This linearity in the text is not related to a measurable time period, regardless of the how fast it is read the linear *structure* is unchanged. Alongside it are the field recording collages, which although are intended to be heard in full, the participant can stop by using the app interface to confirm *'I've read that chapter'*, at which point the next part of the soundtrack will begin. As I have relinquished full control of the sound's time period it can be notated as *moment form* in the score, but more usefully I am calling this relationship between the text and the sound *temporal articulation.* It is a structural element that becomes a key output of the cyclic process, describing the use of temporal content (in this case the field recording collages) to shape a participant's journey through an atemporal element (here that is the printed text). As the temporal structure of the sound is shaping the participant's *sense* of time in the text, it is another interaction where the chronos of the content impacts the kairos transdiegetically, which reciprocally impacts the chronos as the participant's agency (pressing *'I've read that'*) determines when the software progresses. As we move on to the analysis of participants' time-space paths we will see the tangible impacts of these interactions.

3.1.6 TIMESPACE ANALYSIS: DARK BY THEN

So far in this chapter I have identified the multiple transdiegetic approaches I took to try and shape the interactions of chronos, kairos, spatial movement and content within *Dark By Then*. To evaluate the actual impact of these on the work requires analysing the time-space paths of participants.

As detailed in the methodology chapter, the GPS co-ordinates of participants experiencing the work were plotted in 3D as a way of observing their spatial position over time. The collated results of 10 participants of It Must Have Been *Dark By Then* are placed in a time cube as seen in Fig 42. Each of the coloured lines represent the movements of 1 of 10 participants in 4 different cities[58].

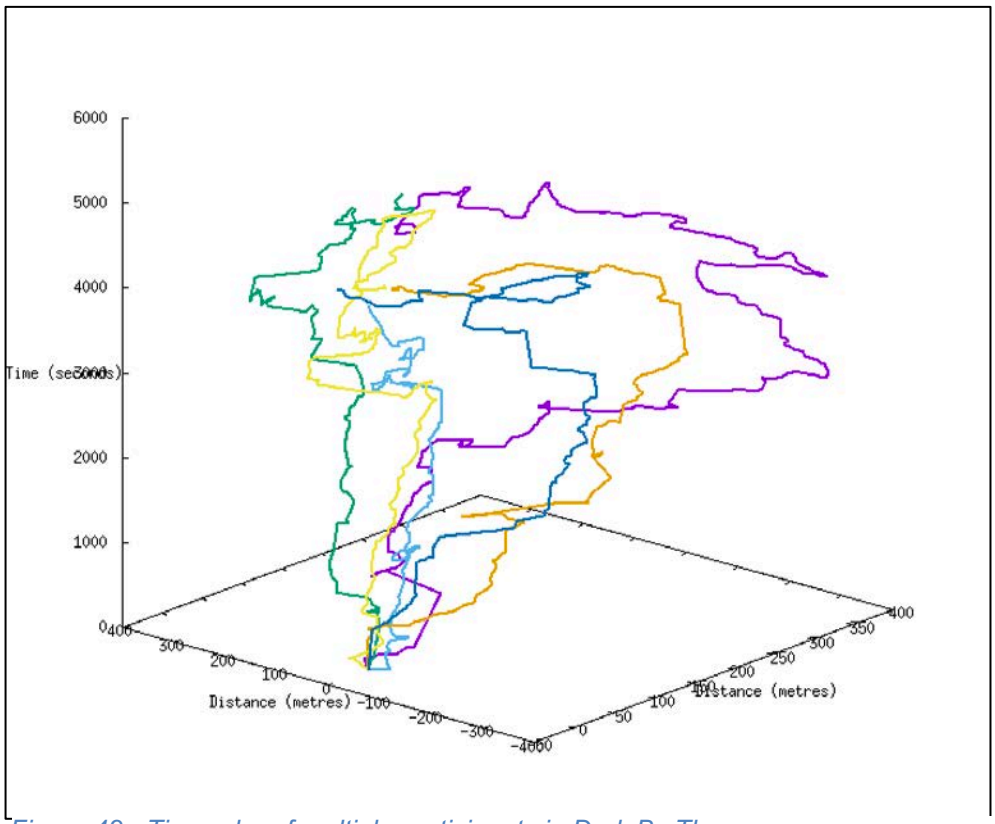


Figure 42 - Timecube of multiple participants in Dark By Then

[58] For the purposes of this research the physical specifics of the different locations are not being taken into account (e.g. ease of navigation, accessibility of pedestrian zones) but each was recorded in a northern European city with a population density between 2500km2 and 5000km2. The time measurement is taken from when they are given the phone and ends when they return it. As it is up to the participant when they actually press the button on the phone's screen to begin the experience there is an error range in the start times of approximately 2 minutes. (based on visual observations of the participants).

As the participants each have an individual choice of route and walking speed it is not surprising to initially see such a chaotic tangle of lines, though if we rotate the plot to see the time values more clearly it reveals a surprising lack of variance (Fig.43). The average time taken to complete the work being approximately 82mins (4911seconds) the standard deviation from it is only 7mins (420 seconds) (Fig.44).

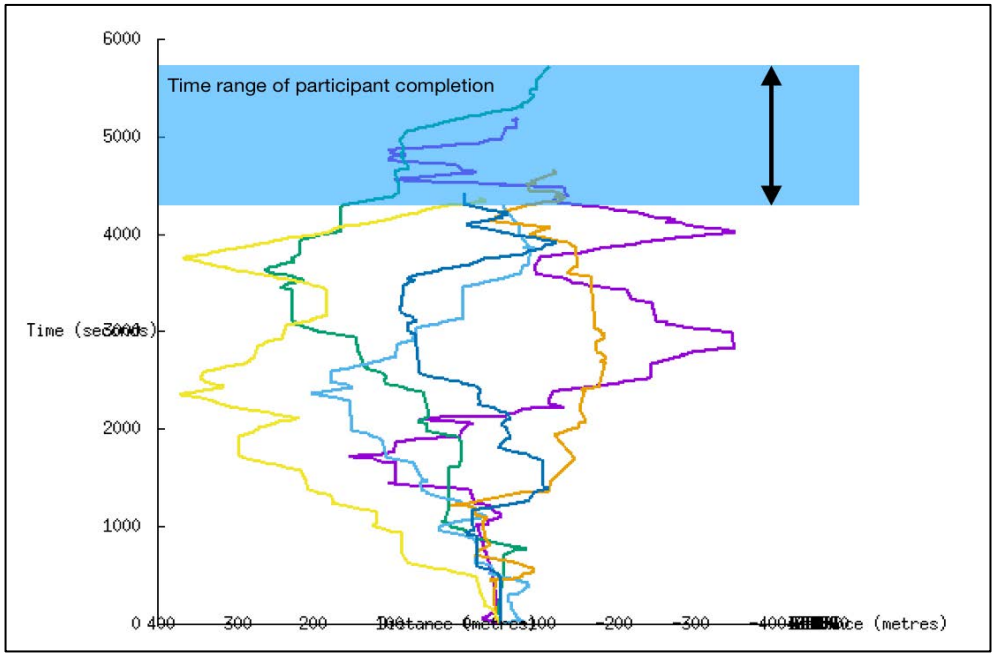


Figure 43 - Timecube viewed from horizontal perspective to compare similarity in duration (vertical axis) of participants' paths.

Considering that the work is constructed from a set of meso scale sections of a few minutes each the importance of this result may not be immediately apparent. To put this 7 mins of variance in context, consider that the entire work has 17 meso scale sections on the outward journey that are open, i.e. where the participants' choices could have created *any* duration and there are only six sections of fixed duration totalling 31 minutes of content. In a work that had the potential to be *any* duration I found this comparatively minute variance astounding. A useful comparison is that the standard deviation in duration is only 8.5% of the average, whereas the deviation in distance travelled is 27% (Fig.44). While not a rigorous study it demonstrated that there was *something* important happening here that could be applied within my own practice of composition.[59]

[59] While these results suggest that the compositional techniques used have an observable impact on the chronos of the work it uses a small sample size and does not account for many external factors. Therefore further study would be required to confirm the full extent of this impact. .

Figure 44 - Numerical comparison of experience duration. Each row represents an individual participant.

	Distance (km)	Time (seconds)
	4.71	4872
	5.092	4974
	2.255	5488
	2.431	5176
	2.526	4658.99
	3.492	4376
	2.437	4412.44
	3.736	5516.4
	3.63	5258.05
	4.207	4388
Average	3.4516	4911.988
Standard Deviation	0.97	420.4060198

I acknowledge that participants may undertake the experience with some underlying assumption of how long the work might be based on previous experiences of similar cultural events. Unless participants asked in advance, they were not given any indication of the length of the work, and even if they asked ushers were instructed to suggest “under 90mins” based on results of these iterative tests. Even then they had no way of knowing how many individual choices there were in advance. Based on this, and the fact that no interviews suggested they were making choices based on temporal expectations I am not considering this as having an important impact on the durations measured.

By focusing on two participants (Fig.45) it is possible to see how their similar temporal journeys had much greater variance in the scale of the physical distance travelled. The difference in the slope of their paths shows that they had different walking speeds (shallower angle means larger distance in shorter time), but they still created a similar temporal structure.

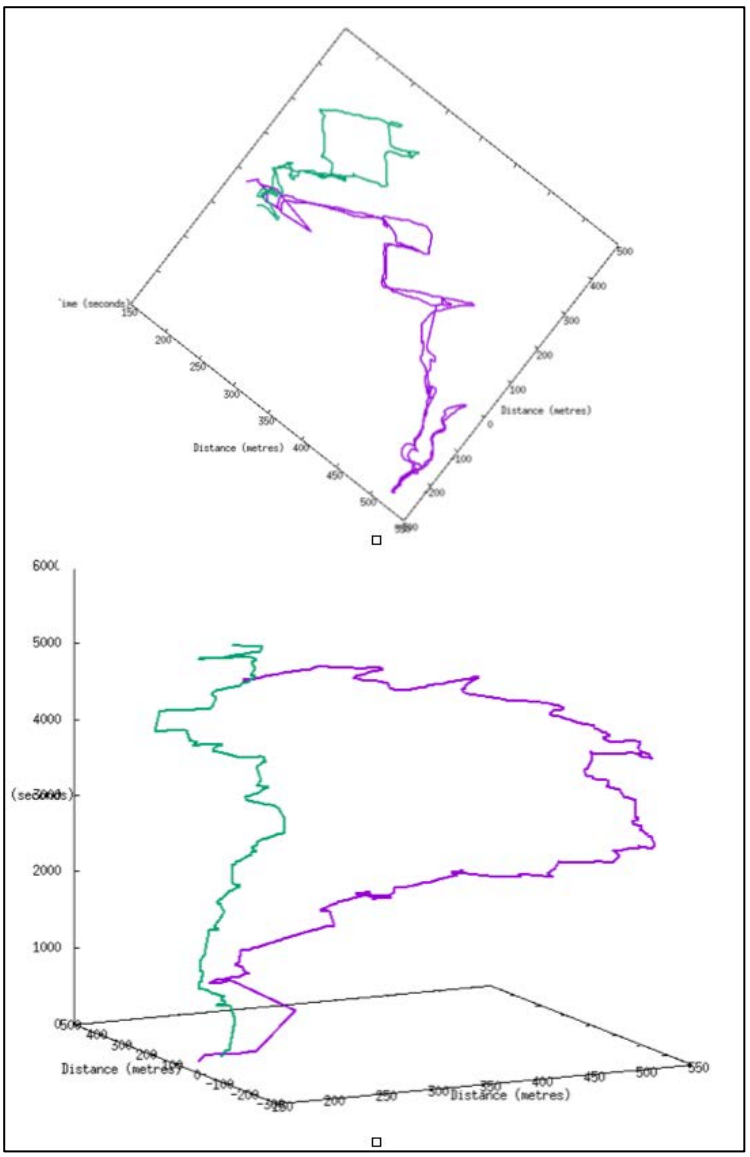


Figure 45 - Upper image shows variance in geographic distance covered. Lower image shows similarity in duration of experience

Through analysing the participants' experiences described in interviews, there are two revealing aspects from the routes with the longest and shortest time periods (Fig. 46). The participants who took the longest time describe taking an 'illogical route' or not 'walking a direct route', which might account for the two journey times that deviated the most from the average. In contrast to this, responses from the participants with the shortest times revealed that one had a software malfunction and did not experience the return journey, while the other consciously walked faster on their return journey.

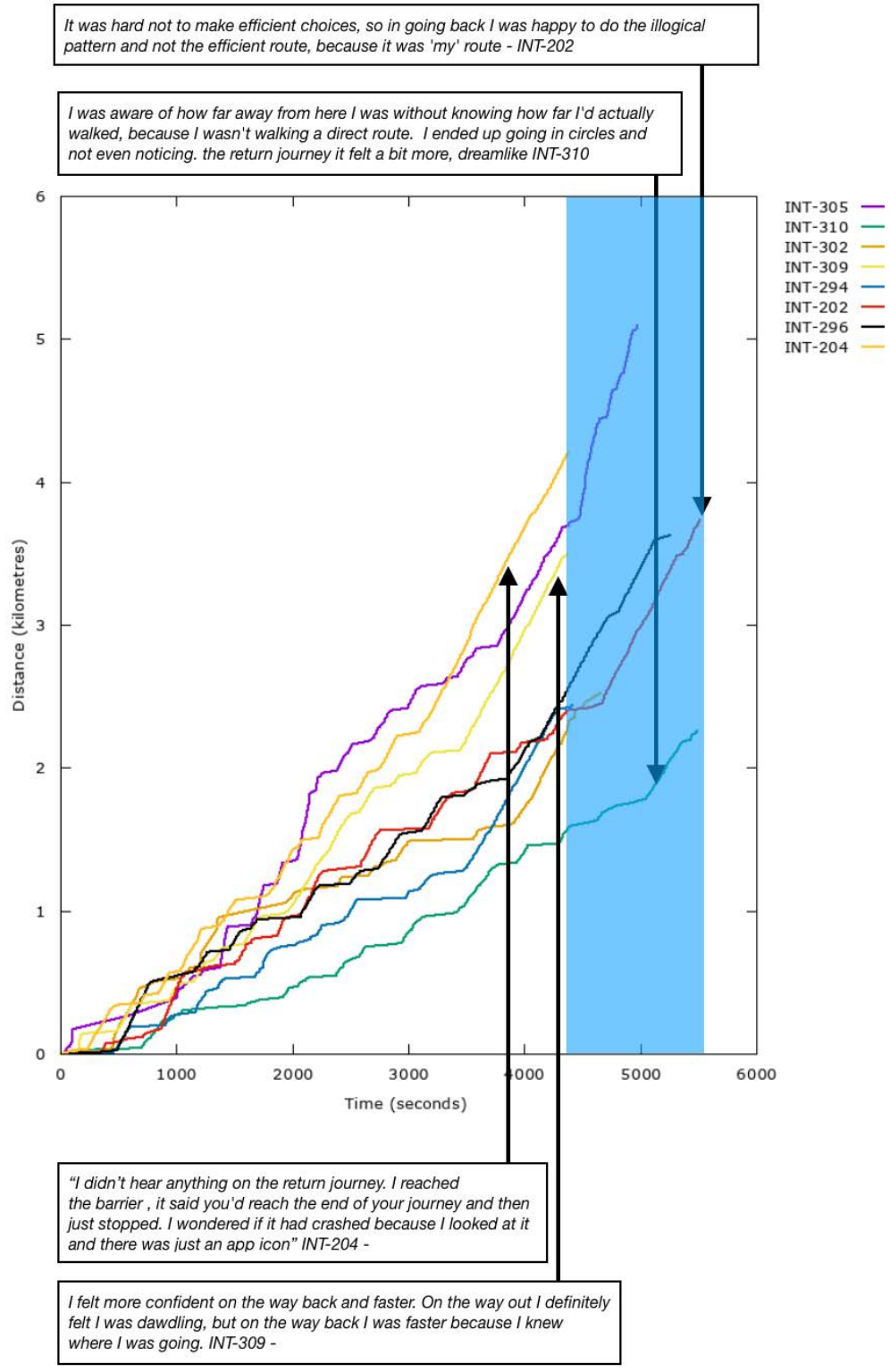


Figure 46 - Comparing participant interviews with duration of experience

These measurements account for the *entire time period* of the participants' experiences, but it is also possible to use the time cube plots to approximate the different lengths of the outward and return journeys (Fig.47). By examining the overlaps in geographic position we can infer the moment a participant began retracing their steps. This is useful because it identifies the impact of the temporal shaping methods I used in the outward journey. Across all the participants we get a similar standard deviation of only 7mins 36sec (457 seconds) from an average outward journey time of 54mins 25s (3266 seconds).

The outward journey was constructed of alternating sections of linear/fixed time periods and open sections that transitioned from linear to moment time. As described earlier, the fixed time periods were intended give temporal shape to the work through an underlying pulse, and the use of linear to moment transitions in the open sections were an attempt to influence the participants' decisions after certain time periods (i.e. the disappearance of linear progression in the sound suggesting that they *should now* do something). The cumulative total of all these *composed* durations from the outward journey was approx. 50 mins (3040seconds), and the resulting average time of a participant's outward journey was only 4 minutes 25 seconds longer (266 seconds).

A way to understand this is that my compositional intent was for the outward journey to last 50 mins, and even though the participants *had agency* to greatly extend that duration, on average they only increased it by about 4 mins 25 seconds.

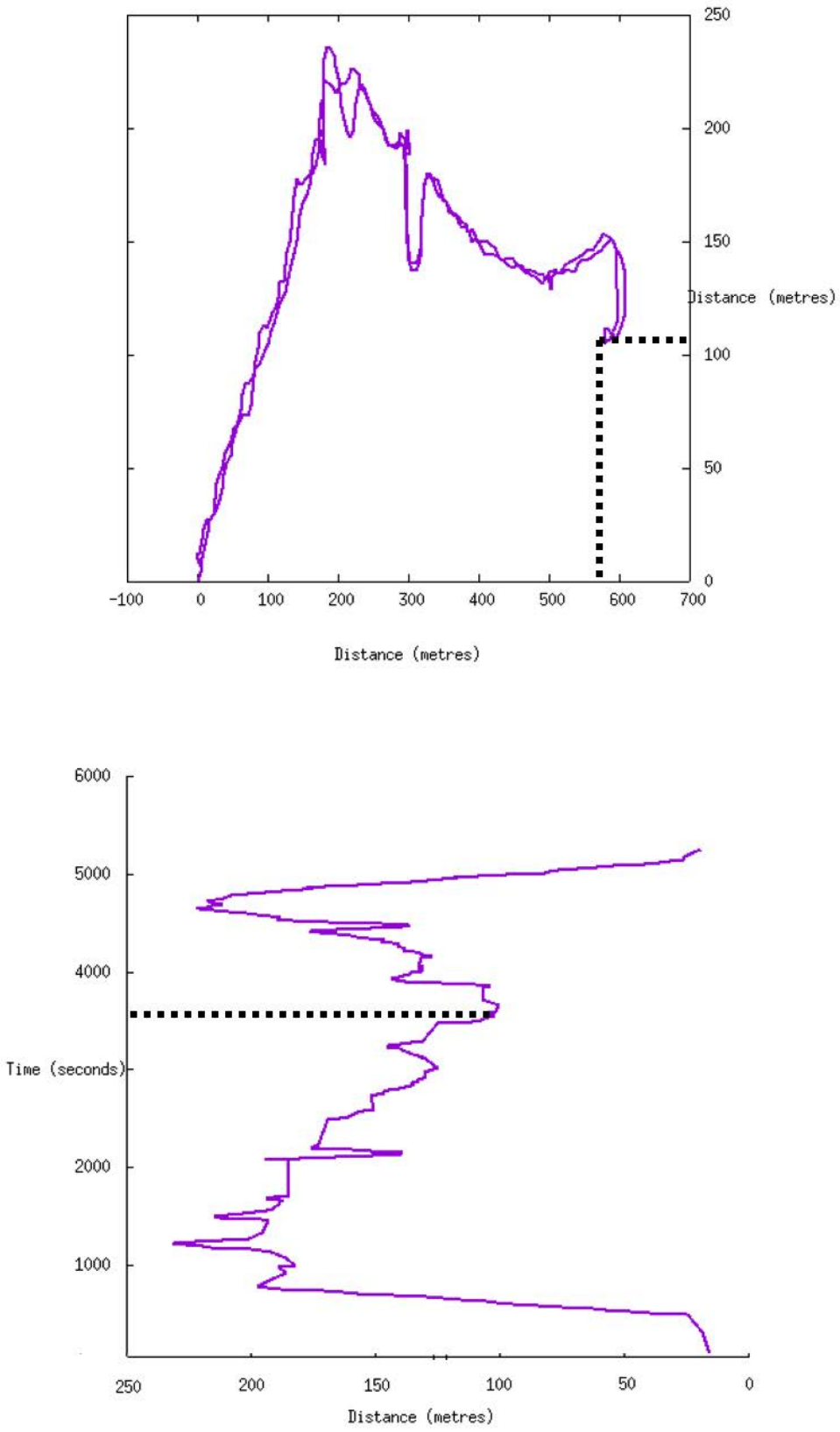


Figure 47 - Using a timecube to infer the beginning of return journey.

Dotted line marks point where their path turns back on itself in geographic space. This point can be associated with a chronological position.

One key aspect I infer from this data is that the underlying patterns of recurring time periods were being subconsciously echoed by participants in the time periods they used to choose locations. This realisation leads to another new structural element that the iterative process has generated, which I call *entrainment.* The concept of *entrainment* occurs across numerous fields of study, with the broad definition as a phenomenon in which two or more independent rhythmic processes synchronise with each other.[60] Its basic components are that there must be two or more autonomous rhythmic processes (or oscillators), and these must interact with each other. In the case of the work investigated here, the two interacting oscillators are the pulse of the linear/moment sections and the participants' temporal choices. While the physiological and bio musicological framework for fully understanding entrainment are beyond the scope of this study[61], using the concept as a structural element offers a compositional approach that has some level of repeatable impact. This interlocking relationship between two rhythms also resonates with the entangled layers of time that will be explored later in this chapter.

Even considering possible errors in measurements, and the small sample size, the overall results here suggest that it is indeed *possible to use the chronos of the content to shape a participant's kairos and in turn their spatial movement and the chronos of the macro structure*. These multi-directional relationships between all four elements are the foundation of the quaternary framework I am proposing.

[60] In her book 'Music in Everyday Life', Tia DeNora defines the concept of entrainment as "the alignment or integration of bodily features with some recurrent features in the environment" to explain the ways that bodily movement is tied to space and sound. She also notes the ways that entrainment can regularize physiological states such as heart rate. She argues that sound can regularize and reproduce bodies and bodily states over time.

[61] For further study on this see Clayton, Martin; Sager, Rebecca and Will, Udo (2005). In physics there is less energy used when 2 objects are entrained with each other. In other words, we expend less energy when we are in step with the surrounding energy or we expend a lot more energy when we are not in sync with the greater surrounding energy.

3.1.7 SHIFTING AGENCY IN ONLY EXPANSION

The development of *Only Expansion* involved a rebalancing of participant agency in the work. The analysis of *Dark By Then* had demonstrated possibilities for *shaping the temporal structure of an open work*, even when the participants were not conscious this was happening. To explore this further, I decided to leave agency in the participants' spatial movements but work with an entirely fixed chronos in the macro and meso scale durations. Alongside this, the decision to incorporate real-time audio input removed swathes of authorial control from the soundtrack, as at the scale of the sound event the sonic content would be completely unpredictable at points. This pushed my desire to be able to compose in a goal directed linear form, expressing myself within the temporal structure of the musical wherever possible.[62] Taking full control over the temporal structure also meant that GPS technology was not necessary, every transition would be composed rather than left to the vagaries of location-based triggering.

The resulting form had participant agency in their path, but a fixed duration in which to choose a station. The content would therefore need to shape their decisions to ensure they could get to the station they wanted in time. In this way the *coupling constraints* of a participant being at a location at the right moment in the work would become dependent on the interaction of the chronos and kairos.

The initial compositional approach was similar to *It Must Have Been Dark By Then*. Musical ideas and audio processing techniques were developed through an iterative process of sketching and *walking* the work (Fig.48). Once a series of possible processes were identified I created a thematic score of the structure (Fig.49).

[62] Example of goal directed linear composition in Only Expansion can be heard at App.02.11

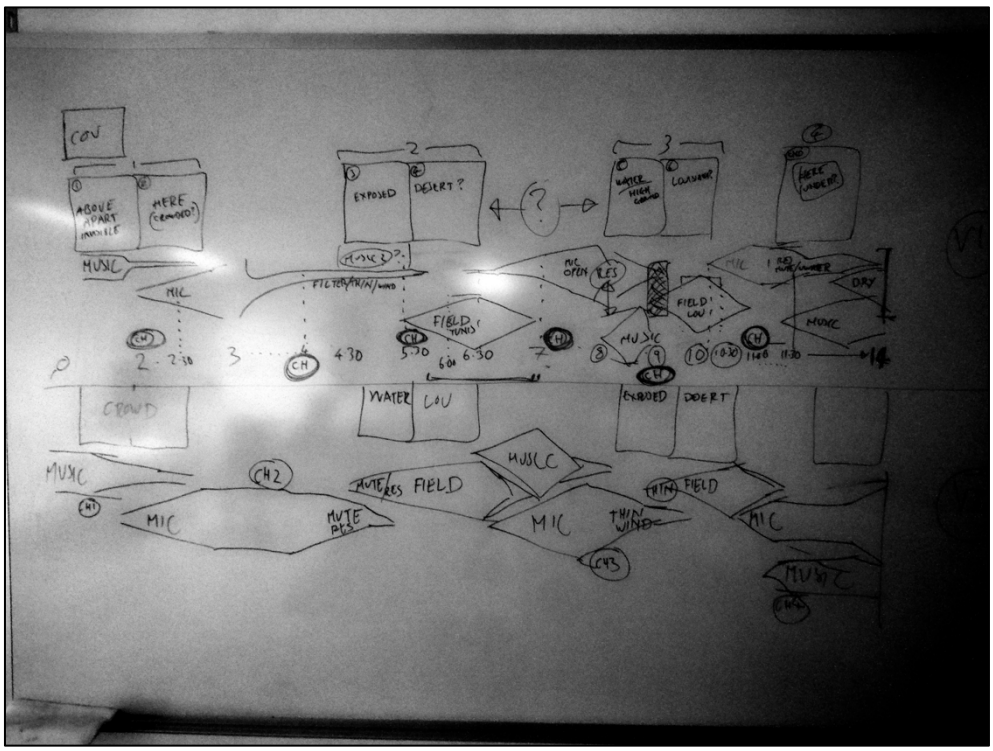


Figure 48 - Sketched score for early iteration, diamond shapes in bottom half represent dominance of either live microphone, field recordings or processing in overall mix.

Figure 49 - Building a sequence of themes and sonic approaches

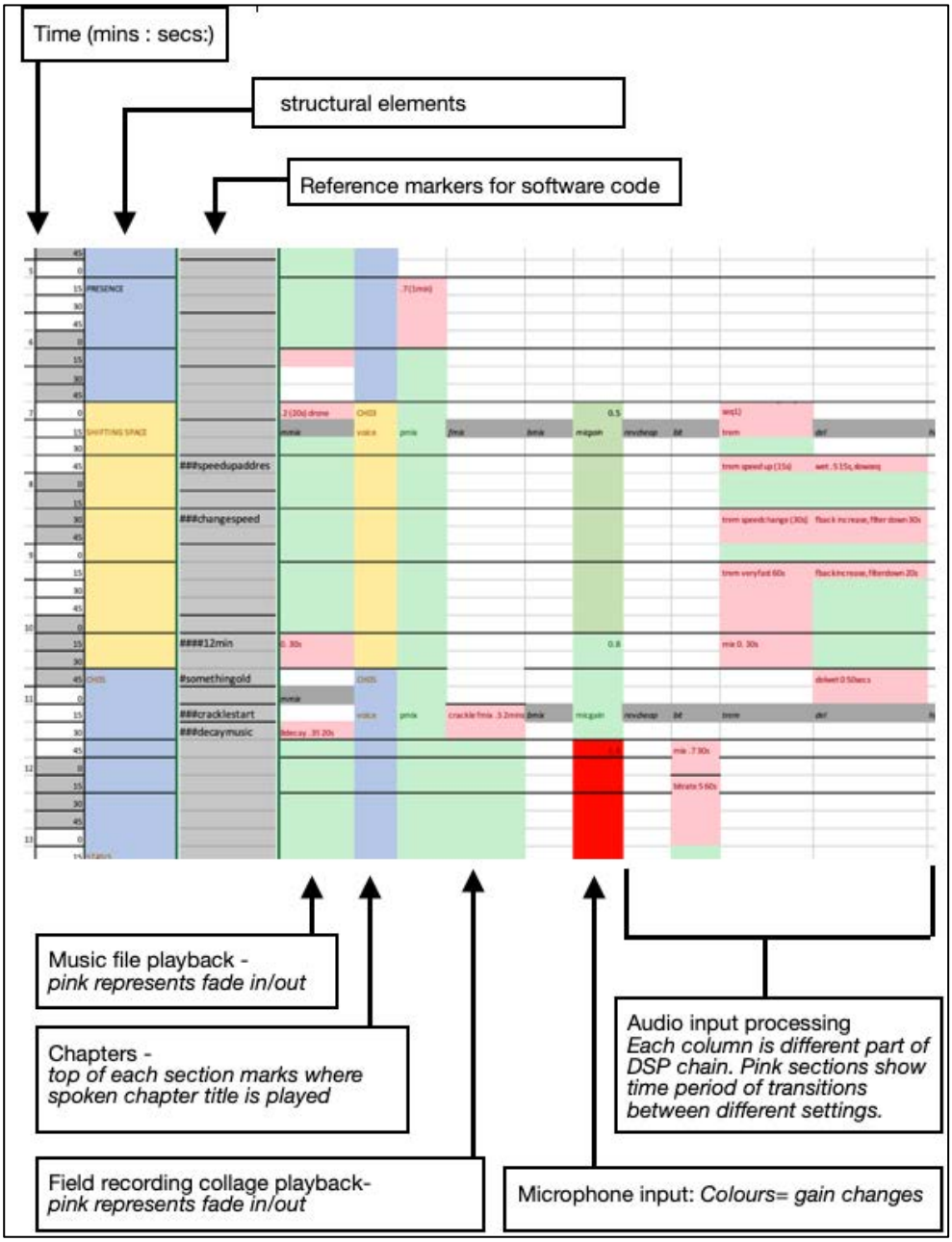


Figure 50 - Detailed plotting of durations across content layers

The transitions between live, processed and pre-recorded sound were plotted over time periods designed initially through the experiential iterative process. My desire to create a deeper entanglement between the participants' surroundings and the soundtrack led to an increased blurring between the different sound sources. As opposed to the clearly defined alternating of music and field recording in *Dark By Then*, here music overlapped with live microphones, and field recordings were woven in and out of the realtime processing. This new complexity of overlapping layers in

the structure required a different scoring approach to the previous works representational blocks, and the fixed durations allowed the chronos of the entire work to be visualised.

While the music was composed and edited using audio software with its own bespoke timeline,[63] the audio processing and playback system in the work lacked similar tools. I designed a vertical timeline (Fig.50) for the work that would allow me to plot the playback of pre-recorded audio alongside the software-controlled processing and microphone input.[64] By using a fixed structure, sections of music or audio processing would be heard in their entirety and could be composed accordingly, using linearly directed dynamics and repetition as deemed necessary for the thematic and aesthetic goals. From participants' responses it was clear to see that the dynamics of the pre-recorded music had a strong influence on their spatial movement.

> *"The sound prompted you to get into a rhythm. The gating dadadada and it gave you a bit of pace, and I kept getting faster and faster…. The music really did give you purpose I really felt like I had to go" (App. 04.02, P_D)*
>
> *"I remember feeling racy, the soundtrack, subtly though, made everything seem more urgent" (App. 04.02, P_A)*
>
> *"The music made me feel like it was actually happening, like it was happening very quickly, like it was going to be happening very soon" (App. 04.02, P_G)*
>
> *"Yes, I certainly had my moments feeling like, time had slowed, or I'd slowed or been slowed down by it and I was being more attentive. I had other moments when I was feeling rushed and like I was being hurried" (App. 04.03.04)*

While the composed music generating this rhythm and urgency through its dynamic linear structures, the use of realtime audio input introduced a new complexity. From a compositional perspective, sections that used it could be considered as *moment form*, as there is no control over the sound events that make up its structure it is not possible to plan its progression or development. While I did shape different DSP processes over time there was

[63] The deeper complexities of the music's internal structure are not under investigation here, but screenshots of the timelines from the digital audio workstation can be seen in App.03.
[64] It would have been possible to create a graphical timeline with automation curves etc. but the time constraints of the development period necessitated finding a faster approach.

no way of fully predicting its sonic shape, but the sonic entanglement between the recorded and the live actually allowed participants to have agency in building their own dynamic linear structures. The unpredictability of events happening around the participant brought its own linear tension and release:

> *"was the water getting louder on purpose or was I getting into a louder position" (App. 04.02, P_D)*
>
> *"something was creeping up at this point, I didn't know what it was. As I came around the corner I realised it was a man with a leaf blower" (App. 04.02, P_D)*

While *Dark By Then* allowed for spatial movement to shape the chronos at the macro scale (i.e. through changing the duration of open meso scale sections) here it was actively shaping the structures *inside* the meso scale sections. Additionally, there is a vibrant interaction here between the participants' spatial movements and experience of kairos as they respond to the changing sound environment. The complexity of these new interactions will be returned to later in this chapter. First, I want to demonstrate through the time-space analysis how *entrainment* and *prisms* were applied compositionally to shape the participants' agency.

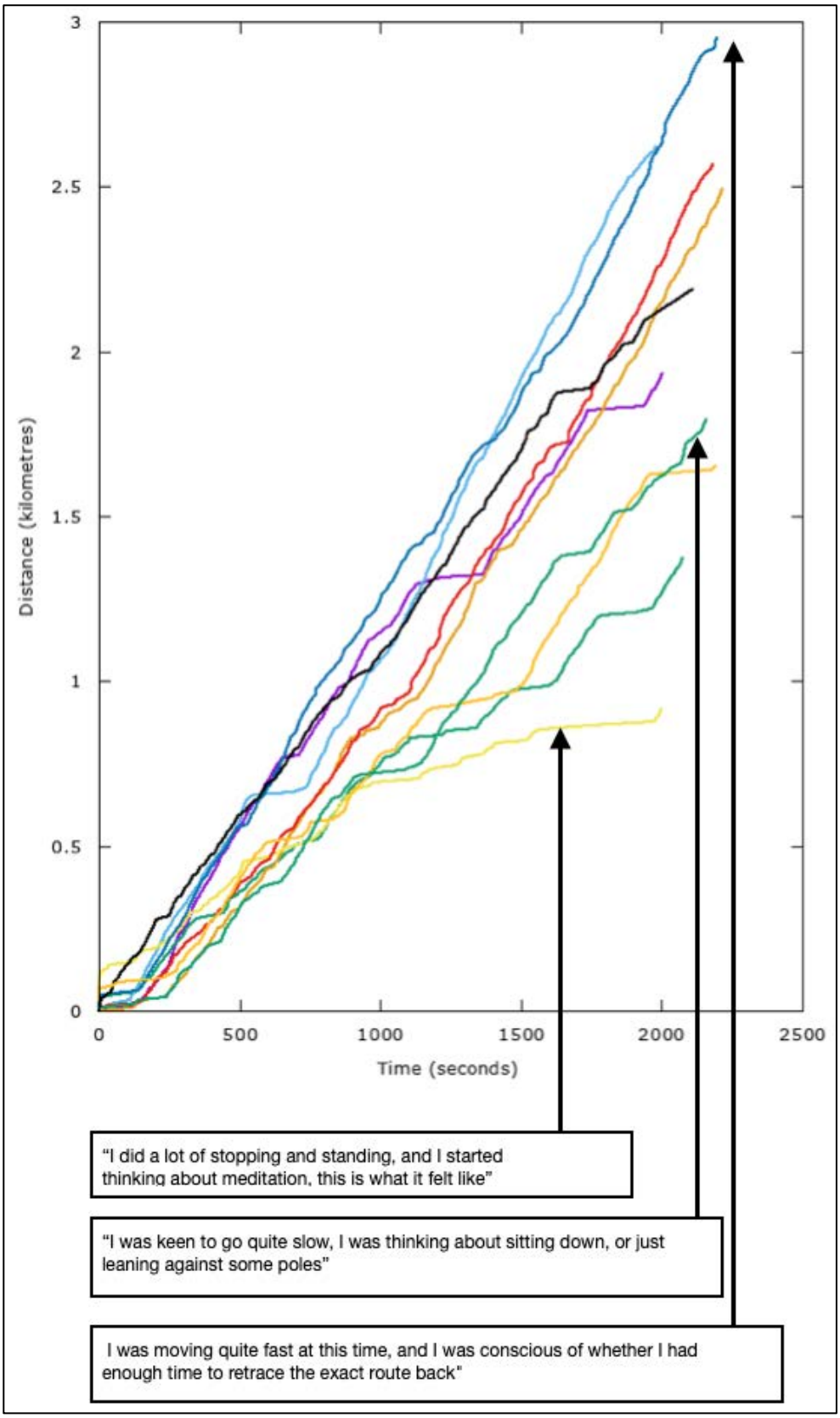


Figure 51 - Comparing participant responses with distance travelled.

3.1.8 TIMESPACE ANALYSIS: *ONLY EXPANSION*

The analysis of participant experience in this work incorporated both GPS monitoring and chrono interviews (See Methodology) of 10 individuals invited to try the work in Bristol.[65] As the macro duration was fixed, I was more interested in how the spatial movement varied between the participants. Reviewing the GPS data in timecube format was not as useful for this process, but plotting distance travelled against time revealed a large variance (Fig.51). Comparing participant interviews against their tracked routes offers some simple explanations though, the shortest distance covered by a participant doing a lot of “stopping and standing” and the furthest distance by participant who was “moving quite fast”. As in the previous work, participants were tasked with seeking out certain environments and locations, creating a *station* that they would return to. The key challenge was that the fixed structure only gave them a certain time period to complete the task, and yet they were not given any specific indication of this time limit. Often the intention was that the participant would create a *station* and then remain there for a while (e.g. in ‘Alone’, where I wanted them to stay in a quiet location while the field recordings faded in). To achieve a situation where the participant might become conscious of the time period they had before the next task the *entrainment* structural element was applied. In giving the first few sections a similar duration the hope was that participants would begin to pick up this pattern and fall in sync with it. In diagram (Fig.52) the duration of each section is shown as a proportion of the entire work. Starting at the 12 o’clock position, the sequence of sections progresses clockwise and, here, the regularity of the early sections can be seen.

[65] This data analysis was performed on the version of the work circa Oct 2018 and does not fully reflect the final version presented as part of this thesis. Further iterative cycles of development were completed to address some of the results described here.

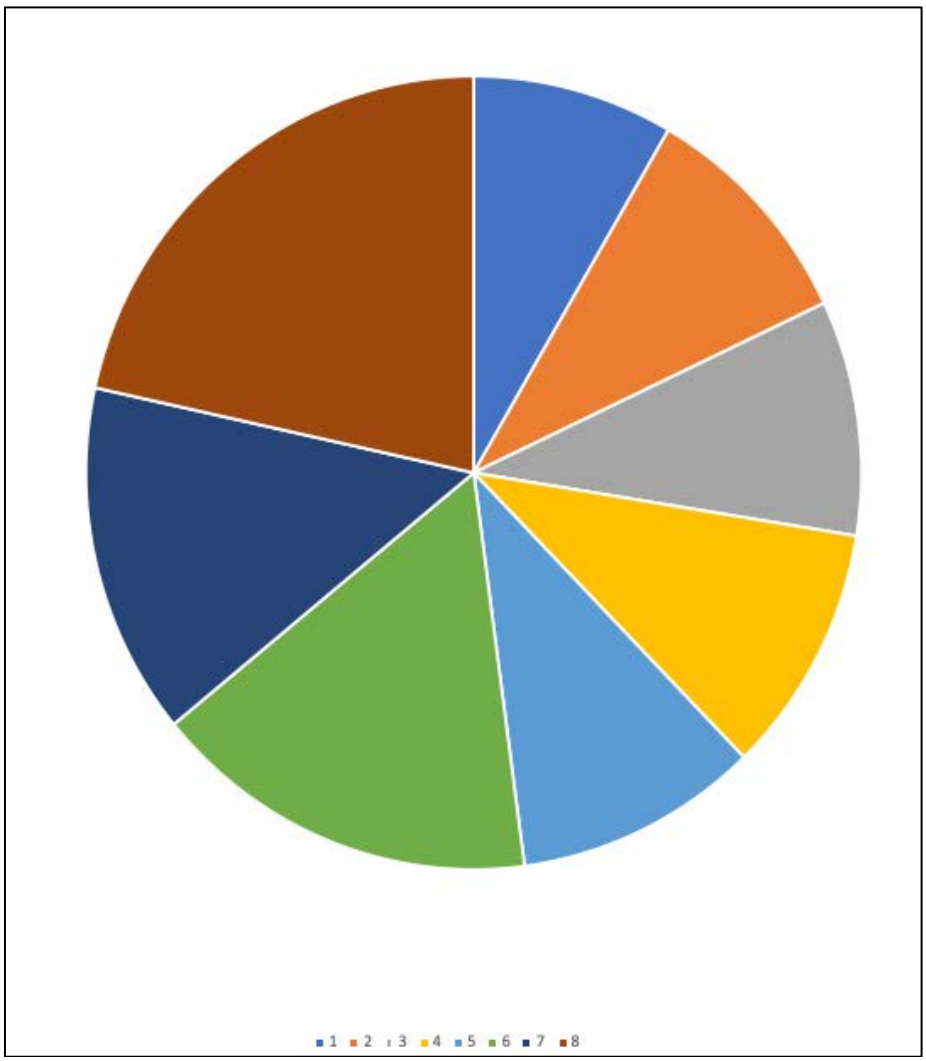


Figure 52 - Starting at the 12 o'clock position the sequence of sections progresses clockwise, here the regularity of the early sections can be seen

In reviewing the chrono-interviews, it was clear that participants had become conscious of the time periods by the section 'Rising' (when they are tasked with finding a vantage point), (Fig.53) many of them describing a sense of urgency or plotting their route based on an *assumption* of how long was available.

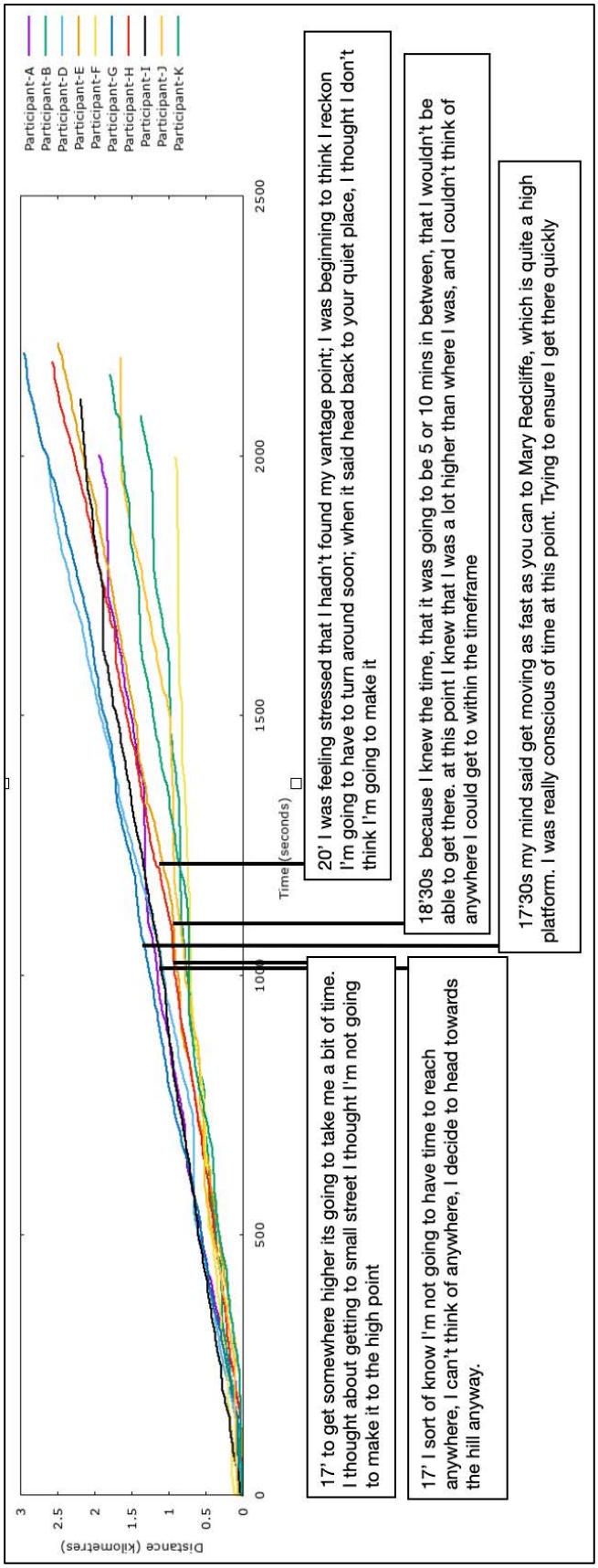


Figure 53 - Example comments from participants describing awareness of time limits, all occurring within the 'Rising' section of the work.

While this does seem to demonstrate the impact of *entrainment* on the participants' experience of *kairos,* it also exposed an unforeseen aspect of the participant trajectory. Across the participant responses there were repeated references to specific landmarks or locations, and assessments that they were "not going to make it" or other comments on changing their route due to assumed time constraints. This seemed to be based on an existing knowledge of the locale they were experiencing the piece in, and would possibly have been less likely to occur had they undertaken the work in an unfamiliar location.[66] While this sense of time *pressure* and *urgency* was not conceived in the original composition, it reinforced many of the works thematics around our rapid acceleration towards climate collapse.

> *"like it was happening very quickly, like it was going to be happening very soon" (App. 04.02, P_G)*
>
> *"You're walking back through the space you'd been through; it really did feel like a return. Again there was this sense of urgency, I had to get back to where I was, because I wasn't aware of how much time there was, it did feel like I was running out of time" (App. 04.02, P_D)*

While this pre-identification of *stations* did somewhat lessen the role, I envisioned wayfaring like exploration to have in the work, it connected to the work's supra scale. As a participant identifies a *station* they already knew about, they use the temporal extension of that station into the past, outside the frame of the work. In selecting a known site, they acknowledge its position both in *their* memory and into a possible future.

> *"because it's episodical you have this sense of something coming so you stop and wait" (App. 04.02, P_F)*

The fixed time period structure, while removing participant agency, did provide a benefit for composing the relationship between the outward and return journeys. It created a capacity constraint that set a maximum limit on how far the participant could move, making it possible to know the approximate maximum time a participant would need to retrace their steps to a *station* they had identified in their outward journey through a *prism.* In

[66] It is possible that participants made similar choices in *Dark By Then*, but the lack of time pressure may have not made it so foregrounded in their reflections.

this way it seemed as though the soundtrack would simply need to be the same length for both journeys. In practice this was not the case for various reasons. Firstly there was no decision or exploration time needed for the participant on the return journey. As in *Dark By Then,* they had already identified all the *stations* and could move directly from one to the other without consideration. Secondly, the impact of the *entrainment* combined with the contextual prompts meant that participants often selected a *station* before the work moved on to the next section and then remained there until it did.

Finally my reflective experience of making the soundtrack temporally symmetrical caused the second half to drag. I would find myself back at my starting station, but the music would then continue for another 10 minutes without any real sense of purpose. It felt like the work was completed by me arriving back *rather* than the soundtrack ending, the spatial movement and content felt separated. I wanted to create a form of *coupling constraint* that brought the end of the content and their return to the starting station in sync. It was important they could *see* the *station* they started at, but I did not want them to arrive excessively ahead of the end of the soundtrack.

This diagram (Fig.53) shows how the time periods of the score attempt to fulfil this intent. The structure laid out on the left represents the full time periods of each section of the score. If the participant were to be continually moving, then the soundtrack would end at least 8 mins before they reached their starting point. The structure on the right reflects the role of the prompts and the impact of *entrainment*. In ‘Origin’ the participant is invited to “be still, to watch, to attend”, so if they follow this instruction we can assume they are not moving. In ‘Alone’ the participant is asked to find “the quietest place”, an instruction that encourages choosing a single location. As they have already heard 4 sections all between 3 – 4 mins in length it is likely they will stop somewhere after approximately this time period, and again during ’Rising’. By accounting for these assumptions around the participant being static we can adjust the limits of the *prism.* It is possible to see that the time periods of ‘Submerge’ and ‘Return’ then allow enough time for the participant to travel back to the location in which they experienced ‘Drift’, the section where they had begun walking away from their starting position. The timings shown here (Fig.54) represent those in the finalised work and are the result of a balance

between time periods designed through intuitive expressive techniques and those shaped by the *constraints* of the participant's *path.*

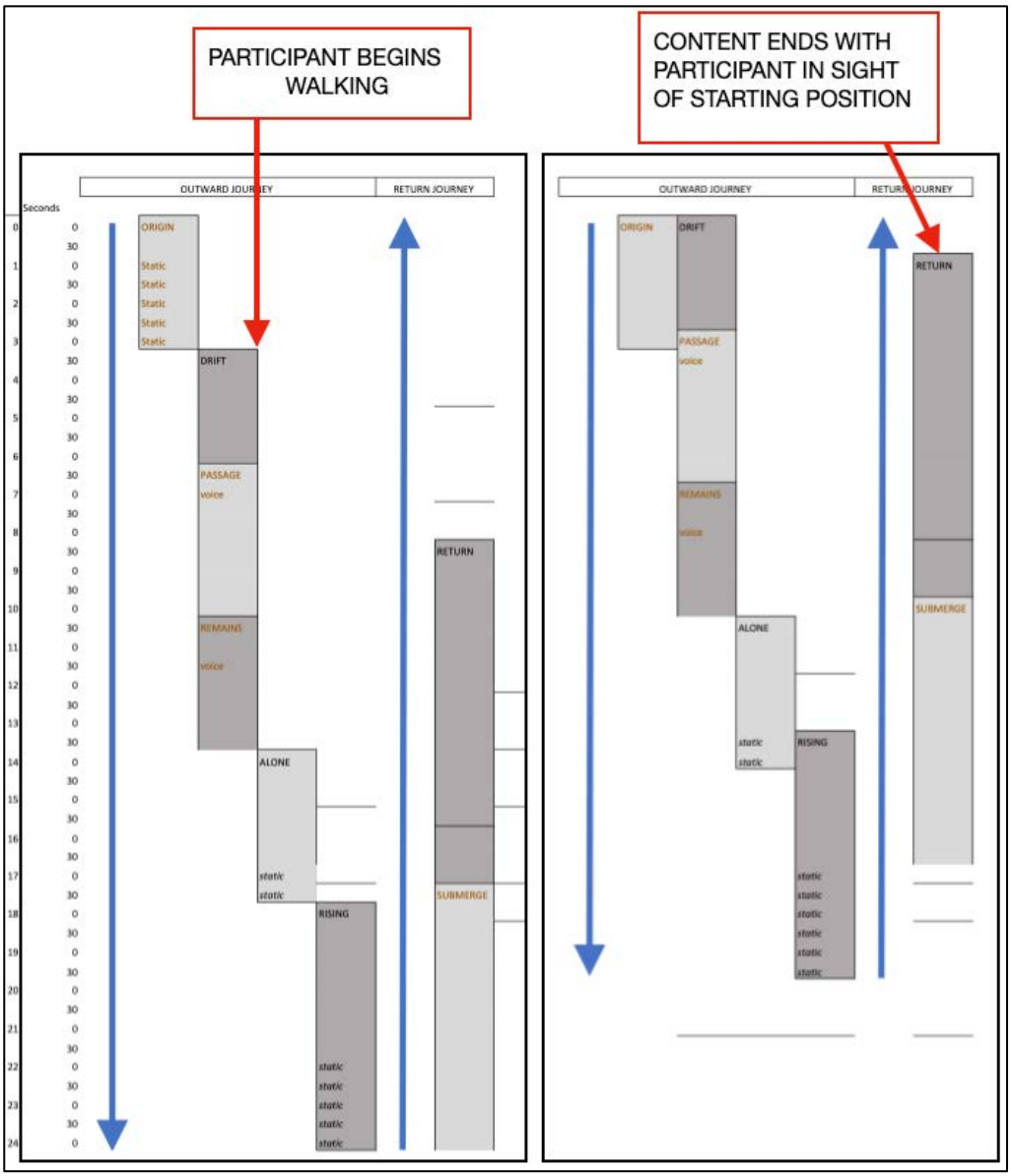


Figure 54 - Score of section durations, time marked vertically.

Blue arrow indicates which sections are on outward or return journey of participant. Score on left shows durations laid out consecutively. Score on right shows sections laid out with accommodation for durations where participant is unlikely to be moving. For example, during origin, or once they have selected a station after a duration influenced by entrainment.

3.1.9 SOFT LIMITS

All the methods described so far are, ultimately, abstractions of the experience a participant has in an uncontrolled urban environment. Unpredictable obstacles and delays (traffic crossings, loose shoelaces etc) would all affect the time periods in question, so both compositions incorporate buffering into their fixed time periods. In *It Must Have Been Dark By Then* this was accomplished through entrainment, linear/moment form composition and looping sound files. *Only Expansion* used *prism*-based time periods in the return journey derived from assumed impacts of *entrainment* and *capacity constraints.* In the absence of pre-defined *stations*, these methods allow the author to shape the *path* of the participant.

This shaping does not have a solid, eternally reliable impact, it is rather a way of placing soft limits on the divergence of the participant and canonical trajectories. I have come to think of the participant trajectory as being elastic, that it gets pushed and pulled away from the canonical. Viewed this way it becomes interesting to consider what would constitute a breaking point? If a participant were to spend 30 mins choosing one station this might appear to have stretched the elastic incredibly thin, but maybe it is only choosing to end the experience prematurely that would actively break the connection and leave the open work incomplete.

In investigating how time can be adopted as a compositional element these soft limits show how the chronos of the work can be shaped and defined using entrainment, temporal articulation and an awareness of constraints. Although as we have seen the chronos is in constant dialogue with the spatial movement and kairos as it shapes and *is shaped by* a participant's *path* through the work. Importantly, as Hägerstrand highlights, while a participant cannot escape drawing a *path* in space time*,"* they themselves are not a path" *(1977).* To more fully understand time in the composition we must explore the subjectivity of kairos and how it is also entangled within the quaternary framework.

3.2 KAIROS

The intention of this section is to unpack the different kinds of time that the work *evokes* and *articulates* through its content and time-space structure.
It will expand Edmund Husserl's concept of the time field to analyse the macro and meso structures of the works. By unpacking the multiple layers of time within the works and their expanding temporal spatial horizons, it will show how they offer an entanglement of the *here* and the *elsewhere*, of the *now* and the *then*.

3.2.1 LAYERS AND KNOTS

Within both works there is a layering of multiple temporalities that occurs through the use of field recordings. Returning to definitions of the sound event (the acoustic action that caused a sound) and the sound object (a listener's perception of a sound) these recordings occupy a complex position.

The field recordings were intended to present a sonic environment *different* to the participants' immediate surroundings, but they are not a *reproduction* of the sound events or sound objects that occurred at the point of capture. Allan Williams (1980) highlights that it is "never the literal, original 'sound' that is reproduced in recording, but one perspective on it, a sample, a reading of it" (p.53), the choice and position of microphones, filtering qualities of headphones, and a new spatio-temporal position all lead to the heard recording being "in effect an ontologically different sound" (p.53). What occurs for the participant is a *representation* rather than a *reproduction,* it is an entirely new sound event (the headphone speaker coil moving) and sound object (the participant's perception of it). Despite this ontological proposition, a participant's experience of the sound is not so easily defined.

In the outward journey of *Dark By Then,* the *head-down* mode creates a connection between specific field recordings and printed text, and in doing so identifies each field recording collage as coming from another place and time. What comes out of the headphones may be a new sound event created at the point of playback, but the sound object they perceive is more often understood by participants to come from a sound event that occurred at the location they are reading about, recorded in their past.

> *"For example, in the Latvia one, where you could hear the sounds of the snow and you were reading about it being all covered in snow, and things. I thought that was actually really lovely because it was totally separate to, you know, London in July." (App. 04.01, S2)*

This connection between the print and the sound embodies Justin Bennett's description of a field recording as "an inscription tracing the engagement of the primary listener with the soundscape at that time, in that place" (Bennett, 2003, p.94). The recordings are not presented simply as sounds, but of sounds *I* recorded when *I* made the journeys. They are not as much trying to say *this is what it sounded like* as they are emphasising that *you were not there,* and of course *the place is still there.* It becomes both an experience and a representation of distance within a connected globality. Within a participant's experience the sections of these *representations* become a layer of temporality taken from *someone else's path*. That they are collages means that it is also not simply just a singular continuous section of another's *path,* but an extended time period collapsed into a sequence of fleeting sonic impressions.

The spoken narration and music involve a more complex relationship with the participant. While they do not identify themselves as having a position in time-space, we can assume that the participant understands they were created in another time and place. The work ignores this fact though; the narrator addressing the participant in the present tense and the music offering itself as a cinematic soundtrack of their immediate surroundings. The narrator is not there, but they are speaking to you as if they know you are listening. In this way, the idea of there being new ontologically different sounds created at the point of hearing is apt, but it disguises a suspension of disbelief that the participant is tasked with.

The simple playback of pre-recorded sound exposes a messy entanglement of temporalities. While all the *representations* are created in the present, they variously identify themselves as coming from the past (field recordings) or from the present (narration and music), but the edges of these identities also blur as the layers begin to interact with each other.

> *"At one point there was a bit where it said, "We are a country without precipitation," and I was crouched down at that point, and it was raining on to the book as I was reading it. It was almost like, yes, that literally*

> *I could only picture it as weird, kind of having stretched out and been hung between the actual world, so that the actual reality here became part of that reading experience" (App. 04.01, S34)*

In *Dark By Then* the textual narratives of travel are full of spatial references (in the place names, the printed latitude and longitude) but any temporal references are vague, it is instead the implied connection with the recording that anchors them in the past. In this way the combination of the two could be described as a *chronotope.* This concept was defined by Mikhail Bakhtin as the intrinsic connectedness of temporal and spatial relationships artistically expressed in literature. In a *chronotope* the "spatial and temporal indicators are fused into one carefully thought out concrete whole. Time as it were, thickens, takes on flesh, becomes artistically visible, likewise, space becomes charged and responsive to the movements of time, plot and history" (Bakhtin, 1981, p. 84).

While the work studied here is not a solely literary work, Bakhtin's ideas become increasingly relevant as he discusses the boundaries of the *chronotope.* Stemming from within literary studies it is unsurprising that he says the *chronotope* positions the reader in "a real, unitary and as yet incomplete historical world set off by a sharp edge and categorical boundary of the represented world in the text" (p.253). While in general the literature he is referring to is presented in self-contained books and does not fundamentally acknowledge the presence of the reader or their physical reality, he points out that ignoring the reader's world be a "dogmatic splitting of hairs" (p.253).

> However forcefully the real and the represented world resist fusion, however immutable the presence of that categorical boundary line between them, they are nevertheless indissolubly tied up with each other and find themselves in mutual interaction; uninterrupted exchange goes on between them, similar to the uninterrupted exchange of matter that goes on between living organisms and the environment that surrounds them. (Bakhtin, 1981, p.254.)

In the *head-down* mode of *Dark By Then,* there is no composed or active exchange between the recorded sound and the participant's environment,

and yet it occurs both physically and thematically. In the way the instructions prompt the participant to seek out locations that resonate with the text they are about to read, (for example they are standing near water when they read about water) the separation between the world represented in the text and the world of the reader might become less clear, placing the participant in both simultaneously or fluctuating between them.

> *"I had a moment of disconnect, when I looked up at a building, was I actually in Latvia , just for a nanosecond" (App. 04.01, 303)*

The impossibility of truly isolating headphones also means that there is often an unintended merging of the *represented* sound (past) and the direct sound (present) of a participant's surroundings creating the interphonic knot.

> *"I thought I was listening to the city, and I suddenly became aware that I was listening to it on my headphones. It blended so naturally. It was so subtle, the introduction to noise and the ambient sounds, that I didn't realise that I was, in fact, taking it all in" (App. 04.01, S29)*

Bakhtin summarises this merging as being of two events, one that is narrated, and one which is the narration itself, explaining that "these events take place in different times, and in different places, but at the same time these two events are indissolubly united in a single but complex event we might call the work in the totality of all its events" (Bakhtin, 1981, p. 254). In these *open works* this complex event is co-authored with the participant, the agency of their spatial movement coming together with the content to complete the piece in a way unseen by the composer.

> *"And the layers of the city and the layers in the book and the layers on the audio all make a new story that doesn't exist, it only exists when you walk the story" (App. 04.01, S28)*

Dark By Then creates this totality through its combination of resonant locations, the timelines of the author's represented path and a participant's actuality. The relationship between the content and the uncontrolled environment is actively cast as part of the experience, which echoes Bakhtin's proposition for "a special creative chronotope inside which this exchange between work and life occurs." (Bakhtin, 1981, p. 255).

I want to define this as the *experiential chronotope,* where a participant's presence and agency are actively acknowledged within time-space. The

experiential chronotope fuses together multiple timelines and leads participants to attend to both the *work and life* in a singular, entangled and reflective experience.

In *Dark By Then* the sonic blurring of the participants' surroundings with pre-recorded content contributes to this though the interphonic knots it has not been consciously composed. In contrast, *Only Expansion*'s realtime audio input creates an entangled experience by actively incorporating interphonic knots into the composition.

> *"I've chosen somewhere I like to stand and this is where the uncomfortable sounds come in. There was a buzzing bee, which I thought was recorded, but then I was like 'is it'?" (App. 04.02, P_B)*

This uncertainty speaks a further dissolution of boundaries between the *real and the represented.* Here, the field recordings are not tied to a moment in the past, but rather they create a hyper focus on the present. The use of the transparent audio system creates an entanglement between sonic events form the source of the recordings and those in the participants' surroundings, the sonic objects they create are fused into a singular temporality. The participant becoming hyper attuned to the present as they try to identify what is actually there.

At other moments the audio processing seeks not to weave together virtual and real sounds, but rather to alter participants' perception of temporal pace. As discussed earlier, the varying intensity of rhythm in the music was commented on by participants as impacting their walking speed, but additionally the music in both works was intended to alter the perceived rhythms of the visual environment. It is here that we find Bull's mono-rhythmic approach, where multiple visual patterns are brought under the influence of a singular soundtrack. In these moments where the sound object in the work is only music it becomes an overlay, essentially silencing the surrounding environment. The complexity increases where audio processing is used to shape the uncontrolled sound environment with musical intention[67]. For example in the 'Passage' section of *Only Expansion* the amplitude of the microphone input is raised and lowered in rhythmic sequences[68] here the

[67] See Chapter 01.03.
[68] Audio example App.02.13

music is no longer an overlay but rather it is a sound object that is entangled with sound events whose sources participants can visually perceive.

> *There's a guy weeding flowers out of the cathedral flowerbed, and it was in slow motion as I was walking past" (App. 04.03.03)*

> *"Like when you take a picture and the shutter is really slow (OE participant" (App. 04.02, P_A)*

In some ways, this is another form of *temporal articulation,* but rather than imposing time on an atemporal element, it is almost reshaping existing temporal structures. Here, the mono-rhythmic approach is affecting perception of a visual environment by altering the temporality of the real sonic environment.

The field recordings in *Only Expansion* are not only being used to alter the present though. Where in *Dark By Then* they explicitly represented *past* segments of the *authors* path, *Only Expansion* seeks to position them as possible *futures* on the *participant's* path. The field recordings are again collages, so even though they are not presented so explicitly, the participant is experiencing a representation of a path distinct from their own. The prompts in the guidebook do not anchor the sounds in the past, rather they tend to point forwards in time. In the depicting of increasing population levels over coming decades, the dates on ambiguous graphs and asking participants to imagine each of their steps taking them forwards by years, the time in the work that is given flesh is yet to come.

> *"as this water came into the sound, it emphasised the reality of this rising water, and what that would mean for Bristol" (App. 04.02, P_F)*

> *"I heard the sound of burning and I imagined all the trees in the square on fire" (App. 04.02, P_K)*

As the sound events from the participant's surroundings are processed to merge with the field recordings, they experience a sonic entanglement of different timelines. The sound object appearing to exist simultaneously in their present *and* future. When a recording of multiple forest environments is combined with the live audio input there is no explicit suggestion of a remote site, but rather a shift in the inhabitants and qualities of their immediate location; an imagining of what it might become. When the live input is explicitly processed the *now* and an *imagined future* becomes even more

entangled. In the section ‘submerge’ the microphone input is filtered to simulate what the participant’s location might sound like if it was underwater when sea levels have risen.[69] In this moment, the sound objects, often with the sources of their associated sound events remaining visible, are cast into a future scenario. So, a passing bus is visually happening *now,* but sonically happening in the *future.* The visio and interphonic knots begin to occur across both space *and* time. Across both works the stories are not just those that occur within the experience of the work, but also include stories which extend outwards from the macro to the supra scale.

[69] Audio example App.02.14.

3.2.2 TEMPORAL HORIZONS

To articulate the way the stories extend in time I draw on Husserl's notion of our expanding temporal horizon (1992). I will not directly apply the phenomenological experience of time perception that Husserl proposed, but rather extrapolate and demonstrate how his notion of the *time field* can be used to describe the macro scale structure of changing time perception that participants may experience .[70] For the purposes of this research, I am defining the time field as containing the increasing scale of temporal events presented to and experienced by the participant over the course of the work.

While the preceding section suggests a breakdown of the linearity of time in the work, I will continue to use linearly orientated terminology here, describing events a participant might consider as in *their* past or future, extensions of the time field both forward and backwards to points both within and beyond the macro scale of the work.

The first extension to consider is that into a participant's path before the work begins. For many participants, they may be experiencing the work in a location they know well or have a daily experience of. As shown earlier, this has an impact on their decisions in relation to urgency and assumed time periods, but the host site also brings with it memories and associations to the participant beyond the macro scale of the work. When these known sites are framed within the auditory gaze and the textual prompts of the work, the participants often become aware of an increased attentiveness to their surroundings:

> *"Normally when I walk out there I just walk, I don't see a tree there or a red building over there so it sort of helped me to anchor myself in the environment better" (App. 04.01, S17)*
>
> *"Surprisingly ethereal, considering it was travelling around an area of London I know really well" (App. 04.01, 310)*
>
> *"First of all I thought this is silly, because I know this area, but it changed it completely. It made me feel as if I wasn't here, I was somewhere else" (App. 04.01, S27)*

[70] This wider application of the time field is directly inspired by Martine Huvenne's work on cinematic sound design (2012)

> *"I walk and cycle past here every day and I don't stop." (App. 04.02)*
>
> *"I never noticed half these buildings actually exist. You think I'll have a pause and actually look around" (App. 04.02, P_D)*
>
> *"I spotted this alley that I'd never been through before; I suddenly found myself in an environment where everything was new" (App. 04.02, P_H)*
>
> *"Sometimes I was imagining things, and other times, the place is so familiar to me, so I was just listening to the music and just letting go. It's hard to describe in words" (App. 04.02, P_K)*

In both works participants repeatedly make comparisons between their daily experience and the heightened level of attention, and, in doing so their temporal horizon begins to extend out to their own memories of the sites. This possibility is alluded to in the spoken narration the participant hears after selecting the station for the section 'Marcis' in *Dark By Then*.

```
How long do you think this has been here?
Maybe this building isn't new to you, maybe
you've been in this location before, has anything
changed since you were last here?
```

Dark By Then narration, after finding building (App.08)

While this affect is present for participants who have their own history in the site, those engaging with the work in unfamiliar places are initially limited to associations they may make with other sites or those extensions presented in the work. *Dark By Then* begins by identifying the authors journey, establishing a path that begins outside the frame of the work, so while not initially intersecting with the participant it does establish a temporal horizon behind them. The printing date of the book establishes a fixed point in time and so while this horizon was a matter of months for early participants, it has the potential to expand backwards by years. In the 'Mouna' section the participants' attention is directed to the immediate present as they look for plant life growing between cracks. After this shrinking of their temporal horizon it is then, again, extended when the narration invites them to consider "this place with no one in it, when not even you are here, the world without us" (App.08), pushing the horizon forwards to an undefined future point.

> *"So for example, when I was reading about how she's all alone and stuff like that. It wasn't very vivid in my mind. But when the voice explicitly said, "Oh, imagine, as you're walking through the space, imagine it being empty of people, and even of yourself," and stuff. Then, that was when I could really visualise it, and imagine it. So, it was when she gave me directions, and then she told me to imagine, and then that was when I was like, "Okay." Yes ". (App. 04.01)*

After this fleeting allusion to the future, the horizon pulls back to the temporal distance between the participant and the author. After the participant selects the station for 'Douz' they are invited to consider "Who first built this place? Who first staked their claim here?", extending the temporal horizon backwards based on a participant's personal appraisal of the location. On leaving this station, the horizon is again extended forward, as they are invited to look back at it and imagine its future and their own.

```
Imagine you could never go back there,
Imagine it was buried beneath sand dunes.
what would be lost to you?
What of it would you remember?
And what would you miss?
```

Dark By Then narration - looking back at Douz station (App.08)

Figure 55. shows the different ways the temporal horizon is extended over the sections of the work described above. For the rest of the outward journey, these two different extensions reappear in different forms; from invitations to consider the history of found wood, or potential futures where areas become inhospitable or wrapped in authority constraints.

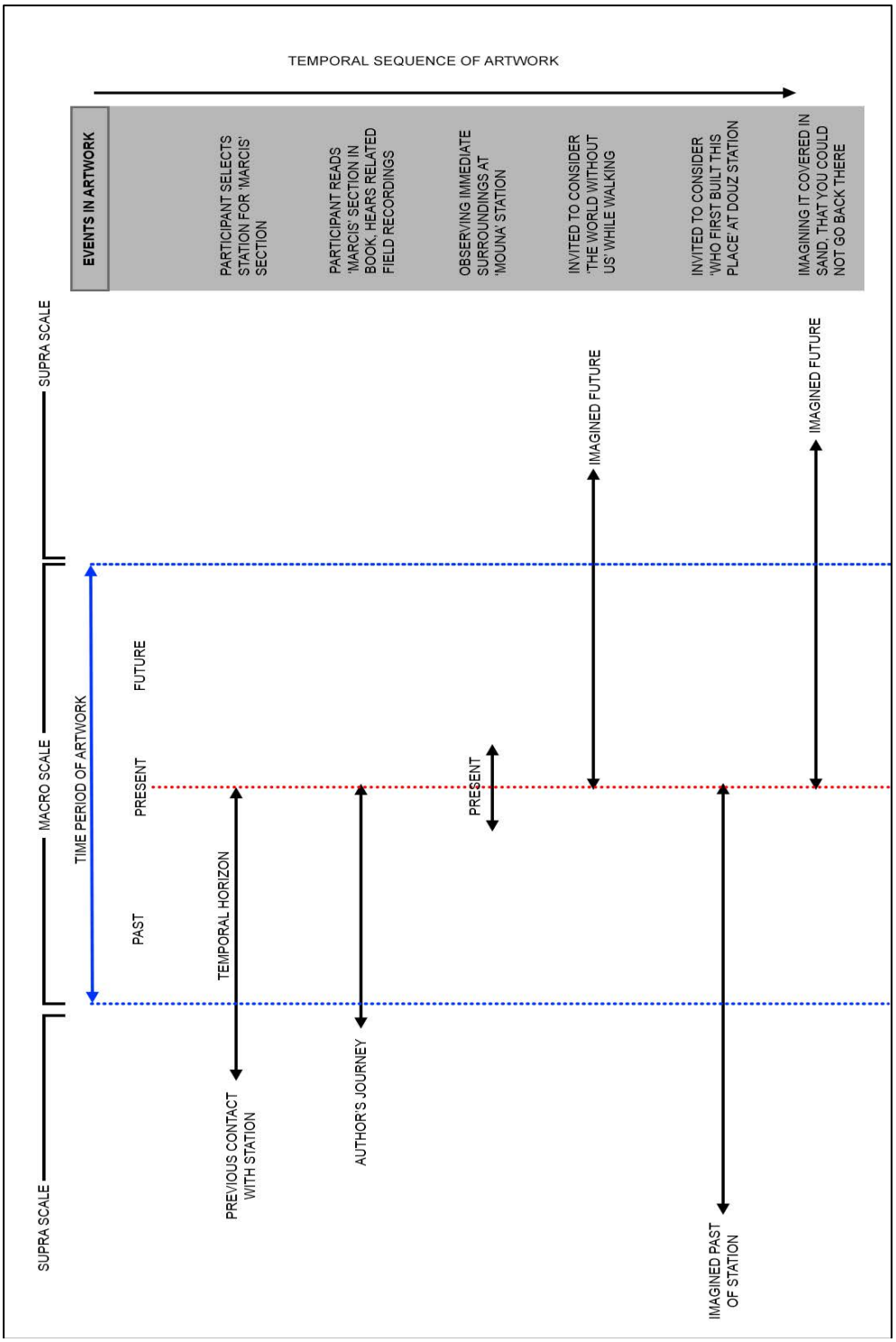


Figure 55 - Temporal horizons in Dark by Then

Up until the participant begins the return journey, their temporal horizon jumps back and forth, from attention to the immediate present to these points external to the work's macro scale. In the return journey, these continue but become entangled with another shifting temporal horizon as the time field becomes filled with a participant's experience of the work so far (Fig. 56).

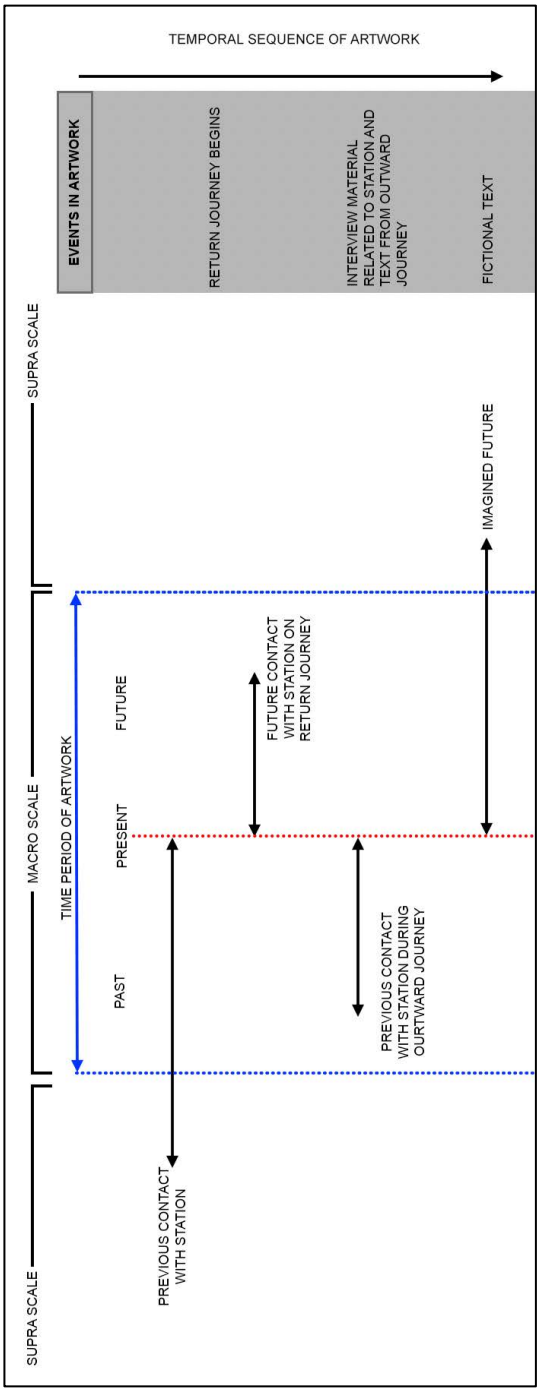


Figure 56 - Temporal horizons on return journey in Dark By Then

As they retrace their steps, the invitations to consider what has changed since they were there pull moments from their outward journey into their time field, creating a new temporal horizon within the work. Simultaneously the knowledge of all the stations they are about to return to extends the horizon forwards into the second half of the work. Alongside this is the interview material and its association with the primary temporal horizon of the outward journey, and then, finally, the narrative voice often shifts into describing fictional futures (Fig. 57).

there are things that I remember
now I am 7 and I am playing in the mangrove swamp
now I am 10 and my uncle sits with his shotgun and whisky
now I am 56 and there is still oil in the sea
I can hear the water rising,
there's a storm coming, and someone's got to give me shelter

Figure 57 - Dark By Then narration from Port Fourchon return section (App.08)

The move into fictional futures brings a shift to the content of participants' expanding temporal horizons.

> *"Made me think of how tiny we are as humans, and that our permanent structures are not so permanent" (App. 04.01, S16)*

Here we begin to see a participant reframing their temporal position, becoming conscious of timescales beyond the human. The opportunity to think beyond human time influenced the decision to focus on expanding and contracting temporal horizons in *Only Expansion*, and to de-platform the more explicitly human narratives of *Dark By Then*. While observing the shifting horizons in *Dark By Then* has been a discovery, in *Only Expansion* it was consciously articulated and became part of the scoring method.

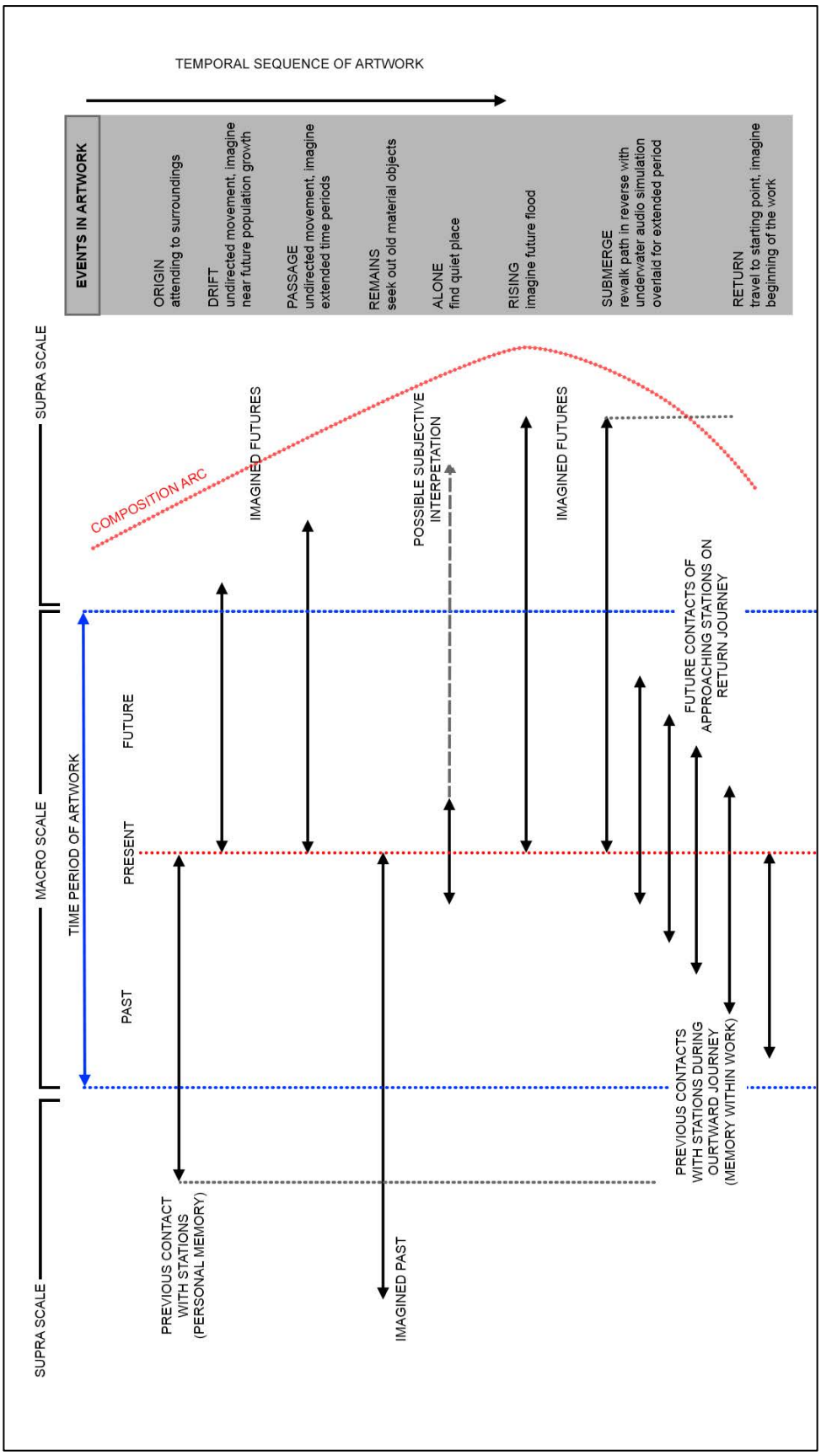


Figure 58- Temporal horizons in Only Expansion. Dotted red line denotes intended compositional arc shaping the extension and retraction of horizons over the course of the work.

This diagram (Fig. 58) visualises how the shifting temporal horizons were given a structured arc of over the course of the work. Of course, kairos is inherently subjective, so the diaqram cannot represent a participant's actual internal experience. Instead, it is a way of articulating compositional intent, the score becoming a *potential of what might happen,* and attending to the existence of temporal horizons within the quaternary framework.

Following the diagram reveals the intended horizon shifts in the composition. At the beginning of the experience, participants are invited to attend to their immediate surroundings, but they may have an existing memory of their starting station. In the next two sections, they first see contextual information of near future population increases, and then are invited to imagine each step taking them further forward in time (Fig. 59).

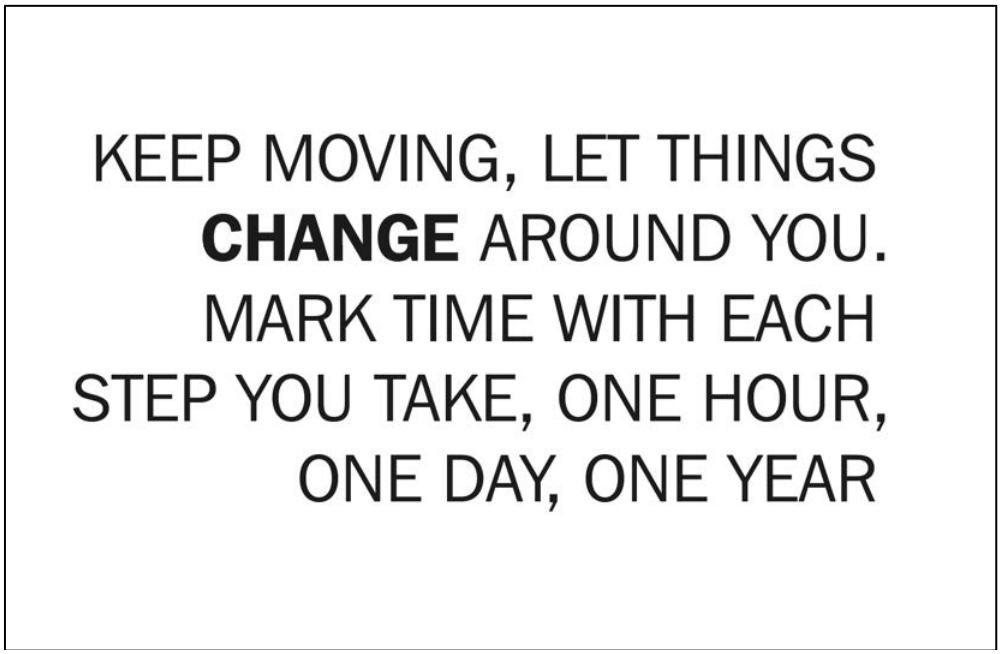


Figure 59- extract from Only Expansion printed book

In the section ‘Remains’, participants are invited to seek out and touch something that ‘has been there longer than them, longer than anything else’. In this moment, the horizon is pulled backwards to highlight that there are things with paths that extend outside of the participant’s own.

> *“I wanted to find a church but then I thought there must be older things” (App. 04.02, P_J)*

> *“find something old, oh I’m surrounded by trees, excellent, which is the biggest, the oldest, first I thought about the statue, but I wanted to touch a tree” (App. 04.02, P_K)*

After this in ‘Alone’ they are invited to find a ‘quiet place’, where field recording collages of forest wildlife are combined with direct microphone input. This tends to have two possible outcomes, firstly it may reveal that it is difficult to find quiet in the modern city, and the field recordings become an alternate present where human and non-human collide. Alternatively if the participant does find a quiet place it is likely to be due to an absence of other humans. In this moment, it is intended to suggest a world after humans, and the field recordings become suggestive of a future re-wilding. In both cases the ambiguous source of the field recordings in *Only Expansion* and their lack of temporal specifics means that rather than pointing to *another place* they hint more to *an alternate time in the current location.* The horizon is then pushed further forward again in ‘Rising’ where participants are asked to imagine a flooded future.

When they begin their *return journey* in ‘Submerge’, the horizons become layered and entangled. The simulated underwater processing of the microphone input suggests viewing all the stations they are revisiting as existing in this flooded future, but *simultaneously* they have a memory of being there on the outward journey. As they retrace their steps this memory extends further backwards to earlier and earlier in the work. By the time they reach their starting station, the sound has returned to an unprocessed live microphone, an attempt to pull back the future horizon and ground them back in the present.

Just as in *Dark By Then*, the repeated extension of the participant’s temporal horizon into imagined futures hints towards an increased awareness of the non-human, revealing ecocritical dimensions of the work that will be investigated in the final part of this chapter.

> *"I felt immersed in the environment, a strong sense of how nature will survive us, even though I'm in a city, everything concreted over….made me think about the longevity of nature, and how it persists beyond us" (App. 04.02, P_F)*

The complex mix of temporal layers and horizons enter and exit the participants' experiences at different points in both works, but importantly they all occur within the unbroken continuity of the participants' paths in time-space. As they travel along that path, their attention is directed to the continuously shifting uncontrolled environment, so their spatial movement through it must also be investigated.

3.2.3 THE MYTH OF THE RETURN JOURNEY

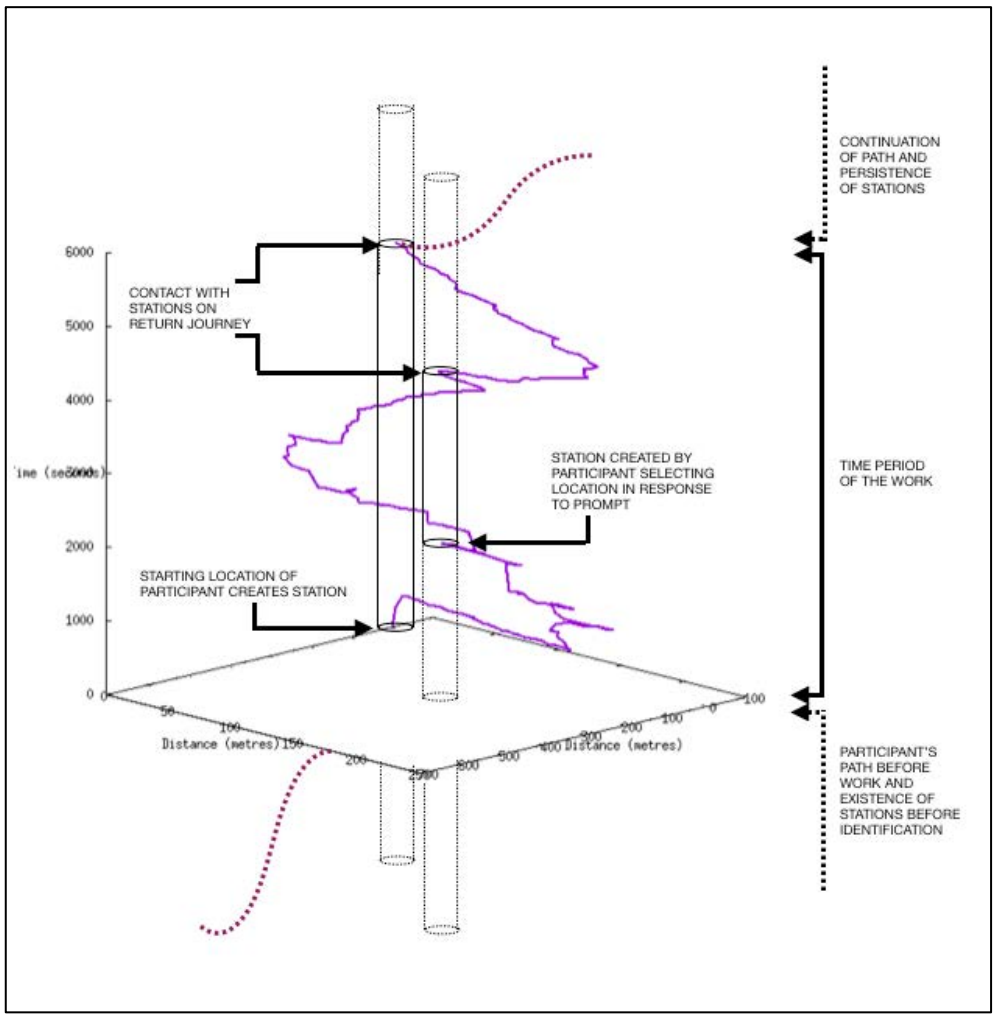


Figure 60 - Timecube showing how both stations and paths extend in time-space outside the macro scale of the artwork

By revisiting the time cube plot of a participant's path (Fig. 60), we can expose a new relationship between the chronos and kairos in the work and its relation to the spatial. As Doreen Massey clarifies, the movement of a participant is "not just spatial, it is temporal" (2003, p.117), their contact with the stations on their return journey is not a backwards movement. The tubular representations of the stations in time-space shows what they have not just been lying there, static on the map, their time has continued as "origin and destination have lives of their own" (Massey, 2003. p.117). If the chronos in the work has a continual forward trajectory then between a participant first selecting a station on the outward journey and coming back into contact with it on their return, the station has also gone through a temporal transition. At

both points there is “a meeting up of trajectories as you entangle yourself up in stories that began before you arrived” (Massey, 2003, p.117).

Each of the works attempt to draw participants’ attention on this entanglement in different ways. The spoken narrative in *Dark By Then* actively encourages the participant to remember qualities of each *station* as they select them on the outward journey.

> You’re going to come back here later, so try and memorise what’s around you right now. Can you recall the route you took to get here?

[Dark By Then SCRIPT EXTRACT (App.08)]

For participants, the impact of this process sometimes only becomes clear to them though the experience of drawing on it for the return journey.

> *“As I was going through each point I was aware of committing it to memory, making sure I knew here landmarks were, when I got to the end I was trying to do a mental journey back, but I couldn’t do it, I couldn’t picture it, that part of my memory wasn’t vivid enough I guess. But as soon as I started walked it’s like you’ve got this sort of bodily memory that just knows where to go” (App. 4.01, 306)*

After repeatedly pushing for this heightened attentiveness, it then collides multiple trajectories into singular moments on the return journey. The narration explicitly suggests paying attention to change that has occurred, asking the participant to compare their primary and secondary contacts with each station.

> *Just keep retracing your steps, so much can change in so little time*
>
> *You were only in this place minutes ago but things have already shifted and tomorrow the ground will forget you were here”*
>
> *What has grown since you were here before?*

[Dark By Then SCRIPT EXTRACT, (App.08)]

This emphasis on being in *the same place* at a *different time* is then echoed in the audio content. The field recordings on the return journey incorporate interview material, drawn from the situations described in the printed text and even, sometimes, directly from the sources of conversations transcribed in the book.

> *"I think it was that narrative voice, the way in which it invited me to engage with the environment meant that it felt much more kind of burnt in when I was re-tracking them" (App. 04.01, 296)*
>
> *"I could see each point, it was the small details, like the plants emerging through the cracks and I could remember the point at which I'd sat there" (App. 04.01, 296)*
>
> *"I think at first it was sort of difficult to tell how they are supposed to relate to each other but as the story progressed, especially when you were walking back and you heard the quotes that you had read before come to life in the audio it was a wonderful full circle sort of experience. So I think the separate entities came together during the course of the tour" (App. 04.01, S17)*

In these moments the participant experiences not only layered segments of the author's past path but also a suggestion that their own path is folded back onto itself. *Dark By Then* creates these overlaps through the composed linking of geospatial position and audio content in relation to the participant's past actions, so the participant trajectory becomes pulled towards the canonical trajectory. While their speed of movement may cause the timing of triggered interview content to blur the implied boundaries of their chosen stations, there is still an active dialogue between the two trajectories. If they move slowly then each geolocated piece of audio will wait to appear at the appropriate moment. If they have accelerated then they may play in a continuous flow, but only if the participant follows the canonical instructions. In both cases, there is connection and dialogue between spatial locations and multiple points of temporality.

In *Only Expansion,* this dialogue in the return journey remains fluid but takes a different form. While the sonic structure is firmly canonical its connection to the participant's chosen stations is dependent on assumptions of *prisms* in their *path,* and so uses a less granular process. Where *Dark By Then*

encourages awareness of change that has occurred over the course of the participant's experience, *Only Expansion* points towards possible futures. [71]

Once the participant begins retracing their steps the sound processing begins filtering the microphone input to convey an experience of submergence, of the water having risen over the city, and this process is sustained so that it is heard while the participant revisits a number of their chosen stations. Here it is not a layering of an author's past path with the participant's, but rather the participant's path overlaps with itself and an imagined future of their current location. The participant is, of course, likely to draw on their memory of what they had experienced along their path, but by not directly alluding to specific *stations* in the sound it attempts to illuminate a more continuous passage of time that stretches backwards *and* forwards. This process is repeated at the beginning of the final section 'Return', where the sound processing shifts to evoke a desolate windswept landscape until the music slowly drowns out the microphone input.

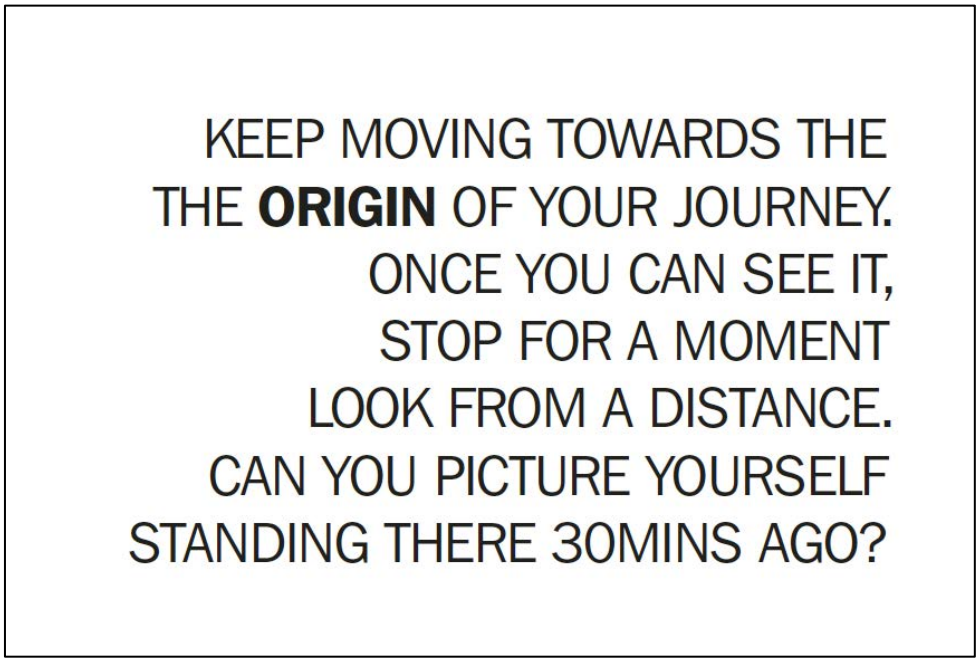


Figure 61 - Final prompt in Only Expansion printed book

[71] Earlier iterations of the work echoed the approach from Dark By Then by using the printed text 'What has changed? Were you Missed?' Tests with participants suggested that this contrasted with the more ambiguous feel of the work leading to responses such as "I didn't really understand these questions" (App 04.02, K)) or "I didn't know what to think about this 'what has changed'. 'were you missed'. I didn't know what to do with that, I didn't have an answer, (App.04.02,J) For this reason the prompt was removed from the final work and replaced with an image of soil strata as a more open visualisation of layered time.

The final prompt (Fig. 61) offers an explicit connection to a location in time-space on the participant's path, as they are encouraged to observe the first station they selected and to imagine themselves standing there 30 minutes ago.

> *" I actually did think I was going to see myself at where I was stood, it was such a weird moment. As I rounded this next corner there was actually someone standing there….it was more like 'what would someone standing there see now, would they see me coming back" (App. 04.02, P_D)*
>
> *"It's the odd thing about time obviously, where's that time just gone, that idea that times is less linear, I was there having that experience, a walk is quite linear, there is a pod like experience to time, this bit in particular …I was over there looking over here that amount of time ago but I didn't know what amount of time that was" (App. 04.02, P_C)*
>
> *"Trying to imagine yourself where you were 20mins ago, it's almost like a ghost of past, the weather changed in that 20mins and now I'm coming back all protected up" (App. 04.02, P_G)*
>
> *"And you see people like ghosts, trailing behind them, and I started to imagine people like that because I was imaging myself like that now. All the places I'd been" (App. 04.02, P_A)*

These participant responses articulate some of the complexities of this moment. There can be a tangible feeling of displacement, of not only remembering yourself at a previous time, but of somehow still existing there in the present and of being unable to define a temporal gap between the then and now. Simultaneously, there is an evocation of time passing and continuing without you, your path being just part of its flow. If we understand a participant's memory to be non-linear, then it follows that they can jump to recollections of moments regardless of the temporal sequence. So at each moment of contact with a *station* they may draw on their experience of previous contacts, and as in the blurring between the temporal layers of sound, there is also a blurring between their immediate experience of being in contact with a *station* and the memory of contact from earlier in their *path.*

This chapter has, so far, demonstrated the interaction and interdependency of the content, chronos, kairos and spatial movement. The temporal structures, layers and expanding horizons come together to create conscious and subconscious attending to the multiple timescales that the participant is

immersed in. A key result of this is that participants' attention is constantly directed towards an immediate environment with its own inherent temporal events and patterns. The entanglement of ongoing stories is made tangible through the interaction of multiple temporalities that participants move through. As the work is not site-specific, the unpredictable nature of this environment means that details of the juxtaposition between the work and the world remain vague and unspecified. Instead, what I try to shape is the mode of attention, through the touching of surfaces, or the simple watching of passers-by, it is about changing the way the participant is engaging with the world. It is in the application of the quaternary framework that this engagement is actively composed. Importantly, the participant is not an outside observer, but is actively enmeshed and entangled within the world, the experiential chronotope creating an intense reframing of their position within time-space. The final section of this chapter will propose that the reframing of a participant's subjective *human* position points towards the work being understood as ecocritical, and offers the potential for a form of *anthropocenic chronotope*.

3.3 ENTANGLEMENT

In the final part of this chapter, I will introduce my proposal for an anthropocenic chronotope. Where the experiential chronotope is formed through the interaction of time in the world and the work, this anthropocenic chronotope primarily concerns the interaction and entanglement between the participant and shifting *scales* of time-space and the resulting breakdown of a human vs. nature dichotomy. To introduce the idea of an anthropocenic chronotope I will consider it through three ecocritical strands; timescales, locality and ecomimesis.

3.3.1 TIMESCALES

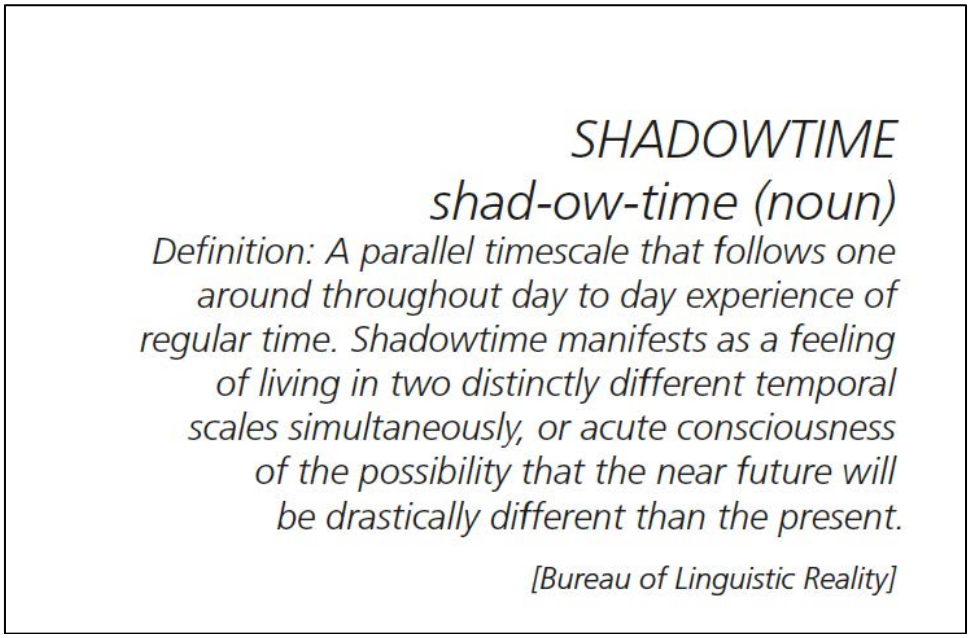


Figure 62 - contextual text in Only Expansion printed book

The above text (Fig. 62) is part of the booklet that participants read while experiencing *Only Expansion*. This definition from the *Bureau of Linguistic Reality* (2014) acts to highlight the multiple timescales that the work speaks to. As Ada Smailbegović proposes, to understand the Anthropocene as not just a category "but as a felt temporality" requires a careful attunement to the multiple "rhythms of transformation". As humans we a "tuned into a limited set of rhythms and durations" (p.97), the timescales of the geological and the microbial are often beyond our grasp. The historian Dipesh Chakrabarty

argues that to consider the Anthropocene is to see how human history "has collided with the timescales of two other histories... the time of evolution of life on the planet and geological time" (2015, p.189). As we begin to rethink the multiple scales of the time-space we exist in, a question arises of how artistic works might respond, and in what form. While there are many artworks whose macro scale extends beyond the human lifespan[72], the challenge here is embodying these supra scales into the limited and singular chronos of a soundwalk.

In 'Science Fiction and the Time Scales of the Anthropocene'(2019), Ursula Heise reflects on this concern in ecocritical literature. Initially she addresses it via Genette's concept of anisochrony, the "difference between the duration of narrated events and the duration of the narration itself" (p.284), pointing to techniques in science fiction novels. Two highlighted techniques that are of relevance here are time-travel and species narrative. In time travel narrative structures a character can be propelled across any period of time instantaneously, the events in the timespan between two points is omitted in the text. So for example in H.G. Well's *The Time Machine* (1895) the protagonist is moved between two points in earth history 800,000 years apart at the turn of a page. The multiple narratives of *Dark By Then* also perform this form of time travel, as the participant reads narratives that jump between different points in time, from the recent past to imagined futures.

> *"when you do pause for a moment, you're lifted off to a desert settlement or the bayou, you're jaunting in and out of the space all the time in quite a good way" (App. 04.01, 204)*

As suggested by this *jaunting*, the field recordings and resonant sites begin to entwine the participant's linear path with the non-linear time jumps of the narrative. In *Only Expansion,* the time travel is a fictional push towards the future, carrying the participant towards a flooded or burnt out city (possibly) beyond their lifespan.

> *"I imagined this apocalyptic fall of Bristol. That the buildings would all be sacked, and the trees would all be these blackened stumps, all smoking" (App. 04.02, P_K)*

[72] For example, Katie Paterson's "Future Library (2014)" involves a series of books written at the tine trees are planted, so the books will not be read until the tress have grown for 100 years and the books can be printed on paper made from them. John Cage's 'Organ2(As Slow As Possible' (1987) is currently being performed in a cathedral in Halberstadt in a recital that will last 639 years.

This interwoven time-travel approach retains a focus on the human, on individual stories that may push the paths of non-human entities to the background. When a narrative seeks to follow planetary timescales, humans "might be reduced to the status of flat or minor characters" (p.283). Heise highlights a *species narrative* approach that involves "abandoning individual humans as narrative actants, replacing them instead with entire species" (p.288).

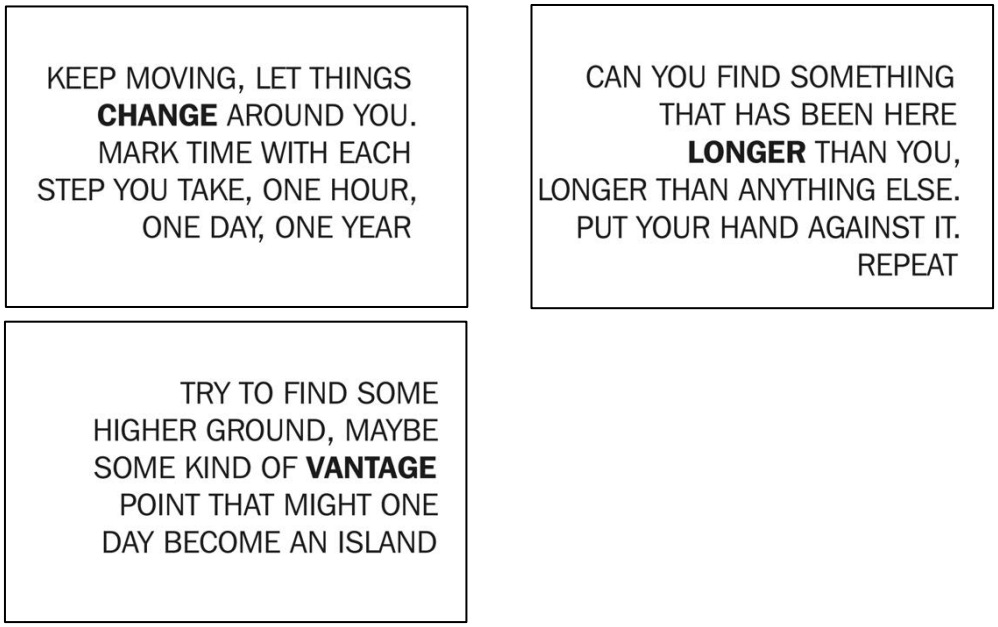


Figure 63 - timescale related prompts from Only Expansion printed book

In its replacing of narrative vignettes with abstracted data and conceptual prompts, *Only Expansion* moves towards this kind of species narrative. From the first piece of contextual print where predicted population figures are displayed, to the thought experiment of asking the participant to consider each of their footsteps as an expanding duration, it shifts the narrative timescale beyond the human. Rather than asking the participant to find sites determined by their physicality, it explicitly asks them to look for temporal markers (Fig. 63). In doing so, their subjective perception of timescale is reframed to encompass the human and the non-human.

> *"there aren't loads of things that have been here longer than anything else, there's always the ground" (App. 04.02, P_F)*

> *"then I realise I'm only 36, which isn't very old in tree terms. I take my glove off, I want to put my cheek on it. Then I think it's going to get cut down for parking. Then I get sad about all the other trees that have been felled" (App. 04.02, P_B)*

Despite this the participant's individuality is never fully removed, as their presence is constantly reinforced through their interaction with the soundtrack via the realtime audio.

> *"I started to be aware of the binaural, of the traffic and people's footsteps, I was feeling a heightened sense of environment I guess; I'm completely aware of my physical presence in a way I'm not normally" (App. 04.02, P_H)*

While the removal of human narratives in *Only Expansion* suggests an extension of a participant's temporal horizon to a planetary level, *Dark By Then* explicitly asks for this when the narrator invites the participant to "imagine this place with no one in it, the world without us". In both works, this not only reframes a participant's timescale, but also the surrounding markers of human progress and existence.

> *"it gave you a sense that all these sorts of solid structures, the entire city, the buildings, can all just be reduced to nothing overnight." (App. 04.01, S10)*

3.3.2 LOCALITY

These shifting scales that reframe the participant do not only occur in time but in time-space. The implications of expanding a participant's spatial framing can be connected to tensions created in the comparative valuation of local and global knowledge. The ubiquitous environmental activism slogan of 'think global, act local' suggests that an approach to addressing the planetary scale of the Anthropocene necessitates attending to one's immediate environment first. Indeed, in the heightened experience of the visiophonic and interphonic knots created in my practice the participants repeatedly describe a deeper connection with their surroundings:

> *"I think it was the way it makes you look… I felt receptive to certain details of the landscape" (App. 04.01, 296)*

> *"I was still considering everything around me in a more heightened way, felt like I was having a bit of clarity" (App. 04.02, P_H)*

> *"I started becoming aware of stuff around being around, I kept hearing my breath" (Part. App. 04.02, P_D)*

> *“There was this one point where like, "Oh, notice anything growing in the floor or something?" I was on a concrete floor, so I'm just like, "No," but it made me realise that there is stuff, even in between the cracks” (Part. App. 04.01, S9)*

Our human sensory organs are indeed “best equipped to observe what happens around them” (Heise, 2008, p57), as we cannot see or hear something happening on the other side of the planet. Both works draw attention to a tactile engagement with the immediate, in their prompts to touch surfaces they encourage a physical connection with the non-human. Engaging with the local may indeed be best suited to our physiology and in turn be taken on as a more ecologically conscious approach to engagement, but this assumes that “individuals existential encounters with nature and engagements with intimately known local places can be recuperated intact from the distortions of modernisation” (Heise, 2008, p.54).

The environmental field recordings embody these distortions through their incorporation of human presence and surrounding infrastructure, offering a reflective connection between the local encounters made by myself and participant in at different points on our time-space paths. Presenting the field recordings in this way is also an attempt to remove suggested visions of idealised landscapes untouched by human presence that the participants might otherwise be led to imagine. The contemporary audience for these works has access to detailed sonic and visual records of remote locations, geographically unrestrained communication mediums mean that “most western citizens can now compare their environment with that of others.” (P.62). The images they conjure in their minds maybe be drawn as much from memory as from the narratives in the work itself.

> *“It made me think of conflict, of climate change, of places where there are disputed borders, like Sudan, Korea, Israel” (App. 04.01, S10)*

> *“Imagining forests, and deserts, and rivers, and lots of different beautiful landscapes, almost, in a way, the superimposing those on to the cityscape. Then it made me feel connected” (App. 04.01, S29)*

> *“It was the oasis at that point, and then I set out walking through the grass and all these butterflies and moths started flying up. It was like this lush vegetation, which was completely the opposite to the story, but it made that sense of loss even bigger, because this is what we are losing, actually.” (App. 04.01, S34)*

Here, it is the superimposition that is important. In *Dark By Then* it is not the removed static mode of watching a lonely polar bear on a television screen in your living room, the work holds a continuous co-existence of the immediate and the remote. The simultaneous and multiple geographic scales in the narratives each bring their own temporal scales, moving towards an "Imbrication of local places, ecologies and cultural practices in global networks that reconfigure them" (Heise, 2008, p.210). While *Only Expansion* makes no specific references to other places, the blurring of a forest field recording into the sound of the immediate city creates a similar if ambiguous superimposition.

> *"I realise there are no bees this time of year ... The birds confused me, because the gulls made a noise, then I heard other things, crickets" (App. 04.02, P_D)*
>
> *"I let myself be in two places at once" (App. 04.02, P_K)*
>
> *"my thoughts were flitting between water rising in the distance and water rising in front of us, looking across at the fountains." (Part. App. 04.02, P_A)*

The augmented experience holds the participant simultaneously between two connected local scales; that of the immediate and sensory, and that of the imagined global. Heise suggests that one challenge for environmental thinking might be to "shift the core of its cultural imagination from a sense of place to a less territorial and more systemic sense of planet." (p.56.), but here it seems that it might be possible to maintain both through these sets of entangled time-space paths.

3.3.3 ECOMIMESIS

Ecomimesis is Timothy Morton's term for the set of tools that ecocriticism uses in its attempt to break down the subject-object dualism of human vs nature. His lengthy exposition of it in *Ecology without Nature* (2007) is primarily a critique of where this attempt falters in nature writing, arguing that "By setting up nature as an object 'over there'—a pristine wilderness beyond all trace of human contact—[nature writing] re-establishes the very separation it seeks to abolish" (p.125).

Within this critique, he argues for an ambient poetics, suggesting that "If we could not merely figure out but actually *experience* the fact that we are imbedded in our world, then we would be less likely to destroy it" (p.64). While his definition of these ambient poetics is amorphous and ambiguous, some of the elements of ecomimesis that he identifies offer insights into how *Dark By Then* and *Only Expansion* seek to create an experience where "the self and the world are intertwined" (p.64).

The first tool of ecomimesis is *rendering;* drawn from Michael Chion's film theory it is the aesthetic simulation of reality in cinema.[73] It is a representation of an environment that says this is real "do not think there is an aesthetic framework here" (p.35). Within a soundwalk no such claim is being made, the aesthetic framework is explicit (the mediated sound in the headphones) and the environment itself is real (the participants' surroundings). Here the rendering occurs through the interplay of visiophonic and interphonic knots as they tie together the real (physical surroundings) and the simulated (field recordings), rather than being an observer the participant in a soundwalk is situated *within* the render.

The second tool, the *medial,* pertains to perception. It is where we become aware of the medium of communication, words highlighting the page on where they are written, the crackle of a microphone being connected. Morton points to the "*as I write this...*" technique within nature writing as medial, because it draws attention to the environment *that surrounds the text*. Relevantly, he points to the medial in experimental artworks, highlighting that

[73] For example the use of artificial lighting to create a continuous visual mood in a sequence of shots in contemporary film making.

while they may not be “directly ecological in content” they are “environmental in form since they contain medial elements”. With the augmented soundwalk medial elements proliferate, but they draw attention to multiple environments simultaneously. The rattles of equipment and background chatter in *Dark By Then*’s field recordings highlight the environment that is being captured, but at the same moment they draw attention to the participant’s surroundings because they are not from there, they come *from a different time-space.* When *Only Expansion* begins to feed in manipulated microphone input, it is highlighting the act of the participant listening to their surroundings, the *process* of capture becomes *content.* In both cases the separation between foreground and background is blurred. Morton’s general principle for ambient poetics is that is “seeks to undermine the normal distinction between foreground and background”. This tool he calls the re-mark, but acknowledges that “although it tries with all its might to give the illusion of doing so, ambient poetics will *never* actually dissolve the difference between inside and outside” (p.52).

As an example of the re-mark he highlights Alvin Lucier’s *I am sitting in a room* 1970). In this work Lucier records his own voice speaking, then plays it back in the same room from a loudspeaker and records it again. As he continually repeats this process the resonant frequencies of the room gradually reshaping the sound of the voice until it could be said it *becomes* the sound of the room. Morton proposes that this is “as environmental as writing about birds and trees”, partly because it tries to “render the actual sensation of environment altogether”(p.48). This takes place in part because there was never a moment where the voice is just itself, it was always *in the room* from the very first recording. I would argue that one reason this type of re-mark will never truly collapse the background into the foreground is that it is still presented as a self-contained work. When we experience it we are not *in the room* with Lucier, even though he acknowledges the listener (“..a room, different from the one you are in now”), our environment never becomes part of his cumulative process, it is always around us, and neither the recording or the room actively respond to each other.

The realtime processing in *Only Expansion* actively attempts to dissolve this distinction within the sonics of a participant’s experience. In pushing the sound from the participant’s surrounding *and* the field recordings through the

same system they become a singular rendering of an environment composed from multiple reproductions, all continuously interacting with each other. While direct acoustic sound spilling in will always add to the interphonic knot, the volume of the work is set so high as to make it difficult for the participant to notice, and when they do the sound sources remain ambiguous. When the microphone input becomes processed to simulate a flooded environment and this is blended with a recording of an actual flood, the differentiation for the participant becomes equally blurred as the real becomes unreal and vice versa.

> *“I wasn’t sure if they were within this or being picked up" (Part. App. 04.02, P_G)*

> *“I wasn't sure whether it was sounds outside or sounds on the soundtrack because it blended in so well and I already liked that not knowing” (App. 04.03.04)*

Within this blurring and interaction the participant remains acutely conscious of their own presence, and, as their own bodily sounds feed back into the sound system there is a further breakdown of subject and object.

> *“I come around the corner and up the steps and I realise its picking up my breath” (App. 04.02, P_J)*

> *I started becoming aware of stuff around being around, I kept hearing my breath, when I got to the traffic lights I think. Is it my feet making those click clack noises” (App. 04.02, P_D)*

The more extreme the processing becomes the more the sound sources collapse into each other. When the sound of forest fires appears in the soundtrack, the software gradually distorts all sound so breath, cars, wind and birds all begin to crackle and spit as one with the recordings. When all the sound is resonated in such a way to impose tonality and rhythm on it, then sounds from human and non-human sources take on a singular and sometimes magical quality, where the differentiation between figure and ground, between background and foreground become insignificant in the face of a transformative experience.

> *“these brilliant girls came out with this amazing laughter, it was like a rainbow.” (Part. App. 04.02, P_J)*

These approaches to timescale, locality and ecomimesis in both *Dark By Then* and *Only Expansion* are made possible through the interweaving of all the elements in the quaternary framework, and the composition of the artwork is dependent on shaping their interaction. Although as Karen Barad suggests, interaction assumes separate entities and, instead, she uses the neologism intra-action, the “mutual constitution of entangled agencies” (2007, p.33). In Barad’s terms, the temporal structure of my practice is the entity that emerges through intra-action, so it is formed not just by the experience itself, but somewhere between the compositional process, a participant’s agency and the uncontrolled environments it takes place in. A work that is produced with blurred spatial and temporal edges has resonance with Donna Haraway’s use of the term **sympoiesis**. Haraway applies the term to mean ‘making with’, a way of describing “collectively producing systems that do not have self-defined spatial or temporal boundaries” (2017, p.160). The anthropocenic chronotope is core to the sympoiesis within the work. Haraway’s problematising of the Anthropocene as a descriptor leads her to generate Chthulucene as an alternate framing, one which “entangles myriad temporalities and spatialities and myriad intra-active entities-in-assemblages—including the more-than-human, other-than-human, inhuman, and human-as-humus.” (2017, p.160). If approaching the Anthropocene is about attending to the variegated processes of change, of multiple interwoven timescales of both the human and non-human, then it appears to be a core of the practice under investigation. Crucially, it seems not only present within the work’s thematics, but to be inherent to the structural form of audio augmented reality.

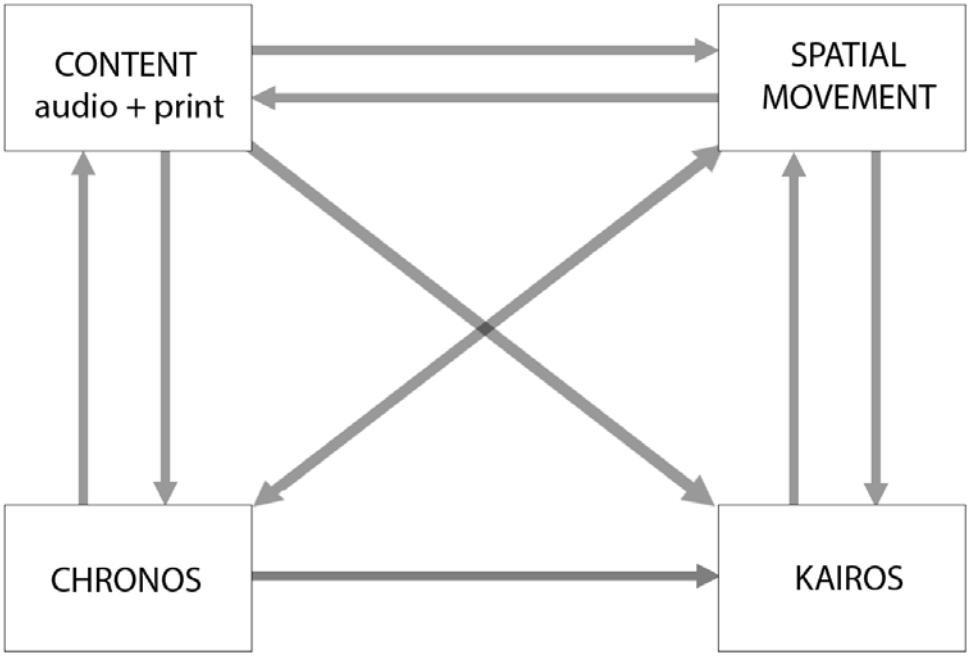
4 CONCLUSIONS

This research began with the question “What approaches can be developed that support the understanding and adoption of time as a compositional element in augmented reality artworks?”. It focused on the specifics of soundwalks in this field and grappled with the tensions between authorship and agency. My aim was to explore how compositional design can shape the unpredictable. The investigation was not simply about acknowledging the complex multiple layers of time that exist but sought to actively structure them. The experience of a soundwalk in an uncontrolled environment takes place within an unbroken time-space continuum striated by digital content. The relationship between the two could be left completely open, entirely dictated by a participant’s choices, but this level of interactivity is unable to actively articulate and structure the temporal qualities of the artwork. If the participant is left to drift, only stumbling upon fragments of content, then the author loses the ability to compose urgency, tension and release, or arcs of attention. I strived to develop an understanding of how one might structure the sequence of multiple shifting temporalities within the continuum, while still allowing for participant agency. The author’s voice creating the soft limits of the open work in collaboration with an “unseen outside party” (Eco)

.

> *“I felt like I was co-writing the story at points” (App.04.01, S16)*
>
> *“And the layers of the city and the layers in the book and the layers on the audio all make a new story that doesn’t exist, it only exists when you walk the story” (App.04.01,S28)*
>
> *“I certainly had my moments feeling like, time had slowed, or I'd slowed or been slowed down by it and I was being more attentive. I had other moments when I was feeling rushed and like I was being hurried” (App. 04.03.04)*

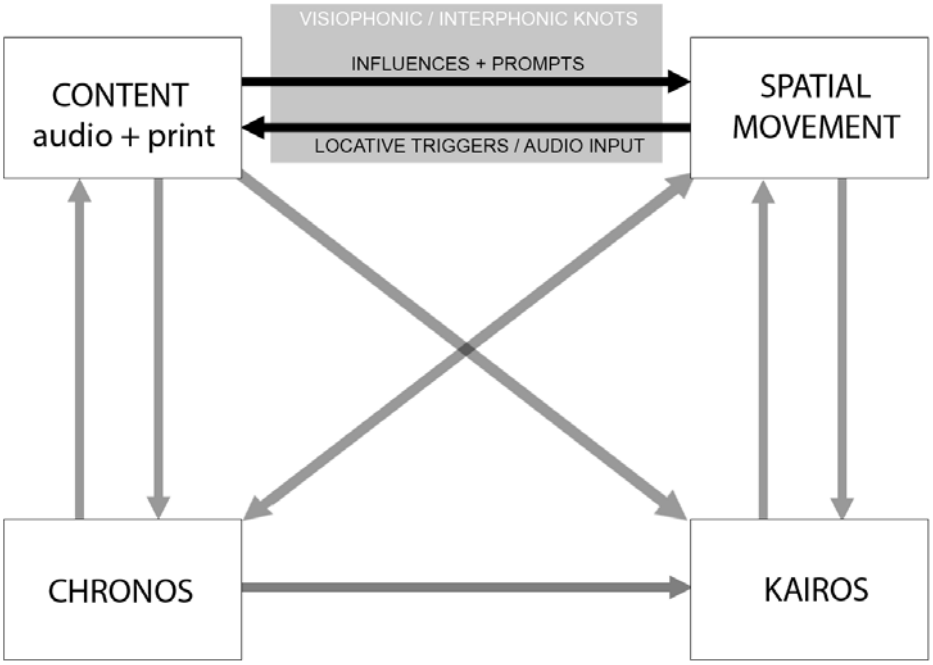
The key contributions of this research are the proposition of a quaternary framework and a set of methods for addressing these compositional issues. The framework identifies the constant intra-action between the content, spatial movement, chronos and kairos within soundwalks.



It can be argued that measurable chronos already exists within the content and the spatial movement but importantly, by separating it out as an individual component it becomes possible to untangle individual dialogues across the framework (see below). What I have shown is that by attending to the interaction between all four elements it is possible to compose and sequence the entanglement that occurs. To identify and use this framework I mobilised a set of methods that combined approaches from time geography with my own iterative development cycle. Integrating my reflective study and qualitative investigations of participant experiences with quantitative measurement and visualisation techniques from time geography is a unique approach that offers much to the field.

Unsurprisingly the complex entanglement of the above framework remains difficult to articulate within a linear text. As such, I will begin by identifying individual connections between the four components before considering the entanglement they create.

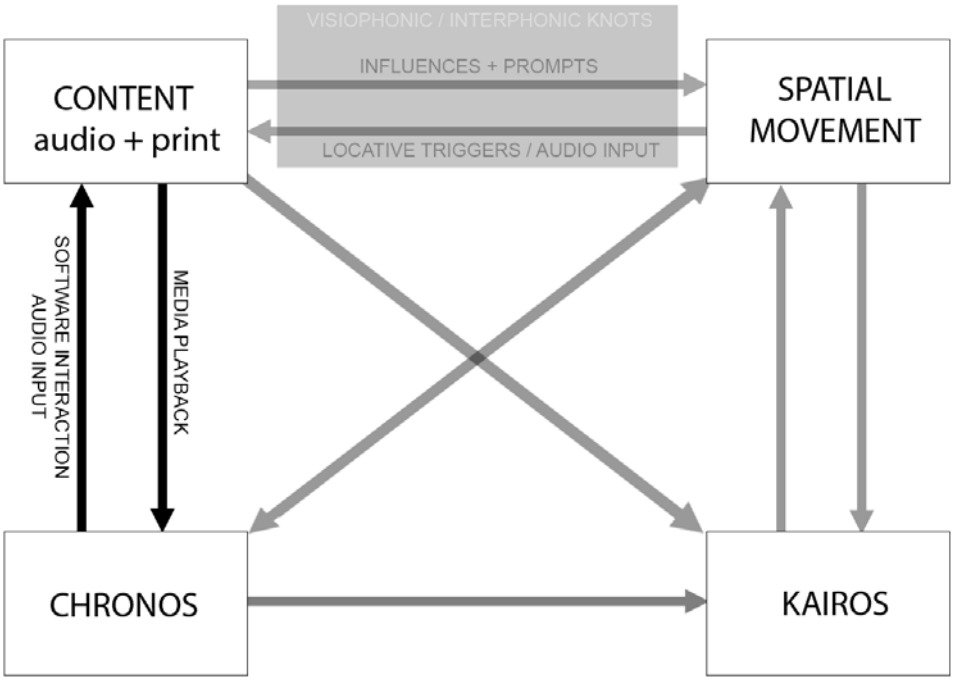
4.1 TRANSDIEGETIC KNOTS



The relationship between the content and the spatial movement acts in both directions. Initially, spoken or printed prompts in the work give participants impetus towards spatial motion, asking them to seek out types of location or environment. It is in this relationship that we find the content offering agency to the participant, with the instructions providing the first soft limit to the shape of the work.

This is a transdiegetic approach, where the extradiegetic content influences the diegesis of the work. The participant's spatial movement then impacts the content in a variety of ways. Firstly, where GPS triggers are used media is played back in response to a participant's movement. As in *Dark By Then* this can result in audio files being curtailed or not played at all (Chap. 03.01.02). In *Only Expansion* their movement changes their sonic environment and in turn the processed audio input heard in their headphones (Chap. 03.01.06). In both works the particular combinations of the uncontrolled physical environment and sonic content is shaped by the participant's movement, creating visio- and interphonic knots.

4.2 AUTHORED TIME

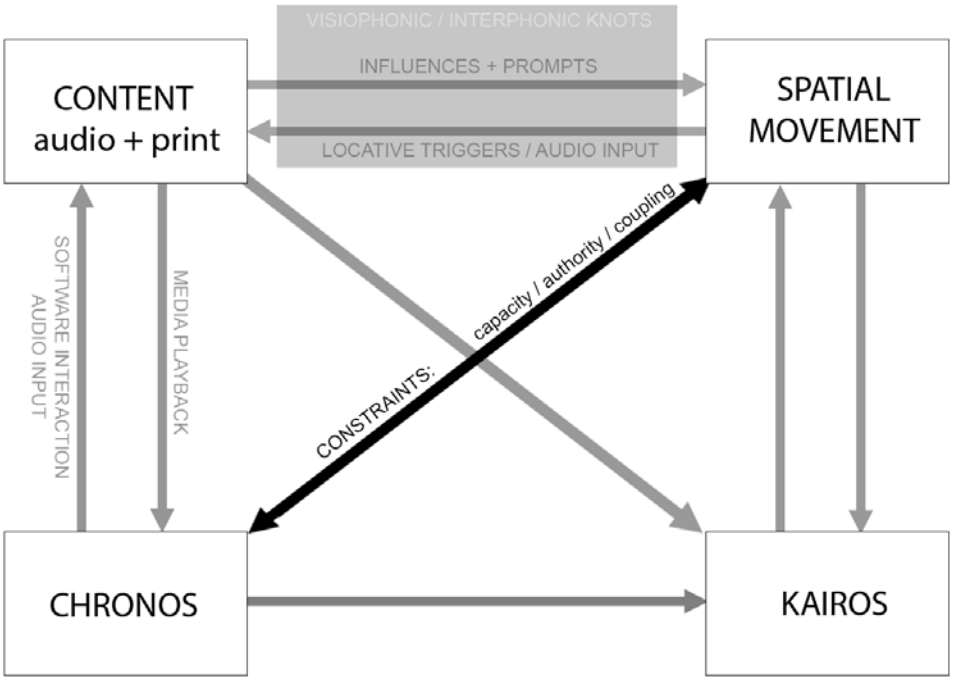


The relationship between the content and the chronos of the experience changes depending on the type of agency. In *Dark By Then* the content offers choices of station to the participant, and so opens up the possibilities for their path. While primarily spatial, the choices they make and their associated interaction with the software control the chronos of both the meso structure (in how much of individual files are played) and therefore the macro structure of the entire experience. Even when stationary, using the software to confirm they have chosen a station or finished reading a chapter changes the duration of a section. In *Only Expansion* the chronos of the macro structure is unchanging but sonic events in the participant's surroundings change the meso structure at measurable moments.

> *"was the water getting louder on purpose or was I getting into a louder position" (App.04.02, P_D)*

It is important to highlight that while this content-chronos relationship can be singularly identified, it is inextricable from the spatial movement.

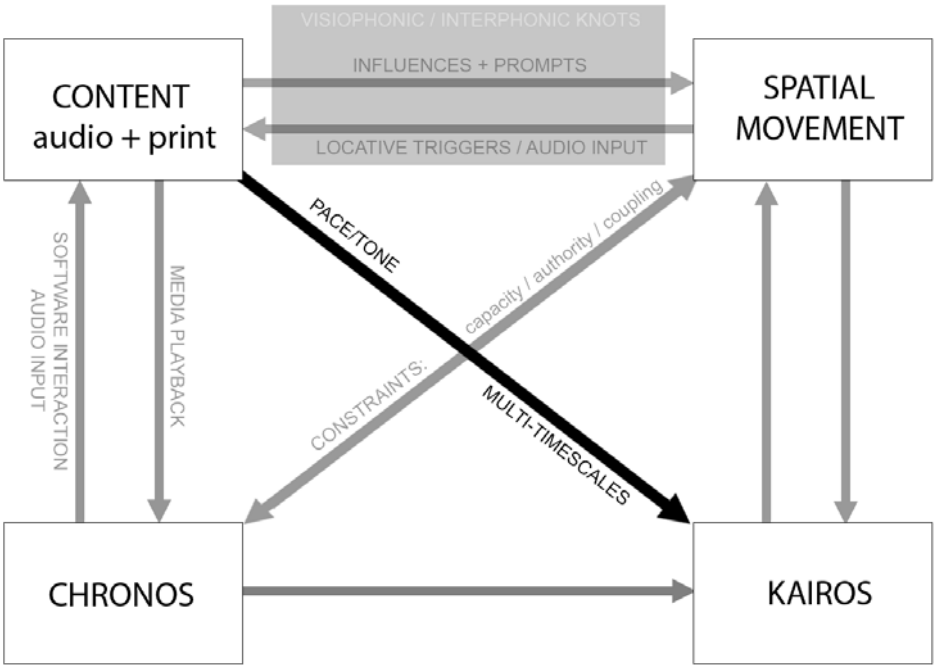
4.3 COMPOSING WITH CONSTRAINTS



Here the entanglement of the framework begins to reveal itself. Spatial movement can both shape the chronos of the content *but also* be influenced by it. When participants are asked to stop (for example by a new chapter starting in *Only Expansion* or a spoken instruction in *Dark By Then*) it is the chronos of the content that shapes the spatial.

It is in this triangular set of connections within the framework where the application of time geography becomes most relevant. As an analysis tool it revealed the consistency of chronos across varying spatial paths. Then, by using its concept of constraints I was able to understand and *compose* aspects of these relationships. The chronos of content needed to consider the capacity constraint of a participant's movement, coupling constraints of participants being at specific stations shapes the chronos of the macro structure, and authority constraints reveal restrictions on spatial movement. While time geography offered tools for analysis and composition they are grounded in the measurable and the quantifiable, to complete the framework we must turn to the experiential qualities of kairos.

4.4 SHAPING SUBJECTIVITY



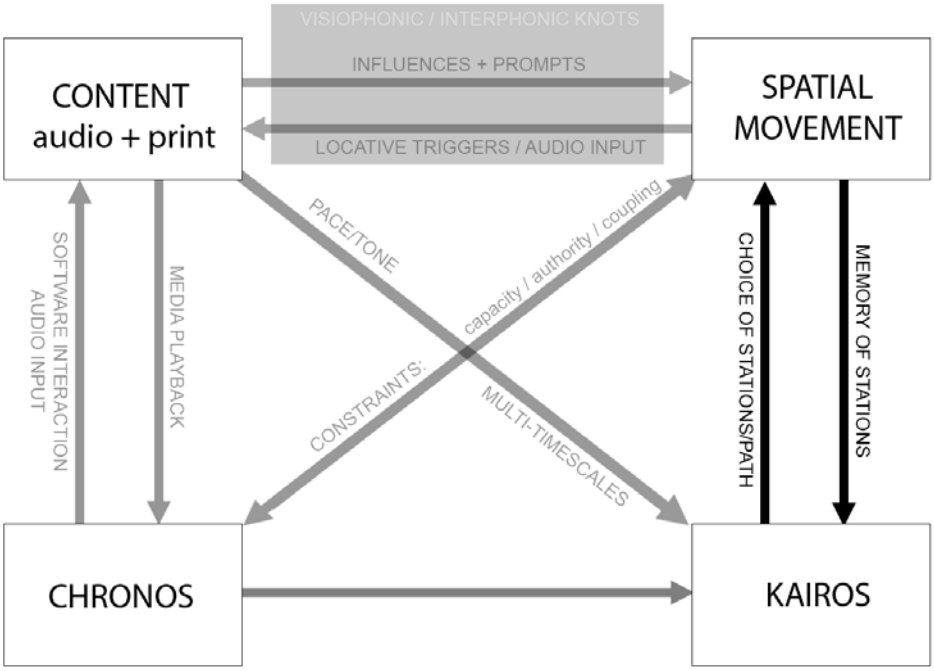
The most obvious connection but fuzzy relationship is between the content and the kairos. In this realm we can consider the thematics of the multiple timescales, of listening to recordings from other places and *other times,* of reading stories of ecological processes beyond the participant's lifespan, of hearing imagined possible futures for their everyday lived environment. This is the beginning of the *experiential chronotope,* where time becomes thickened, and there is a bleed between the edges of the *work* and *the world.* These thematics also play into the visiophonic knot; as the participant responses evidenced, sonic and textual content would shift their understanding and interpretation of the timescales occurring around them.

> *"I felt immersed in the environment, a strong sense of how nature will survive us, even though I'm in a city, everything concreted over" (App. 04.02, P_F)*

The other important factor here is in the pace and tone of the content. In some respects the *pace* of the content exists as part of its chronos (as in the metronomic pulsing of intervals, see below), but sometimes a pace is felt through the length of a piece of printed text, or in its layout. Increases in intensity of sound often gave participants a sense of urgency, of time running

out or of encroaching threat. This sense of an *imposed* pace is also generated through temporal articulation when the realtime processing creates temporal patterns on the sound of the uncontrolled environment (Chap. 03.02.01). All of these aspects could be described as shaping the *temporal tone* of the content, and exist somewhat apart from other more measurable aspects, which have their own relationship with the kairos.

4.5 SHAPING MOVEMENT



As the content directly impacts the participant's sense of time, there is a reciprocal effect that comes as a result of the relationship between the kairos and spatial movement. The outward/return structure of both works draws on the participant's memory, the epitome of the non-linear nature of kairos. As they return to a station they are conscious of the time that has passed, and of change that may have occurred.

> *"You're jaunting in and out of the space all the time in quite a good way"* (App. 04.01, 204)

Additionally as shown in Chap. 03.02.02, their temporal horizon is extended beyond the human scale as they consider the time-space path of that station stretching out into the supra scale. These effects were revealed most clearly

through the chrono-interview method, where a participant's different responses to stations on the outward/return journey could be analysed. Here the timecube of time geography became a tool for not only the measurable and the quantifiable, but for visualising these extending subjective scales (Fig. 63).

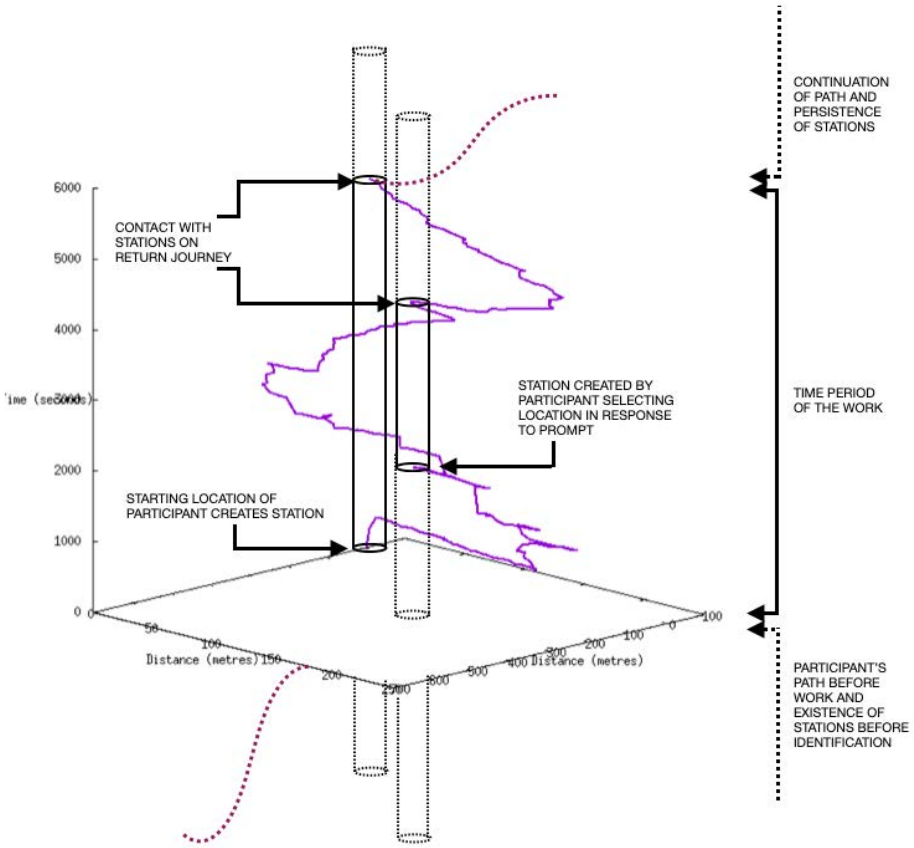
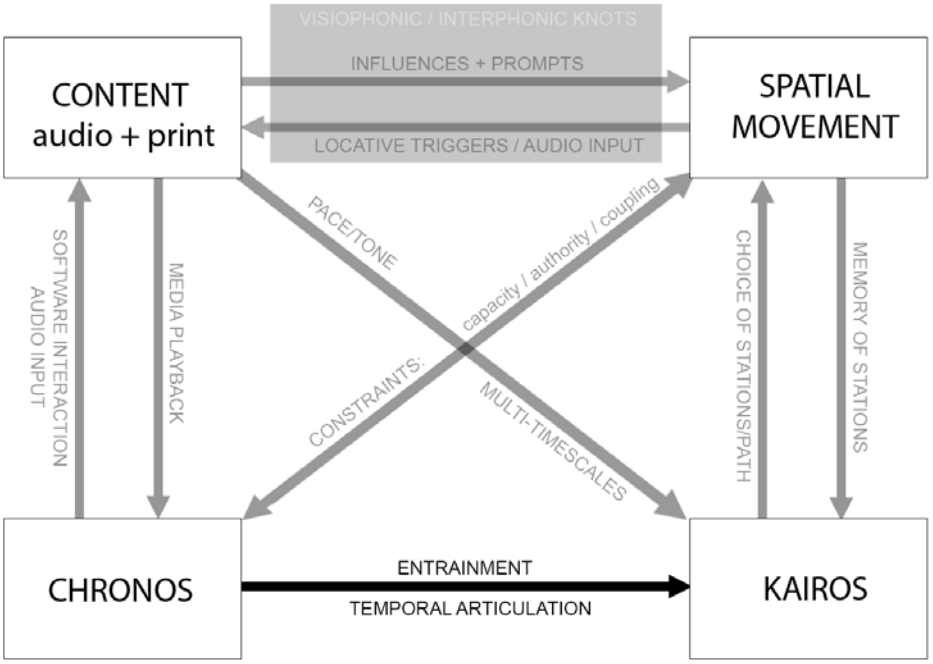


Figure 64 - temporal extensions of path and stations beyond work's macro scale

While a participant's choice of a station is sometimes informed by direct interpretations of time prompted in the content (e.g. find something that is older than you), it is also sometimes because they *feel* it is the right moment to choose somewhere. In the chrono-interviews for *Only Expansion* it was demonstrated that participants built up a sense of the chronos in a chapter, of when it would end, and so made their location/route decisions based on that. It is this impact on the spatial movement (and in turn the content and chronos) that makes the kairos of the work not simply an outcome of the other elements, but also a shaping force. Importantly I have demonstrated that this *sense* of time is influenced by the chronos of the content.

4.6 ENTRAINMENT AND ARTICULATION



The compositional intentions and time cube analysis of *Dark By Then* led to one of the key discoveries in the research, namely the use of *entrainment*. In offering agency to participants in their choice of station, there was the potential of the meso scale chronos becoming unpredictably shortened or extended. The gaps between stations refuse authorship, as the chronos of the macro structure is determined by the participant. To address this I embedded sections with fixed chronos, creating a pattern of repeating pulses across the work (Chap. 03.1.02). This consisted of both fixed durations (e.g. where spatial movement is controlled by the *content - "stop where you are right now"),* but also of informing the content's tone and pace through *linear* and *moment form* musical composition. These compositions played into the kairos by trying to imply progress or stasis, an attempt to influence a participant's perception of time passing, to encourage them to think "it's time for me to stop walking and choose somewhere". The time cube analysis showed that rather than a series of widely varied *open* sections interspersed with repeating pulses of fixed durations, the participants seemed to become entrained with the pulses. The chronos of their location choosing echoed the authored chronos of the content, so that regardless of locality or constraints, there was a consistency in the chronos of the macro structure.

This shaping of participants' subjective choices was also attempted through the *temporal articulation,* where the chronos of the field recordings gave temporality to the act of reading printed text.

It was the consistency achieved through these techniques that resulted in my decision to entirely author the macro chronos of *Only Expansion*. Participants could still have agency in their spatial movement but would develop an internal sense of *when* they should choose stations through the repetition of section durations.

4.7 EXPERIENCING THE ENTANGLEMENT

I have proposed that the complex temporal relationships between the components creates an *experiential chronotope*, where the experience of time is "thickened and given flesh" (Bakhtin, 1981, p.84). This is because their intra-acting is not a representation in the work, rather the participant is enmeshed *within* the framework, shaping and being shaped by it. Their path moves through the work and the world as one, leaving both "indissolubly tied up with each other" (Bakhtin, 1981, p.84). The components of the framework and the participant's path are entangled, as in Barad's words they "lack an independent, self-contained existence." (Barad, 2007, p.ix). It is in this entanglement that I have identified resonances with ecocritical perspectives, creating an active experience of the pervasive concept that "the self and the world are intertwined" (Morton, p.64). It is the constant reframing of the participant's subjective position in time-space that "entangles myriad temporalities and spatialities" (Haraway, 2017, p.160). The collapsing of the human/non-human dichotomy is articulated through the composing of knots; temporal, spatial, inter- and visiophonic. It is in this aspect of the composition process that I propose we might also find an *anthropocenic chronotope*.
If confronting the Anthropocene is about entanglement of scale, from microbial to planetary, from the immediate present to geological or networked time, then to begin describing or even understanding it, we might need to develop new forms of attention. These forms of attention might not be the static contemplation produced when simply presented with the scale of ecological disaster. Rather than merely viewing a picture of a collapsing glacier or a stranded polar bear, the practice here embeds the participant in

an entangled singular system. In layering temporal horizons, heightened listening and tactile engagement with environments, it creates modes of attention that offer the potential to rehearse and repeat and thus in some way *actually experience* the intra-action of multi scalar entities.

4.8 COMPOSING THE ENTANGLEMENT

The continuous entanglement of the framework means that a shift in one element can cascade through it and even feedback on itself. It is for this reason that I argue for a compositional approach that considers this framework in its entirety, with the possibilities of the relationships understood. The works under investigation here were created for uncontrolled environments and offered agency to their audience, yet as a composer it is possible for me to shape the structure, to create a set of elastic soft limits, limits that can be pushed at pulled by the participant, but have a breaking point, at which point I could clearly say 'this is not the composed work'.
In approaching composition I would argue that some form of score is important. Within this field of augmented experiences there is no established notation format, and I would be reticent to suggest one due to the range of aesthetics and thematics. Where one artist might make their work entirely text based, another may use only non-verbal sound. The spatial movement of a participant may be a simple walk or could be tightly choreographed. As such the design of a score can be highly idiosyncratic (the range of graphic scores for music and various approaches to dance notation are testament to this). It is difficult for any notation method to represent *every* aspect of a temporal artwork, a traditional music score contains little information about the acoustic space a work should be performed in, a film storyboard does not really capture the changing pace of edits.

What I have presented is a number of different notation methods that each account for interplay between components of the framework. In both the horizontal block based scores for *Dark By Then* or the vertical time based scores of *Only Expansion*, the chronos structures are composed with an awareness of the framework. Capacity constraints were used to prepare for participants meeting the requirements of coupling constraints, the caesura

between them becoming part of the fabric of the work, while the temporal horizons discovered in *Dark By Then* were able to be articulated through notation in *Only Expansion*. I want to argue that regardless of notation approach, a compositional approach must account for all four elements, where a score represents the *potential of what might happen.*

4.9 FUTURE DIRECTIONS

The outcomes here point to a number of possible directions for future research. Firstly there is the potential for an enhanced approach to my personal notation style that would draw together the elements of the framework into a singular visualisation. At present the shifting temporal horizons, fixed/open chronos and time-space paths exist in separate visual domains, but it may be possible to draw them together. The timecube format itself offers many opportunities in this regard but the wider range of methods within time geography have further potential applications in the field. In these site-responsive works where the *path* is defined by the participant the time cube is unable to say what will happen, and yet there may be some benefit in using it to show us *what might happen.* By creating an imagined path using known capacity constraints we can visualise a possible experience, and consider structural balance between periods of movement and stasis for example, or fixed or open chronos structures. Where this approach might become even more key is in the creation of site-specific works. Knowing the geographic position of stations in advance would allow the identification of issues created by any of the constraints. At that point the timecube becomes not just a way of visualising what *has* happened but becomes a way to notating more accurately what *should* happen. This area would be suitable for research in the media arts and emplaced audio in a coming world of permanently available augmented reality.

In the specifics of the music there is an area to be explored in the use of generative audio. The practice here has concentrated on my personal expression through strongly authored musical forms, using linear goal directed structures to evoke progression in the sound. It may indeed be possible to create these kinds of structures for sections whose durations are defined during the experience by using context aware or machine learning systems.

Finally, the contributions of the work to ecocritical thinking deserve a more thorough investigation. Here I have suggested the idea that it is the inherent form of AAR that creates an ecocritical experience. The practice investigated directly addressed these concerns in its content. The question remains about whether the same kind of ecological entanglement is as clearly present in works that are exploring very different subject matter.

4.10 EXIT

At the end of this research, when I reflect on my practice, I find myself understanding that what is being composed is a sequence of perspectives, from the intimate to the epic, from looking forward and backwards in time to listening between the immediate and the remote. As plants in the cracks beneath feet bring focus to the now, the submerged city opens up the future and the imagined. The simple prompt of moving in a certain way, combined with a sonic statement, the choice of microphone or music or field can shift between the attentive and enmeshed or the cinematic and disconnected. The different ways participants are entangled in the fabric of the environment become temporally structured. In an echo of Fell's critique of Husserl, where music is not an example of how we perceive time, but *is itself* creating our perception, the practice here is not showing us what entanglement is, it is composing it

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GLOSSARY

Anthropocene The Anthropocene Epoch is an unofficial unit of geologic time, used to describe the most recent period in Earth's history when human activity started to have a significant impact on the planet's climate and ecosystems

Audio Augmented Reality (AAR) The introduction of virtual sound material into the real world.

Chronotope A literary device for the expression of intrinsic temporal and spatial relationships in a text.

Digital Signal Processing (DSP) The mathematical manipulation of an information signal, such as audio, temperature, voice, and video to modify them in some way. In this thesis it refers to audio signals.

Ecomimesis A set of literary tools used in ecocritical literature to try and break down the subject-object dualism of human vs nature

Extra-Diegetic Occurring outside of the narrative or story space. (e.g. a film soundtrack that is not heard by characters who exist within the fictional diegesis of the films story.)

Geofence A virtual perimeter for a geographic area. Often determined by software using latitude and longitude, (but also possible through proximity to devices such as Bluetooth beacons) it can be used to signal software events when a device enters or exits its boundaries.

Interphonic knot When a listener is situated between two simultaneous sonic worlds. For example listening to a piece of music on headphones but the sound of traffic next to you can still be heard.

Macro scale the duration of compositional structure of the experience I am authoring, often from the moment a participant puts the headphones on and presses go to the moment the mediated content stops (or the participant ends the work through a software interaction).

Meso scale the duration an individual component or section of the work that combine with others to create the macro scale structure.

Path The movement of a singular material entity (an 'individual') through time-space. It accounts for the time period of the individual being born/created/produced to the point of death/destruction/dissolution.

Quaternary of, relating to, or consisting of four units or members

Sound Event an acoustic action that happens at certain point in time-space

Sound Object the perception of a sound generated by a sound event. It takes place at the site of the listener, combining a physical reception of sound with a cognitive interpretation.

Station A location in time-space with unchanging geographic position (though it continues to create a path in time-space while it exists).

Supra scale the time period that extends ahead and behind the macro scale of the work, incorporating everything from the duration of a festival the work might be in, to the lifespan of the participant and outwards to planetary timescales

Sympoiesis A term for a collectively producing system that does not have a self-defined spatial or temporal boundary

Transdiegetic Where extra-diegetic material has an impact on the diegesis.

Transparent audio system Auditory system that is capable of actively or passively intermixing both real and virtual sounds.

Visiophonic knot – a convergence point between the audible and visible. Hearing and seeing something at the same time, even if the two are distinct events.

LIST OF FIGURES

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APPENDIX 01: PRODUCTION CREDITS

It Must Have Been Dark By Then (2017)

Commissioned by the AHRC funded Ambient Literature research project - a two-year collaboration between UWE Bristol, Bath Spa University and the University of Birmingham.

Written and directed by Duncan Speakman

Dramaturgy: Tineke De Meyer

Music: Duncan Speakman, Sarah Anderson, Sean McGhee

Production assistants: Katharina Smets, Sara Zaltash, Elina Ventere

Book design: Krysztoff Dorion

Producer: Tom Abba

Application development: Calvium Ltd.

Interface design: Tom Metcalfe

Exhibited at IDFA, Amsterdam; British Library, London; TrueFalse Festival, Columbia; Screencity, Stavanger; OpenCityDocs, London; Hay Literature Festival, Hay; Watershed, Bristol;

Only Expansion (2018)

Commissioned by University of Exeter Arts and Culture, Theatre in the Mill Bradford. Developed with support of Lydgalleried Bergen and Arts Council National Lottery Project Grants.

Written and directed by Duncan Speakman

Music: Duncan Speakman and Sarah Anderson

Production assistant: Will Taylor

Technical consultancy: Steve Symons

Book design: Tom Abba

Exhibited at: Oxford Science Festival, Oxford; Kaleider Mikrofest, Exeter; Niantic, Oakland; IDFA, Amsterdam; SonicActs, Amsterdam; Watershed, Bristol; Silbersaltz, Halle;

APPENDIX 02: DIGITAL ARTEFACTS AUDIO

(Files provided in repository as part of zip file "Appendix_2_3_4.zip")

02.01 Original Dark By Then drone
02.02 Early improv01 Dark By Then
02.03 Early improv02 Dark By Then
02.04 Reworlded noise experiment 01 Only Expansion
02.05 Reworlded noise experiment 02 Only Expansion
02.06 return journey audio example Dark by Then
02.07 building searching music
02.08 junction search music
02.09 opening drift music
02.10 Mouna to Port Fourchon
02.11 Dynamic goal directed music Only Expansion
02.12 Marcis field collage Dark By Then
02.13 passage audio example Only Expansion
02.14 submerge example Only Expansion
02.15 Only Expansion puredata patch (OE_bristol.pd) minus audio (zip file)
02.16 Text score for pure data Only Expansion

APPENDIX 03: DIGITAL ARTEFACTS SCORES

(Files provided in repository as part of zip file "Appendix_2_3_4.zip")

03.01 : Dark By Then final temporal structure score (Excel spreadsheet)
03.02 : Only Expansion final timeline score (Excel spreadsheet)
03.03 : Screenshot of Dark By Then example DAW timeline
03.04: Screenshot of Only Expansion example DAW timeline

APPENDIX 04: DIGITAL ARTEFACTS TRANSCRIPTS

(Files provided in repository as part of zip file "Appendix_2_3_4.zip")

04.01 – Dark By Then sectioned transcripts (Excel spreadsheet)

04.02 – Only Expansion chrono interview transcripts (Excel spreadsheet)

04.03.01_Only_Expansion_Group_Interview_Transcript (word document)

04.03.02_Only_Expansion_Group_Interview_Transcript (word document)

04.03.03_Only_Expansion_Group_Interview_Transcript (word document)

04.03.04_Only_Expansion_Group_Interview_Transcript (word document)

04.04.01_DarkByThen_Individual_ (word document)

04.04.02_DarkByThen_Individual_ (word document)

APPENDIX 05: TECHNICAL DEVELOPMENT

IT MUST HAVE BEEN DARK BY THEN

The development of Dark By Then was based on a work at I had created in 2007 called 'Always Something Somewhere Else'. This work used locative media system called MScape (created by HP Labs) which was primarily designed for creating *placed sounds* experiences. I adapted the system so that the participant was able to identify geofence regions that could be used at later stages in the composition. When I decided that *Dark By Then* would incorporate participant agency I returned to this approach. Due to the nature of the funding commission that made the work possible the software development was undertaken by a 3rd party (Calvium). The limited scope of their work precluded the use of generative composition or dynamic responsive audio systems (e.g. no possibility for audio ducking which would have been very useful). While in many ways detrimental to the possibilities of the piece, it allowed me to focus on how linear pre-recorded audio files could shape the participants temporal choices. The core functionality of the software available was:

Play an audio file in response to a participant's screen interaction (a button press)

Store geographic location of the device in response to a participant's screen interaction (a button press)

Create geo-located regions based on participant's route.

Play an audio file in response to a participant's geographic location

Play a series of audio files in a pre-determined sequence

Display the current geographic location of the device relative to the position of geo-located regions.

The system delivered by Calvium was functional on iOS and Android mobile devices but suffers from some key bugs. Primarily as native audio code was not employed it is not possible to lock the screen of the device and keep the audio playback functioning. Additionally it has a common bug where audio files will not

play. Post research the software is being redeveloped by a new developer for future distribution.

ONLY EXPANSION

HARDWARE DEVELOPMENT

Once I had made the decision to develop a transparent audio system for *Only Expansion* I returned to one I had developed in 2012 in collaboration with Tim Redfern. That system was based on a Gumstix embedded computing platform running a custom Linux build and PureData audio software. This system was used to create the first set of iterations tested in Bergen at Llydgalleriet.

The first problem encountered here was the audio quality. The hardware system used could only work at a 22khz sampling rate. This greatly reduces the amount of high frequency information in the sound, which is a key factor in how our brains identify the spatial position of sound sources. When listening to the sound coming from the microphones my attention was constantly drawn to what was actually making the sound. Hearing people talking or a car starting would often result in me turning to visually locate the source of the sound, identifying it visually gave a sense of being in a rich sound environment that was all around me, never feeling doubt that these sounds were actually happening all around. Contrasting this with listening to field recordings through the system, where any audiovisual correlation with my surroundings was serendipitous, it was hard to feel enveloped by the sound of another place. The sound lacked any great spatial quality, and when combined with the live microphone audio it gave a strong feeling of being 'here' while listening to a 'transmission' from there. Comparing this with walking while listening to the field recordings in a device capable of 48khz playback, and in these journeys the recordings had a much greater spatial clarity. Not only did I feel enveloped with this remote sound environment, but also often found myself unconsciously turning to locate the source of sounds that were not there.

Future iterations demanded a more capable hardware platform. In addition to handling a higher sampling rate it would be able to work with a greater variety of audio processing as the current set I was testing were pushing the limits of the CPU when used simultaneously.

The possible systems identified were :

Mobile phone : iPhones were too expensive to be useful, and while there were affordable and high powered devices running Google's Android platform, the possibilities for audio input were limited. There were very few devices that allow for stereo audio input to an Android phone, and those that could do so with minimal latency (the time gap between audio input/output) were also prohibitively expensive. In addition to this I would need to develop the software skills necessary to build the necessary android software before I could continue developing the piece.

Bela + Beaglebone : the Beaglebone is a small embedded computer similar to the Gumstix I was already using and also capable of running Linux and Puredata. The Bela is an audio input/output card designed to work with the Beaglebone, it was possible to run Puredata on it with some limitations. This system was affordable and I felt it would not be too complicated to make my existing software run on it.

Raspberry Pi and PiSound : the Raspberry Pi is an affordable micro-computer capable of running Linux and Puredata. The PiSound is a soundcard designed specifically to work with the Pi. The benefit of this system over the Bela/Beaglebone was that it had built in audio input/output gain controls and a button based control system with pre-built scripts for controlling PureData and the Raspberry Pi. In the end I opted for this system as I could transfer my current software directly to it and the addition of volume controls/buttons meant I would not need to design and build these myself (unlike the Bela).

The final iteration of the system was built using a Raspberry Pi computer (running PureData for the audio processing), a PiSound audio interface (to receive the microphone input and output audio to the headphones), and a pair of binaural microphones. The computer and interface were housed in a laser cut Perspex case and powered by a Li-ion battery for portability.

SOFTWARE DEVELOPMENT

[The full puredata patch and associated score are in Appendix 02.15]

At its simplest level the system was designed to combine the live microphone feed with field recordings and music, then process and manipulate the incoming audio in a variety of ways. Many of the audio processes were based on the rjLib developed for the RjDj software system.
The sequence of audio processing/sound playback was controlled a text file score that used relative timing triggers rather than fixed durations from the beginning of the piece. Each cue to play a sound file or manipulate the audio happens at a specified duration *after* the previous cue. So any changes made to the duration of a specific section would leave the timings between remaining cues intact without any additional editing.

Example: This cue point occurs 30 seconds (30000ms) after the previous one. It plays the audio file CH04 and changes the amount of delay process to 0 over a 90 period. After 90 seconds the audio file BRforestV02 is played, and the audio mix level of the field recordings is changed to 0.4 over a 30 second period.

```
30000 # ####quiet;
0 voice CH04.wav;
0 delwet 0. 90000;
90000 field BRforestV02.wav;
0 fmix .4 30000;
120000 fmix 0. 50000;
```

A number of different audio processing techniques were developed iteratively, the final set consisting of the following:

(naming is drawn from idiosyncratic personal preferences)

FILTER - a set of shape variable filters[footnote explanation?] that allowed for the removal or accentuation of specific frequencies. This was intended to simulate specific environments (e.g. removing high frequencies from the microphone feed to create sonic effect of being underwater) but also to manipulate the texture of the audio, especially in combination with other processes.

RESONATE : a set of comb filters (footnote) that could add tuned resonance to the audio. This was designed to give musical tonal qualities to the microphone feed, allowing for a dialogue between the composed music and the unpredictable surroundings. When using the RESONATE process to imbue the microphone feed with harmonic or melodic qualities, it was noticeable that in my own and other participants experience there was a greater tendency to create sounds specifically to hear how the system responded. Whether this was clicking your fingers or tapping nearby surfaces, the experience shifted from a sense of ‘what sounds are around me’ to ‘what sounds can I make’. The audio process created fixed tunings and rhythms from any sound that was fed into it, so every noise one made felt cohesive with the others, so for example it was impossible to be out of tune. While this sense of playfulness did connect with ideas of interaction with environments, it seemed to risk leading the themes of the work back towards an anthropocentric viewpoint, with the participant in control, the central focus. Maybe also in here was a personal fear of creating an ‘instrument’ rather than a statement through experience.

SPACE : a reverberation system to add artificial acoustic space to audio. This was used to both change the participants perception of their immediate environment but also to place the pre-recorded sound and the microphone feed in a shared acoustic space. In trying to simulate the hydrophone recordings from *It Must Have Been Dark By Then*, a combination of the FILTER and SPACE processes created what sounded like a convincing articulation of the sound you hear while underwater. Walking with the live microphones going through this process demonstrated to me that while the effect was arguably an accurate simulation, it failed to be convincing without context, this feeling was confirmed through conversations with test participants. This lack of context can be considered alongside what Kanngieser describes as the inherent ambiguity of sound (2016). As the listener is not actually underwater the sound of cars and passers-by muted and echoing into new shapes might appear as new, unidentifiable alien sounds. This leads more to questions of ‘what is making that sound’ rather than any sense that it is the immediate environment in an imagined submerged situation.

This problem was equally apparent when using the same processes to create the sound of wind from the microphone audio feed. Placing the SPACE process before the FILTER made it possible to turn the noise of the surrounding city into create thin echoing whisps of sound akin to the desert wind recordings from Tunisia, but again it tended towards the ambiguous not the recognisable or meaningful. My observation was that while this had the potential to tap into an unconscious or emotional reaction it failed to articulate the sense of *elsewhere.*

DEGRADE: reduces the bit rate of the digital signal which leads to crackle and breakup of the audio input. Designed as an approach to evoking ideas of silence, revealing the absence of sound by highlighting the failure of the audio system.

STROBE: a variable modulation of signal amplitude, designed to add punctuation and rhythm to continuity of external audio input. Initial tests with participants revealed that when the modulation speed was fast they did not recognise the source sound as coming from their surroundings. Instead it was more often (and accurately) described as being like a 'train passing' or 'some kind of pulsing rhythm'. Combined with my own experience of listening I reasoned that this happened because the fast alternation between sound on and off didn't actually give enough time of sound 'on' to allow identification of its source. To address this the system was modified so it instead used a looping envelope as a modulation source. This allowed for more control of the relationship between sound on and off, making it possible to reveal more of the sound source while maintaining rapid modulation.

1

HAPTIC HOPES

An additional approach I explored was trying to influence the participants movement through haptic communication. If I could shape their actual walking

pace accurately I could blend recordings of walking on different surfaces into the soundfield. The participant would not be 'playing' but rather the sounds would appear to be following their actions, and eventually this might lead to some kind of perceptual blur where it did sound like it was their own feet making the sound.
To test this proposition I connected a Lofelt Basslett into the sound output of the audio device. The Basslett is a wristband that turns the low frequencies in a sound signal into physical vibrations that can be felt by the wearer. I wanted to know if the participant would more naturally fall in step with the music if they were physically feeling its rhythmic pulse. Testing this system myself it became very clear that the feeling was more distracting than influential, it would take at least 10 minutes before I became less self-conscious of the vibration on my wrist and began to feel it more centrally in my body and as part of the music. When I tested it with participants they also described feeling no clear incentive to walk in time with the pulse. I resolved to abandon this strand of enquiry for the current iteration of the project. In the future though I am still interested in exploring what a sensor based system might offer beyond a sense of play.

APPENDIX 06: FIELDWORK DOCUMENTATION

DARK BY THEN

With the intention of the piece being to connect the site of the participant to remote locations it was necessary to collect material from remote sites. To fully explore the idea of links with the wider world I wanted the material to come from a variety of countries and environments.

For the piece to remain geographically flexible, allowing it to be experienced by participants in a location of their choice, it also made sense to make for the selection of sites globally varied. This would mean that in whichever country the piece was experienced there would always be content from remote locations. To collect the content and further develop the themes of the piece three field trips were planned. Each field trip was intended to collect both field recordings and interview material alongside thematic research. Through extensive research into relevant locations (and working within the budget constraints of the project) the field trips took place in the following locations:

Latvia: While the majority of research had focused on changing *physical* environments I became aware that Latvia had a rapidly shrinking population. With one the lowest birth rates in Europe and a young population eagerly seeking work in other countries, it had lost 25% of its population between 1990 and 2015, with a prediction of a further 30% by 2040. Working with Elina Venter (a resident of Riga) I travelled the length of the country over two weeks. From the Russian border (also a border of the EU) to the Baltic Sea, visiting abandoned villages and empty farms, speaking to local residents and geographers.

Tunisia: Tunisia has been undergoing the most rapid desertification process on the African continent (Ref). Working with Belgian radio journalist Katherina Smets I travelled from Tunis to Douz on the northern edge of the Sahara desert. En route we made contact with journalists, climate activists and youth groups across the region.

United States: Having selected a site with disappearing water, a poetic logic suggested that the final choice would be a location where the land was disappearing due to rising sea levels. While this situation would appear to be increasingly common internationally, Louisiana was chosen for a number of reasons. Firstly, the residents of Ilse de Jean Charles had become the world's first officially recognised climate change refugees , and yet their country had just elected a president who repeatedly denied climate change was real. The irony of this fact along with the legacies of Hurricane Katrina cemented the decision.

Empty towns near Jekapils, Latvia

Recording at the edge of the Sahara

Meeting engineers near Douz, Tunisia

Hydrophone recordings in Louisiana mangrove swamps

Louisiana flood defence wall

ONLY EXPANSION

While I intended to use some of the existing field recordings from Dark By Then, I wanted to expand the range of material for Only Expansion.

I continued an exploration of water but looked for more present/local sources. Primarily the Suffolk coast (for conceptual drive I retraced W. Seabald's route from The Rings of Saturn) and the crumbling cliffs that are letting houses fall into the sea. As a counterpoint to the water based stories I also decided to return to the United States to explore the impact of wildfires in California.

Houses on Suffolk's crumbling hilltops

Burnt forest near Whiskeytown, California.

Remains of housing estate after Carr fire in Redding, California

APPENDIX 07: STRUCTURAL ELEMENTS

As part of my Masters in Research (Scoring the World: Compositional Strategies For Structured Experiences, 2016) I developed a set of methods for using pre-recorded audio and spoken instructions in soundwalks that led to repeatable and observable experiences for participants. I call these methods 'structural elements' and I continue to use them repeatedly in my practice and research (including the work undertaken in the current thesis). What follows is a description of the form and effect of each of them:

Settling (and its inverse) - this is the transition from the participant being 'in the world' to 'in the work'. This is a not an instantaneous moment once the headphones are put on and the sound starts. No lights are dimmed, no curtain rises, the participants' physical environments have not changed and it can take a few minutes for them to feel inside the experience. In practical terms this leads to the creation of a temporal buffer, where for a period of time the sound is bereft of key content as the participant may not be fully engaged and ready to receive it yet. This is equally true of the participant leaving the piece at the end, a rapid transition from key content back 'into the world' may be disorientating. Equally this effect can be used to create an experiential shock if no buffers are used, dropping a participant immediately into or out of rich content may be a desired aesthetic.

Shifting Space - This element uses transitions in the sonic content to change the participant feelings or perspective about their surroundings. While the specific feeling they take on is very subjective (and I have not nor do I wish to quantify it) it is clear that something shifts. The shift in the content may not even be consciously observed by the participant (see appendix) even though they might clearly describe the shift in their mood.

Shifting Focus - the introduction of musical elements whose source could be identified (e.g. recognisable instruments over abstract textures) caused a cognitive shift and changed the type of elements the participants focused on in their surroundings.

Stasis - this element draws on cultural associations with the cinematic image. By

instructing participants to stand in one location and simply view their surroundings, playing music leads to participants describing the experience as if ‘watching a film’. This effect appears to become more pronounced if there is only music or abstract sound (I.e. No field recordings or recognisable non-musical sound sources) and the headphones have some level of acoustic isolation. My proposition for why this effect occurs is that watching a recorded moving image is the only really moment where we might see the world without its actual sound (if the soundtrack is non-diegetic), and as such using this element recreates part of that experience. This element can be used while participants are moving but their need to navigate/engage with world can sometimes distract from simply ‘watching’. Though if this mode of experience while they are stationary it is often retained once they begin moving.

Isolation - This element is dependent on text or verbal instructions, and asks the participant to find a location where they are alone, and brings with it a focus on the self and a sense of intimacy in the experience.

Shaped Agency - in the creation of works that offer agency to the participant, for example in their choice of route, this element creates restrictions that allow the author some degree of knowledge about the participants experience. This element may involve setting the starting location of a piece, for example by a waterfront, so that if the participant is free to choose their direction of travel the author knows that it will be restricted by the water. It may use temporal restrictions, so the time a participant is given to complete a task is fixed, letting the author know the arc of the sonic content regardless the participants actions.

APPENDIX 08: DARK BY THEN SCRIPT

Full transcript of the spoken narration from *It Must Have Been Dark By Then*:

INTRODUCTION

So,
The text that you just read,
those words on the page,
they were not mine.
Did you imagine a voice speaking them?
What was it like?
Whatever it was like, it was not this voice. Not my voice.
My voice is just here to guide you, to help you make a kind of map
To create this new map, I'm going to sometimes ask you to read certain chapters of the book, and sometimes I'm going to send you on journeys, seeking things out
I hope that's ok.
We'll explain more to you as you go along.
Right now you should just open the book again.
And turn to chapter 01

[AFTER READING CHAPTER 1 – SOMEWHERE]

Once you've marked the page and closed the book,
have a look at the screen of your device,
There's a blue dot on the screen, this is your current location.
You'll also see a circle around your location.
There will be no other markings on the screen,
no roads, no buildings. You'll have to find your own way around the physical obstructions that are not marked

The circle marks a place, some locations you will have to choose, some will be chosen for you.
The map you are making is designed to be looked at from above,
It is a map that you will be inside,
You will create it by walking the city
The things you will be mapping can't really be represented on a screen.
For now
you should just start walking,
leave the shelter of this building,
it doesn't matter which direction,
I'd like you to really travel though. You don't need to look at the screen of your device while you walk.
Just let your instinct guide you for a while.

As you walk
Feel free to drift, to let the world push and pull in the direction you feel is right.

But try and pay attention to the route you're taking. Later on we're going to ask you to retrace your steps

Where are you right now?
You could be anywhere, in any city, any town,
somewhere near you there are probably people's homes.
apartment blocks, houses, flats above offices.
Could you try and find one of these places
some kind of place that people live in.
Wherever it is just try and get quite close to it.
When you think you've chosen the right place
just tap the button on the screen of your device

FOUND BUILDING

Do you feel comfortable where you've stopped?
Buildings seem so solid but our cities are always in flux,
some structures come and go like the tide.
Some have been brought down at the least expected moments.
How long do you think this has been here?
Maybe this building isn't new to you, maybe you've been in this location before,
has anything changed since you were last here?

Will you be able to remember this place?
You're going to come back here later, so try and memorise what's around you right now. Can you recall the route you took to get here?

Look again at the building you chose.
Who might live there? What can't you see?
What do you think might be happening inside? **
When you're ready, you should read chapter 02 in the book

[AFTER READING CHAPTER 02 – MARCIS]

Today you're walking a map of relationships,
between you and this city
between here and somewhere else
between you and another.

Have a look at the screen of your device.
you should see there's a circle around your current position marking this place.
A new circle is about to appear nearby.

Can you see the new circle on the screen?
In a moment that's where you will be going.
With no landmarks it can sometimes be hard to navigate.
At the end of chapter 01 in the book there is a map that will help you get there.
Have a look at it now..
The circle at the bottom represents where you started.
The one in the middle labelled Jekapils represents where you are now.

The one labelled Zilupe is where you are going.
Can you see how to use the map? First, you should turn your body so that your back is towards where you started the whole experience.
Now if you hold the book flat in front of you, the arrow pointing towards Zilupe shows the direction you should begin walking.

You'll see the blue dot on the screen of your device moving, it can sometimes take a moment to catch up, so don't worry if you don't see it moving straight away.
You'll need to walk until the dot is inside the new circle.
As you walk you will still need to navigate the city you are in right now, so keep your eyes open. there might be barriers, or maybe places you can't access.
If you really can't find a way to get there just tap the button at the top of the screen.

[ARRIVING AT CHAPTER 03 ZILUPE]

Ok

You're here //

You're about 70m from where you were a moment ago

It's close to where you just were, but do you notice the differences?

How far must we travel before we're conscious of the small(est) shifts?

In the book, you should now read Chapter 03.

[AFTER READING CHAPTER 03 ZILUPE]

You can put the book to one side again now, use the bookmark to remember your place.

This was the first real edge that they reached on their journey across Latvia. The presence of the Russian border police meant they couldn't go any further.
Right now you're free to travel where you want.
So now you should just walk, and keep walking, in any direction you choose.

Are there many other people here right now?
could you imagine this place with no one in it
when not even you are here,
the world without us

Ok
Could you stop where you are for a moment?
look at what's around you right now. What is the ground like under your feet? Is anything growing there?
We shape the places we live in.

We designate where plants and trees should grow.
We create shelter from the weather and channels for water.
but there are always things pushing through the cracks.
Take a look at chapter 04 in the book now, it's quite short.

[AFTER READING CHAPTER 04 MOUNA]

Ok you can leave Mouna here now, but remember this place. You're going to come back here later, so choose something that will help you find it again.
Then put the book to one side and just keep walking in the same direction you were already going.

Wherever we choose to live, to build our settlements
there's nearly always water somewhere nearby.
Some of it is in plain sight,
the canals and rivers that we build bridges over,
but it is also often beneath our feet,
it's path only revealed by drainage covers and access points.

Can you find some water now,
water that is moving, it doesn't matter if it's visible or not.
It could be a river,
Or It could be just be marked by a metal grate in the pavement,
it could be a fountain or a canal.
Whatever you choose, just be sure that you are close to it when you use the button on the screen to mark it.

remember the water in our cities is not always so visible, it might be hidden under a drainage cover. Sometimes it's just marked out by metal plates in the pavement

Even when everything seems static around you, there is always movement in the water. Can you see the surface of the water, or is hidden from you? What brought this water here? What is carried in its flow? Right now this water runs below your feet, but one day everything here might well be under water, and what was once invisible beneath will be floating above your head. You should read chapter 05 now.

[AFTER READING CHAPTER 05 – PORT FOURCHON]

When you're ready you should move on from this location.
Maybe there's a way you could keep travelling in the direction that you think the water is flowing.
Try to follow it as far as you can.
And Try to remember the route you're taking so you can come back here later.

Ok
Can you stop where you are again.
Is there somewhere here you can rest for a moment?

Somewhere to lean or sit, where you can read comfortably without feeling exposed.

Sometimes we don't get to choose where we settle.
We are forced to take the refuge offered.
We build homes on land that has been sometimes gifted, and sometimes taken.
Have a look at what's around you right now,
Will you remember this location?
Who first built this place?
Who first staked their claim here?
And who owns it now?

You should read Chapter 06 now.

[AFTER READING CHAPTER 06 DOUZ]

Now, Have a look at your device again.
Can you see the blue dot marking your position, the circle you're in right now represents Douz.
A new location is going to appear on the screen for you now.

Can you see the new circle?
You'll need to walk until your blue location marker is inside the rings again.
There's a map at the end of the chapter you just read that can help you.
The circle marked 'port fourchan' represents the place where you found water, make sure your back is towards there before using the map.
To get inside the new circle, you need to walk in the direction of the Oasis.

[ARRIVING AT CHAPTER 07 OASIS]

Ok this is the place.
If you look back, can you still see the location you were at just a moment ago, it's close, but is it still within sight?
Imagine you could never go back there,
Imagine it was buried beneath sand dunes.
what would be lost to you?
What of it would you remember?
And what would you miss?
You should read chapter 07.

[AFTER READING CHAPTER 07 OASIS]

When they stood at the edge of the oasis they could only see sand dunes stretching out to the horizon.
What's the furthest point you can see from where you are right now?
you should begin walking in that direction now,
You're not expected to get all the way to the point you're looking at,
Think of it more like a beacon,
a navigational star that shapes your direction, An aspiration,
That marks the edge of what you know.

As you walk you're probably looking at your surroundings, maybe at the people passing, maybe at the architecture.
We look a lot, but we rarely reach out to feel the texture of what's around us, to touch it. There is a repetition of material in our cities. Stone, glass, concrete, wood. Could you try and find some wood? It could be part of a structure, or maybe a tree. When you find some just mark the location again.

the wood you've found. Is it still alive? What you've found, is it still alive?
Can you put your hand against it for a moment. Where do you think it came from?
Was it planted here? was a tree cut down to make it? It's such a porous thing, absorbing so much from its surroundings. Everything around you now, the breath and fumes in the air, dust and dirt blown in the wind, sunlight and rain, all leaving their traces.
You should read chapter 08 now.

[AFTER READING CHAPTER 08 – TALSI]

Ok, when you're ready you should leave this place now and just keep moving onwards. You're going to reach the edge of your map soon.**

How many real choices have you made on your walk so far?
Maybe you've just followed familiar routes, or just drifted through this place. Right now you should try to find some kind of junction.
A place where you'd need to make a conscious decision about which route to take.
When you get there just mark the place again

So this is the junction you've chosen.
How many paths are open to you?
How will you decide which way to go?
Don't make any decisions yet…
Before you move on you should read chapter 09

[AFTER READING CHAPTER 9 ROADS]

Ok, it's time to make a decision about which way to go.
Did you already have a choice in mind?
Maybe you could work against your natural instinct?
or just begin walking the way that feels right,
In a moment you're going to find the edge of your map.

There was a time when none of this was here
and there will be a time when all of this has gone.
There will be a time when you cannot walk here.
The defining of our borders and territories is often out of our hands.

Ok. Could you try and find some kind of barrier?
A point you cannot pass.
It could be somewhere you're not allowed go into.
Maybe a door that to you remains closed.
maybe a door that you're not allowed through

Maybe a locked gate, or a secure fence.
Something that blocks your path.
Something that refuses entry.

This is the edge, the furthest point of your journey.
Can you read comfortably where you are?
If you're not then find somewhere very close by, where you can still see what you picked.
What does this barrier protect?
Can you see what's on the other side of it?
This location might not seem so important, but right now it belongs to you.
You're the only one who knows why you chose it,
and now it exists as the edge of your map
the last point of your outward journey.
You should read chapter 10 now.

[AFTER READING CHAPTER 10 – LAFITTE AND THE WALL

Every person that walks these stories will create their own map.
But this one is yours.
And this is the moment where you will walk through it,
you're going to return to where you started, travelling inside the map you made.
Can you remember all the places you stopped?
Where you found wood, the oasis you walked to, the junction and all the other marks you made.
You won't need the book for this part of the journey, and you probably won't need to look at the device,
just try to retrace your steps,
The order isn't so important,
and you don't need to stop when you reach the locations,
Just try and make sure you walk through all of the places as you travel back to where you began

As you leave this last place, take a look back at the barrier you chose,
the edge of your territory
the edge of your map

[EXTRAS FOR ERRORS]

[CAN'T GET THERE (ZILUPE)]

01 - we're always dividing the land, and move borders rapidly. We're going to move the location to a place much closer to you, if you look at the screen of your device you should see it move in a moment, maybe you can get to it now…

02 - ok, this location will remain forever out of your reach. There are some places you just aren't allowed to go, you can just carry on walking now.

[CAN'T GET THERE (OASIS)]

01 - the dunes in the desert are constantly shifting, sometimes it is hard to find the right route, and we have to rely on older methods of navigation.
Do you know which was north is from where you are? We're going to move the location, so that it is 40m north of where you are right now. If you look at the screen of your device you should see it move now.

02 - This location is fluid, and the wind has carried it to where you are right now. Take a look around you, remember this place, this is now your oasis.

[RETURN AUDIO]

Just keep retracing your steps
so much can change in so little time
but the marks of those changes remain
there will come a time when none of this is left
and before it goes we try to preserve what seems valuable
what seems worth keeping
but we don't always get to choose what we will remember

[ROADS]

we carry the weight of our decisions
and struggle to justify the simplest ones
we listen to denials of action
and responsibility is handed over

[TALSI]

Somewhere the stars are always visible.
and there is hope and commitment
even when those around me have left.
Grass has grown over the wooden skeletons of the farmhouses.
Just underneath the map something is ok
and something is in fragments

[DOUZ]

You're following a line that only you know.
You were only in this place minutes ago
but things have already shifted
and tomorrow the ground will forget you were here
now I am 12 and there is more salt in the water
now I am 20 and no one tends the oasis
now I am 35 and I work in a hotel
now I am 70 and the sand is reaching the north

[PORT FOURCHON]

there are things that I remember
now I am 7 and I am playing in the mangrove swamp
now I am 10 and my uncle sits with his shotgun and whisky
now I am 56 and there is still oil in the sea
I can hear the water rising,
there's a storm coming, and someone's got to give me shelter

[MOUNA]

what has grown since you were here before
and what has disappeared under the sand
which maps will need to be redrawn?

[ZILUPE]

we maintain so many borders
but there are divisions we try to forget
what is left of the places we claimed as our own
and of those that we wanted to share

[MARCIS]

as you return to the beginning of your map
you pull back it's edges with you.
What is behind you is just memory.
Tied to places that only you know.
Which of these buildings has its own memories?
One day they will lie empty.
Hoping to be filled again.

[SOMEWHERE]

there is always something happening somewhere else
and there are always fault lines
fissures hidden by apparent sheen
we know dying, losing and forgetting
just underneath the map
something is ok
and something is in fragments
I hope you remember being here now
They will remember you