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Constructing Performance Scenarios:

Exploring the Action, Ensemble and Arena Spaces of Performed Music, Through Composition

Hollie Harding

PhD Creative Practice

Commentary

Trinity Laban Conservatoire of Music and Dance,

Research Department, April 2019

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CREATIVE PORTFOLIO CONTENTS

Scores and documentation are available at:
hollieharding.com/constructingperformancescenarios
Password: **TrinityLaban**

PIECES

- *Mirror* (2016) – Sinfonietta, 8 minutes
- *Mixed Messages* (2017) – Percussion Quartet, 24 minutes
- *by breath and bow* (2017) – Flute, Bb Clarinet, Violin and Cello, 8 minutes
- *bellows, breath and bow* (2018) – Flute, Bb Clarinet, Accordion, Violin and Cello, 9 minutes
- *Extension* (2018) – Solo Cello, 4 minutes
- *Motion* (2018) – Solo Cello, 7 minutes
- *Melting, Shifting, Liquid World* (2019) – Solo Electric Viola, Electronics, String Ensemble [6.5.4.4.2] and Fixed Media delivered over Bone-Conduction Headsets, 32 minutes

STUDIES

CoMA Studies (2017-2018) – Open Score

- *Spatial Study on D* (2017) – 6 minutes
- *Spatial Study on Rotation* (2017) – 15 minutes
- *230 Strings* (2017) – 8 minutes
- *Graphic Score II* (2017) – 10 minutes
- *Traverse the Score* (2018) – 15 minutes

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Declaration

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Abstract

This research includes seven pieces, five musical studies and a written commentary created in order to explore the different interlocking and dynamic types of space present in performed music, through composition. The research considers the relationships between sounds; performer's physical actions, spaces and spatial placements, in order to (1) generate alternative listening and viewing perspectives for audiences, and (2) identify alternative methods for generating and developing musical ideas, beyond sounds.

The approach taken in the research begins with imagined performance scenarios that are developed, refined and realised as performances, through experimentation and collaboration with performers and audiences. The overarching concept and construction of the performance scenario framing this enquiry, is built out of three types of space: Action Space is the space of the performer and their instrument, Ensemble Space is the inter-subjective, interactive space between performers, and Arena Space is the entire public space of the performance, and includes the audience. These different spaces are explored in order to uncover new approaches to using spatial placement and physical action in composition including (1) the applied use of Carnal Musicology as a compositional tool, and (2) the use of bone-conduction technology to create multi-layered, immersive listening environments.

The creative portfolio and commentary draws together two previously separate threads of research and activity in composition – space as a compositional parameter, and physical action as a compositional parameter. It also examines practical and logistical issues that arise when working with performers in varied spatial placements.

Introduction

When composing I have noticed that my starting point is always an imagined performance scenario. These scenarios may include a visualisation of an instrument or instruments, a particular performer or ensemble, or a particular venue. They might begin with an imagined physical action acted out by the performer(s), with a particular relationship between performers and audience, or with a certain sound world or atmosphere. These scenarios are always built from a combination of imagined sonic, physical, spatial and visual ideas that morph, change and gain clarity over time, through realisation, experimentation and trial and error.

The compositional process is the means through which I develop and realise these initial imaginings into a concrete musical work with performers, designed for an audience. The scope, accuracy and detail of my imaginings are expanded through research, experimentation and collaboration with performers in a cyclical process. The commentary reflects this cyclical process of practice as research, and therefore takes the form of a dialogue between the creative exploration of ideas in practice and relevant context and theories surrounding these approaches.

The key line of enquiry throughout the creative portfolio is an exploration of how an initial reconfiguration of the performance space can impact upon and influence all other creative choices. This includes considering ideas such as multiple performers playing on one instrument, seen in works *230 Strings* (2017) and *Mixed Messages - Movement II* (2017); spatial separation and movement of performers, seen in *Spatial Study on Rotation* (2017), *Spatial Study on D* (2017) and *Mixed Messages –*

Movement I (2017); mobile audiences, seen in *Traverse the Score* (2018) and *Melting, Shifting, Liquid World* (2019); and utilising a new technology (bone-conduction headsets) to create immersive, multi-layered sonic environments, explored in *Melting, Shifting, Liquid World* (2019).

My interest in varying the construction of the spaces of music performance has, no doubt, been fostered by more than ten years of working as a freelance events producer and curator. Through working for contemporary music festivals such as Borealis Festival[1], London Ear Festival[2], and CoLab[3] at Trinity Laban, I have had the opportunity to facilitate and manage a huge variety of different musical performances with a diverse range of approaches to the sharing of live music with audiences. This first-hand practical experience has firmly established the reality of a musical composition as much more than a notated score or part, instead considering it holistically as a live performed event acted by musicians, shared with an audience in a specific way, and in a specific environment and setting. As a result, elements of music performance such as performer and audience placement and movement, setting, venue, and performer physical action have all become compositional parameters that can be explored, imagined, and formalised alongside sound.

The chosen construction of the performance space of a composition is usually motivated by a number of different interlocking ideas surrounding the conceptual foci of the work in question. In *Mirror* (2016) for example, the use of an unseen ensemble was primarily borne out of ideas relating to the chosen source text, *Mirror* by Sylvia Plath (Plath 1961), which gave

[1] borealisfestival.no/en/ (Borealis Festival, accessed April 2019)

[2] londonearfestival.co.uk (London Ear Festival, accessed April 2019)

[3] trinitylaban.ac.uk/creative-innovation/colab (Trinity Laban, accessed April 2019)

the theatrical idea of having unseen and distant sound sources reflecting and expanding on the visible foreground sound sources – a hidden ensemble through the looking glass. Whereas, in *Spatial Study on D* (2017), the distribution of the performers across the Arena Space and around the audience, all playing similar sounds on different instruments, was motivated by a desire to explore the impact of spatial separation upon the role of the listener, and to use spatialisation to develop material, as an alternative to developing material harmonically or melodically.

Commencing a composition through the construction of a performance scenario, throws emphasis onto the physical actions and spatial placements of the performers. Visual, kinaesthetic and spatial elements of performance therefore become as important as sounding elements. I explore physical actions as source material for composition in two works for solo cello: *Extension* (2018) and *Motion* (2018) developed in close collaboration with cellist and researcher Amy Jolly. A different manifestation of the influence of the physical on compositional processes can be seen in *by breath and bow* (2017) where the players' unison breathing determines the pace of the sonic and visual action alike. In *Mixed Messages* (2017), the varied physical placement of the four percussionists for each movement of the piece determines everything from the performer's interactions to the spatial orchestration of ideas.

I have realised that my starting point of an imagined performance scenario, which I initially overlooked, is key to understanding my creative motivations and processes. From this approach, composition becomes concerned with exploring the relationship between sounds, physical and

visual actions, and the setting, and considers the dramatic, social and perceptual potential of this action-to-sound-to-space relationship. What emerge as a result are works that embrace a holistic approach to composing music in order to create live, shared experiences between audiences, performers and participants.

The creative portfolio contains twelve original scores, listed on page 4 of this document. Supporting documentation from performances can be found via the link provided on that page. Wherever possible this documentation includes video footage and a binaural recording that should be listened to using headphones. I elected to record most of the documentation using a binaural microphone as it was the most cost-effective method of capturing moving performers and sound sources, and making immersive audio tracks from the perspective of a listener attending a concert. This approach assumes that there is no optimal viewing and listening position[4]: the reader should be aware, however, that nothing can ever truly replicate a live experience.[5]

The commentary focuses on some key ideas that require prior explanation. In the first, contextual chapter, I identify an interest in the sound, action, performers, objects, placements and spaces in live music performance as concerned with music's presence and *presence-effects* (Gumbrecht 2003); the tangible and perceivable parameters of music that

[4] As Henry Brant explains, "Spatial music must be conceived in accordance with the premise that there is no one optimum position in the hall for each listener, and no one optimum distribution of the players in only one ideal hall…Spatial music must be written in such a way that the composer is able to accept what he hears as a listener, regardless of his position in the hall." (Brant 1967, p.224).

[5] This is particularly pertinent with regards to the concluding work of the portfolio *Melting, Shifting, Liquid World* (2019) where one of the layers of sound is delivered to the audience over bone-conduction headsets; therefore the multi-layered aspect of the work can only be experienced live.

exist independent of inferred meaning. Space in this context refers to embodied, perceived, lived, corporeal space. In this approach, given musical understanding is experiential, a discussion of experiential cognition (Reybrouck 2005) is therefore undertaken.

Where the word *embodied* appears, it refers to the idea of *embodied cognition* (Lakoff & Johnson 1999) where understanding is acknowledged to be shaped by aspects of the body of the organism. The aspects of the body that shape cognition include the motor system (movement), the perceptual system (information captured by the senses) and bodily interactions with the environment (situated-ness). Where the word *immersive* appears, it refers to works that "…surround the audience, player, etc. so that they feel completely involved…" (Cambridge English Dictionary, accessed April 2019).

The approach to the construction of the performance scenario taken in this thesis determines the commentary title, structure and chapter headings. These all relate to Edward Hall's theory of different layers of personal space, called *proxemics* (Hall 1969), which was later borrowed by Dennis Smalley to briefly introduce the different interlocking and dynamic types of personal space present within a musical performance. The physical action of the performer, applied to their instrument, is defined by Smalley as the *gestural space*. I have chosen to adopt a new terminology for this spatial layer, calling it Action Space, as this describes, less ambiguously, performer movement and physicality; this is considered in *Chapter Two: Action Space*. *Chapter Three: Ensemble Space* considers the personal and social space among performers and also looks at practical and logistical solutions to working with spatialised performers.

Finally, *Chapter Four: Arena Space* considers the overarching space inhabited by the performers and observers alike (Smalley 2007, pp.41–42).

The text considers two bodies of research and activity in contemporary music in order to support the creative practice: (1) space as a parameter of composition, and (2) physical action as a parameter of composition. I explore the latter area physical action, through two elements (a) the applied use of *Carnal Musicology* (Le Guin 2006), a relatively new methodology used to describe the physical and phenomenological aspects of music performance in order to unlock new understanding, an approach previously under explored by established methodologies of music theory and analysis. The second (b) includes discussions of *Instrumentale Theatre* concepts developed in the works of Mauricio Kagel and John Cage, and Helmut Lachenmann's *Musique Concrète Instrumentale*. The former body of research, relating to the use of spatialisation in composition ((1) above), considers key observations made by other composers such as Henry Brant and Charles Ives regarding the use of space as a compositional parameter. I also highlight the relationship between composers' explorations of space as a material and metaphorical concept, and wider philosophical and perspectival theories.

These two broad areas of creative activity and research in contemporary music (points 1 and 2 above) seem, at times, to emerge from diametrically opposed conceptual and philosophical starting points. However, I find that an increased general awareness of the importance of embodied cognition (Lakoff & Johnson 1999) and bodily presence in the making and perception of music has resulted in a more unified approach to the

parameters of space and physical action in my work, and in the work of my contemporaries.

CHAPTER ONE: CONTEXT

> *"…more and more music is being made and listened to without any recourse to mechanical production beyond the vibrating loudspeaker cone. Most music now heard appears to present little evidence of living presence. Yet we persist in seeking it out"*. (Emmerson 2007, p.xiii)

Presence in Music

In our digital age, where the economy centres on the intangible world of information with ever-increasing methods of distance communication[6], face-to-face human interaction is becoming increasingly important to me. The live performance of music is a social and corporeal physical activity; it requires individuals to collaborate to make it and an audience to share it with. The physical and social aspects of creating, sharing and making music are among the most fascinating aspects of composing, the process of taking something imagined and making it real – with real people, acts, objects, spaces and places.

This research enquiry is therefore initially motivated by a desire to seek out, highlight and explore those tangible aspects of music performance within composition. The research aims to demonstrate that the corporeal parameters of music performance can be of great importance to compositional processes, and that there can be added social, perspectival

[6] By distance communication I mean any interpersonal communication in which the physical gap between the participants is beyond the physiological limits of unaided human perception (Chandler & Munday 2011).

and experiential value to attending and participating in live music, as opposed to consuming music in isolation[7].

In his book *Production of Presence: What Meaning Cannot Convey* (Gumbrecht 2003), Gumbrecht argues in favour of a *presence-based* philosophical approach, arguing that an historical emphasis on interpretation in academic intellectual practices leaves our understanding incomplete. A *meaning-only* model of understanding, in his view, does not account for the subjective experience of the arts. He believes that there is a "tendency in contemporary culture to abandon and even forget the possibility of a presence-based relationship to the world…a systematic bracketing of presence…against the uncontested centrality of interpretation, in the academic disciplines we call 'the humanities and arts'" (Gumbrecht 2003, pp.xiv–xv). In Gumbrecht's view, a complete understanding of the world can only be generated through tension between *presence-effects* and *meaning-effects*, in other words, through a balance of lived experience and interpretation (or our search for meaning).

Performed music is an inherently spatio-temporal art form: it occurs in a physical location, it is perceived through the embodied senses of its observers, and it is generated through the physical actions of its performers. Actions are applied to specific objects to make specific sounds at specific timings, in specific positions within the performance space, and in specific positions in relation to audiences and performers. All performed acoustic music requires a location, a placement within that

[7] I hold this view even after reading Auslander's, *Liveness: Performance in a Mediatized Culture* (Auslander 2008) – because personal experience finds that live performances are often unique acoustic, perspectival, spatial and embodied social experiences.

location, an action, a performer, a sounding object, sound and an audience. These fundamental components are the *presence-effects* of music, where presence is "the spatio-temporally located existence of physical objects and events" (Gumbrecht 2006, p.317) and "is in front of us, in reach of and tangible for our bodies" (Gumbrecht 2003, p.17).

These *presence-effects*, perceived through our senses, make up the lived experience of an artistic work (Gumbrecht 2003, pp.91–132). From this perspective, the lived experience of a composition extends beyond the sound. Compositional parameters therefore expand beyond the score and the sound, to include everything from the requested presence of certain objects, instruments and performers in certain placements within certain venues, to the physical, kinaesthetic and visual parameters of sounding-actions. This research explores how changes to the corporeal aspects of the performance scenario can offer new perspectives for the audience, the performer and the composer.

Gumbrecht believes that our desire for presence is motivated by a desire to "help us to recuperate the spatial and bodily dimension of our existence" and "give us back at least a feeling of our being-in-the-world, in the sense of being a part of the physical world of things" (Gumbrecht 2003, p.116). By focusing on the tangible parameters of the music, I aim to highlight and enhance awareness of the spatial and bodily experiences of music, for performers and audiences. This approach lends itself to the collaborative development of ideas with performers through experimentation and direction, and fosters a holistic approach to composition, as a live performed, shared experience.

Gumbrecht's statement above inspired me to consider how the observer perceives the corporeal aspects of music. His approach seems to resonate with philosophical ideas relating to *embodied* and *experiential cognition* (Lakoff & Johnson 1999). The body must be central to his approach, since in order for the tangible aspects of the world to be acknowledged, they must be perceived by the observer through their senses and through their bodily *presence* in that world. His ideas also seem to resonate with Merleau-Ponty's conception of space as lived and immersive:

> "Space is no longer . . . a network of relations between objects such as would be seen by a witness to my vision or by a geometer looking over it and reconstructing it from outside. It is, rather, a space reckoned starting from me as the zero point or degree zero of spatiality. I do not see it according to its exterior envelope, I live in it from the inside; I am immersed in it. After all the world is all around me, not in front of me" (Merleau-Ponty 1962, p.178).

Our understanding of music from this point of view becomes influenced by our *embodied* and *lived* experience of the physical, mechanical and tangible environment. In our everyday lives, we are immersed in sound: we can be mobile or static, and sounds can emerge from moving or stationary sources. The human auditory system is able to localise sound in three dimensions – the azimuth or horizontal angle, the zenith or vertical angle, and distance (for static sounds) or velocity (for moving sounds). We are able to determine the horizontal localisation of sound based on interaural differences of timing, timbre and head-shadow. Distance is determined through the ratio of direct or reverberated signal, loss of high frequencies and loss of detail with increasing distance. Velocity is determined through pitch change, called the *Doppler shift effect* (Roads 1996, pp.457–469).

Part of the aim of this research is to explore how these aspects of our three-dimensional, embodied hearing system can be utilised within a composition to generate different listening perspectives. I have therefore created several pieces of music where performers and audiences are able to move as a part of the composition, and where sounds can potentially happen in front of, behind, and all around the listener for examples see; *Spatial Study on D* (2017), *Spatial Study on Rotation* (2017), *Traverse the Score* (2018) and *Melting, Shifting, Liquid World* (2019).

Experiential Cognition and Music as Environment

In "Body, mind and music: musical semantics between experiential cognition and cognitive economy" (Reybrouck 2005), Reybrouck argues that adopting an embodied approach to musical understanding "stresses the role of sensory-motor experience and interactions with the sounds – both at the level of manifest and virtual interactions" (Reybrouck 2005, p.2). Reybrouck cites this approach as being related to the early claims of cognitive musicology, quoting Laske, "[score analysis] of music misses the crucial point that music is above all a human experience, not merely a set of artefacts or 'structures'" (Laske 1977, p.71). This strand of cognitive musicology is also the origin of *Carnal Musicology*, a physical and embodied form of musical analysis utilised in *Chapter Two: Action Space*.

Reybrouck suggests that as a result of experiential cognition, "each theoretical discourse about music therefore should deal to some extent with an understanding of bodily activities – if only at a subliminal level – that are involved in the production and perception of sounds". This becomes problematic, however, because "…there is a considerable amount of music which obscures the recognition of sounds as the result of

sound producing actions" (Reybrouck 2005, p.3). Reybrouck is referring to acousmatic music and 'reduced listening' where sound is considered "…for its own sake, as sound object, independent of its causes or its meaning" through "isolating the sound from the 'audio visual complex' to which it initially belonged" (Chion 1983, p.18).

However, even in acousmatic music there is some natural search of auditory source-images, which Reybrouck claims is typical for listening in general. He states: "auditory cognition involves source-knowledge (Bregman 1990; McAdams 1984; McAdams 1993) and this in a cross-modal way (motor, kinaesthetic, haptic and visual besides purely auditory components). As such listening can refer to auditory sources, to sound producing actions and to the associated kinematic images (Godøy 1997; Godøy 2001)" (Reybrouck 2005, p.3). In other words, even listening when a sound source may be obscured involves an internal search for the *presence-based* source of the sound, for a relationship to source that has been previously experienced multi-modally by the listener in the environment. This concept is also discussed by Dennis Smalley in his "Spectromorphology: explaining sound shapes", where he calls it 'source-bonding' (Smalley 1997, p.110).

Reybrouck determines that music perception is "conceived in terms of organism environment interaction – with the music user as an organism and the music as environment" (Reybrouck 2006b). Further, if music is an environment, "human beings - are sensitive to the functional characteristics of their environment. They perceive environmental objects in terms of what they 'afford' for the consummation of behaviour rather than in terms of their objective perceptual qualities" (Reybrouck 2005,

p.25). Reybrouck finds that it is therefore possible to consider music as an environment in terms of a metaphorical sonic landscape or "perceptual aspect" tied to memory, with "places to be labelled in perceptual or action terms"(Reybrouck 2005, p.26).

Musical affordances can also relate to music as an "action aspect" or manifest activity:

> "There are, as yet, many possibilities that stress the "action aspect" of dealing with music. I mention five of them: (i) the sound producing actions proper, (ii) the effects of these actions, (iii) the possibility of imagining the sonorous unfolding as a kind of movement through time, (iv) the mental simulation of this movement in terms of bodily based image schemata and (v) the movements which can be possibly induced by the sounds" (Reybrouck 2005, p.26)

This research primarily considers points (i) and (ii) of the above 'action aspects' of musical affordances, focusing on the sound-producing actions proper and the effects of these actions. Whilst it is of lesser focus in this research, I also follow Reybrouck's notion of music as an environment or metaphorical sonic landscape where sounds unfold as a kind of movement through time, and where the imagining of this movement directly relates to our embodied, lived experience.

Metaphorical Musical Space

The concept of a metaphorical 'musical space' is complex and fluid. Harley, in her *Space and Spatialisation in Contemporary Music…* (Harley 1994), gives a comprehensive account of a variety of different notions of musical space, "…revealing a range of disparate conceptions of music" (Harley 1994, p.108). She finds that "the meaning of space in music

depends on the notions of 'space' adopted for each enquiry" (Harley 1994, p.109). Some of her varied examples include: Adorno's "withdrawal of time into space" – where it is music that lacks development and direction that should be considered spatial; Webern's composition as configurations of points and blocks of sound in a "pseudo-space" (Eimert 1958) which is either flat as a surface (pitch/time) or three-dimensional; or Xenakis' mathematical notions of space, borne out of the "outside-of-time" permanence of musical notation (Harley 1997, pp.109–111).

Harley finds that the notion of 'musical space' appeared "in the context of the romantic idealization of music conceived of as a purely temporal art. When music is a domain of disembodied, immaterial sounds, its actual spatial aspects of performance and perception are dismissed as irrelevant" (Harley 1997, p.109).

However, she goes on:

> "…if space means 'space', that is a segment of the physical three-dimensional expanse in which the performance of music is taking place, musical space is synonymous with the space of performance and perception…Here, the focus shifts from the question of 'how can space be musical?' to 'how can music be spatial?'"(Harley 1994, p.111).

My research follows this line of exploration, focusing on the three-dimensional space of performance as opposed to the disembodied, 'metaphorical space' of music unfolding only in time. Harley finds that there is a general shift towards the space of performance that results from "the emergence of new modes of perception and cognition. In contemporary music, literal space, previously considered 'external' to music, has become –to paraphrase the title of Henry Brant's important

article – an 'essential aspect of musical composition' (Brant 1961)" (Harley 1994, p.112).

This research therefore primarily considers the affordances of the manifest space of music performance. In *Chapter Two: Action Space*, I focus on manifest sound-producing actions and their effects, investigating ways in which a performer's physical action can be classified, tracked and mapped within a compositional process. In *Chapter Three: Ensemble Space*, I expand these ideas to consider how structural elements of a musical composition, such as foreground and background layers of sound, cues for change, or 'spatio-vertical' relationships between pitches, can be emphasised, re-enforced and made manifest for an audience through variations to performer placement and movement. In *Chapter Four: Arena Space*, I consider how spatialisation can be used to generate alternative listening and viewing perspectives for the audience.

Constructing the Performance Scenario

Thinking back to my imagined performance scenario as a starting point for a composition, it becomes clear that these visualisations are initially borne out of the imagined potential corporeal, *presence-effects* of a new piece. Aspects of the compositions that are fixed in advance usually start to determine the spatial boundaries and relationships of the imagined performance space. With an external commission, predefined elements would normally include the performers, the instrumentation and the performance venue, which all have predetermined physical and spatial characteristics. Whereas when the composer defines the parameters of a composition, the first things to consider are usually: (1) who is playing, (2) which instruments are they playing, (3) where is the performance is taking

place, (4) where are the audience, (5) what is the relationship between the performers, and (6) what is the relationship between the performers and audience. These initial decisions begin to give detail and definition to the imagined scenario, and to the different interlocking spatial areas and activities that will occur within it.

Dennis Smalley in his article "Space Form and the Acousmatic Image" (Smalley 2007) borrows Edward Hall's term *proxemics* (Hall 1969) to describe different dynamic types of space and spatial interaction in performed music. Hall introduced this terminology to describe interpersonal distances in four zones: (1) intimate space, (2) personal space, (3) social space and (4) public space, in widening concentric circles surrounding an individual. Each area of personal space has associated biometric concepts and norms that categorise and explain the way people typically interact and behave within the different zones (see Fig. 1).

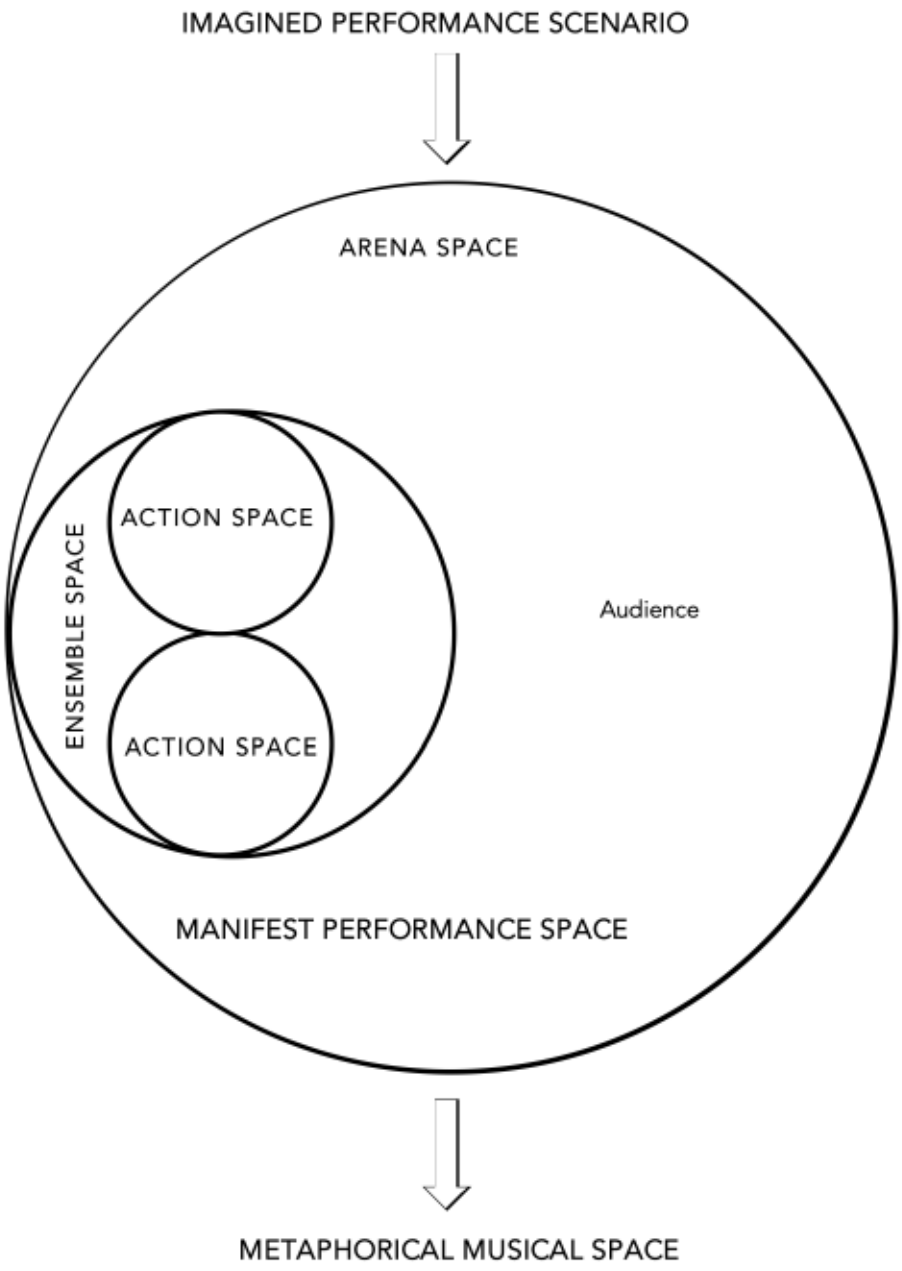
Smalley states, "in instrumental music we can identify mixtures of Hall's four zones at work, producing three spaces – gestural [action], ensemble and arena space" (Smalley 2007, p.41). While Smalley introduces these spaces in his article, the given exploration of them is only introductory, as the main focus of his article concerns acousmatic music which, as previously discussed, is a completely separate field in fixed-media. I realised, however, that these different interlocking layers of space and spatial behaviour that are introduced by Smalley, are present in all

performed music, and can subsequently inform the way that I construct imagined and realised performance scenarios (see Fig. 2).[8]

[8] In *Living Electronic Music* (Emmerson 2007), Emmerson also proposes a similar concept of Space Frames in relation to electroacoustic music which considers local and field spatial layers and sub-categories (Emmerson 2007, pp.97–98).

Figure 1 – Chart showing Interplay of the Distant and Immediate Receptors in Proxemic Perception (Hall 1969, p.76) [redacted]

Figure 2 – Dynamic Types of Space in Performed Music



In *Mixed Messages* (2017), one of the earlier compositions written as a part of this research, each of these dynamic types of space is considered in each of the movements of the work. The piece is therefore a useful way to explain the overarching concept of the different dynamic types of space in performed music. *Movement III,* for example, focuses on and highlights Action Space and the relationship between cause and effect by exploring actions that make sound, sounds without visible actions and actions without sound. In this movement, the players have foot pedals that resonate cowbells, removing the presence of the performers' physical action from direct view as it occurs in the feet, and the observer's focus is on the action in the hands.

In this third movement of the piece, the performers are also positioned in a line (see Fig. 3), and the material is spatially orchestrated: at the beginning of the piece the melody passes consecutively, hocketing along the line of players in sequence. As the movement progresses, and increases in complexity, more and more left-to-right motion and physicality is demanded of the players so the pace of physical action in the work moves from something comparatively static to something very active.

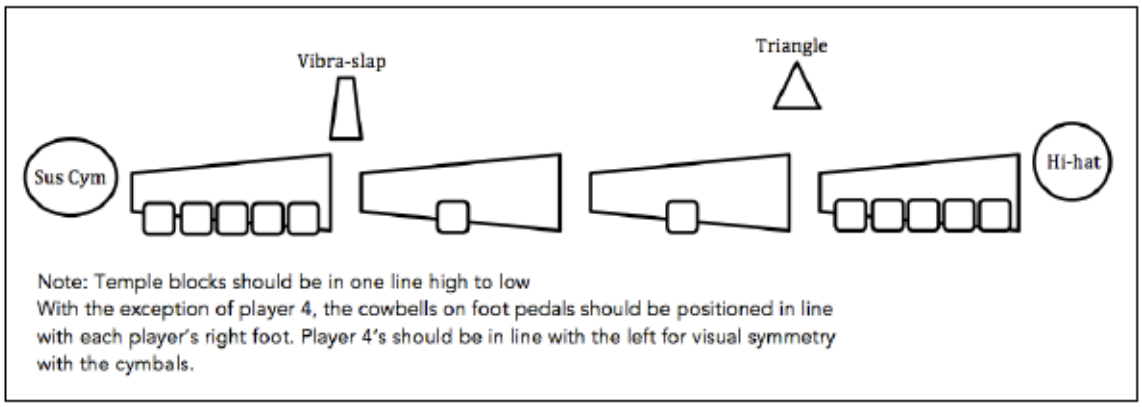


Figure 3 – Set-up Instructions, *Mixed Messages - Movement III*

(Harding 2017)

Movement I, in contrast, explores the outer dimensions of the Arena Space by positioning performers around the audience and in offstage areas rather than solely on the stage (see Fig. 4). Here the rotating action, enacted by the performers in order to sound one of their instruments, is spatially amplified by linking it to a larger rotating motion of performers between their performance positions (see bars 12, 48, 65 and 100 in the score). Spreading the musicians across the venue creates multiple streams of audio and visual information that the observer can choose between, and choose to prioritise. The instruments for this movement are defined by and selected as a result of their modes of interaction. Symbols are used in the score to denote the actions of scraping back and forth, winding, dead hits and resonant hits (see Fig. 5).

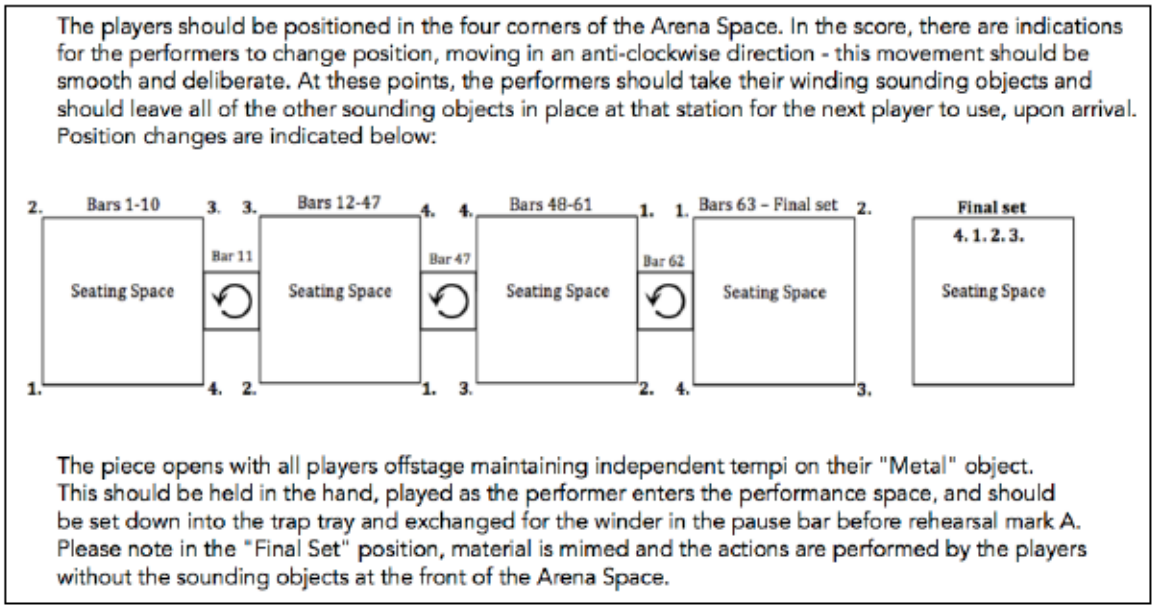


Figure 4 – Set-up instructions, *Mixed Messages - Movement I* (Harding 2017)

Movement II focuses on interactivity within the Ensemble Space by placing the performers close together, and having them share cymbals, thus influencing each other's sounds by choking and holding the cymbals, as well as striking them (see Fig. 6). The performers face inward in this

movement rather than facing the audience or conductor. This orientation sets up a dynamic of interchange and play.

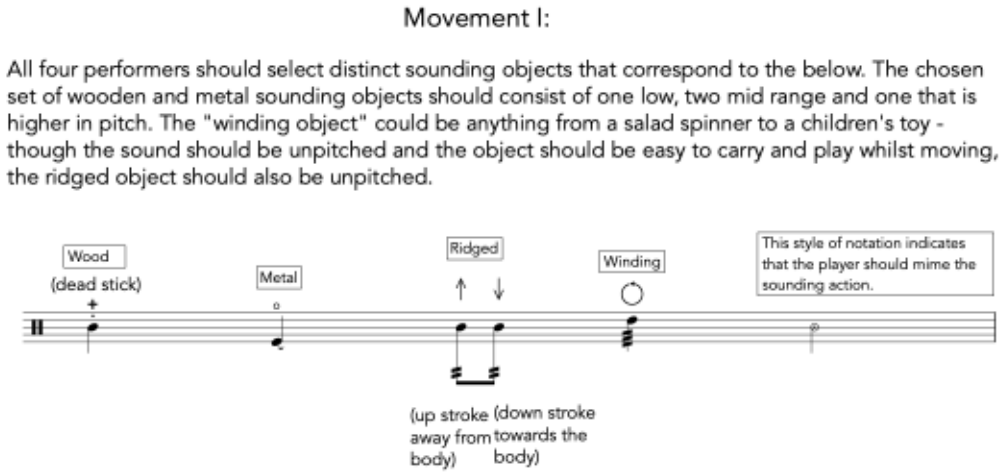


Figure 5 – Notation/Instrumentation, *Mixed Messages* – Movement I (Harding 2017)

Every piece of performed music is made up of these different interlocking spatial layers of Action, Ensemble and Arena Space, which combine to create the overall lived experience of the music for audiences, performers and composers. Each layer of space has its own associated behaviours, physical, aural, perspectival and visual relationships that can impact upon and inform compositional choices. Further, each "spatial situation of music is created by people who directly participate in this space (in an active or passive manner); they delineate the boundaries of this space" (Bielawski 1976, p.221).

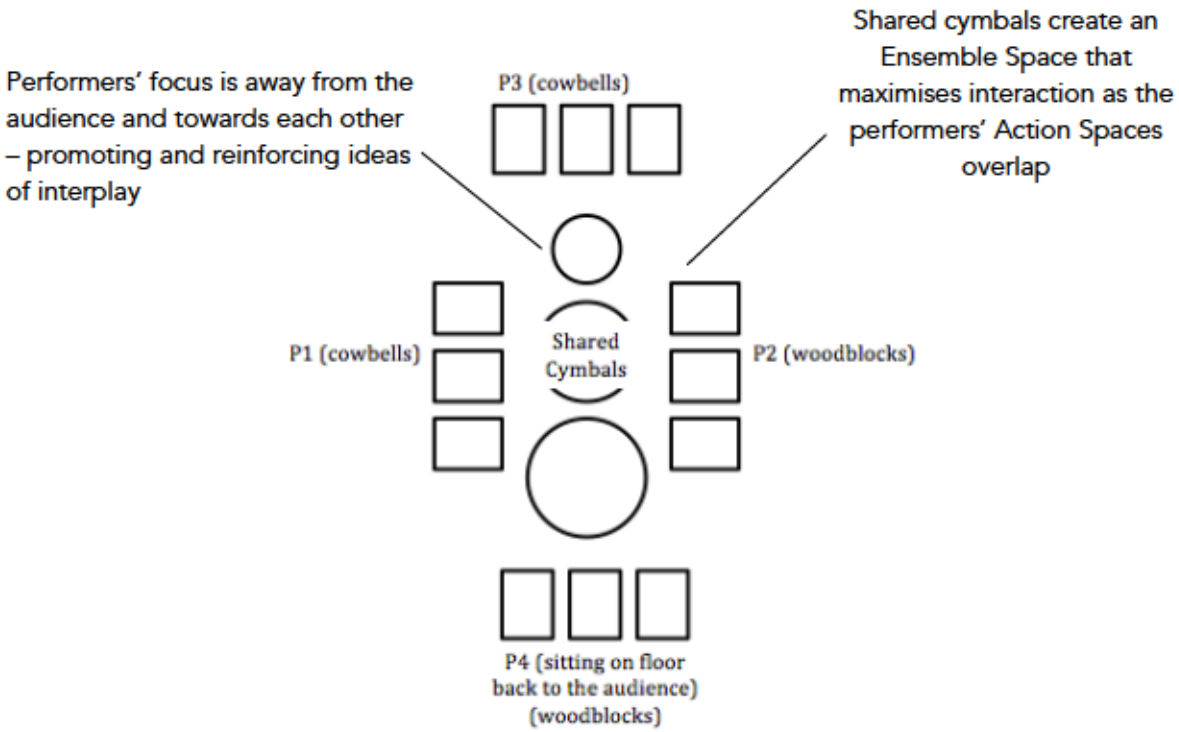


Figure 6 – Set-up Instructions, *Mixed Messages – Movement II*

(Harding 2017)

Chapter Summary

The three categories of space, as identified by Dennis Smalley, form the structural basis of the creative exploration of space and physicality as elements of composition. *Chapter Two: Action Space* considers action-to-sound relationships: it looks at the work of other composers, including Kagel's *Instrumentale Theatre*, Lachenmann's *Musique Concréte Instrumentale* and *Carnal Musicology* as relevant methodologies and sources of inspiration. The original compositions referenced in this chapter are all fully notated works:

- *Mixed Messages* (2017) – Percussion Quartet, 24 minutes
- *by breath and bow* (2017) – Flute, B-Flat Clarinet, Violin and Cello, 8 minutes. Written for Ensemble Via Nova.

- *Extension* (2018) – Solo Cello, 4 minutes. Written for Amy Jolly.
- *Motion* (2018) – Solo Cello, 7 minutes. Written for Amy Jolly.
- *bellows, breath and bow* (2018) – Flute, Bb Clarinet, Accordion, Violin and Cello, 9 minutes. Written for Ensemble Via Nova.

Chapter Three: Ensemble Space explores performance interaction and the impact of spatial separation, partitioning and de-partitioning of the Ensemble Space on compositional choices. This chapter also discusses practical and logistical concerns that arise when working with spatialised performers, such as synchronisation. The original compositions referenced in this chapter include fully notated works and studies that form the basis of devised / directed performances:

- *Mirror* (2016) – Sinfonietta, 8 minutes
- *Mixed Messages* (2017) – Percussion Quartet, 24 minutes
- *CoMA Studies* (2017-2018) – Open Scores
    - *Spatial Study on D* (2017) – 6 minutes
    - *Spatial Study on Rotation* (2017) – 19 minutes
    - *230 Strings* (2017) – 8 minutes
    - *Graphic Score II* (2017) – 10 minutes
    - *Traverse the Score* (2018) – 15 minutes

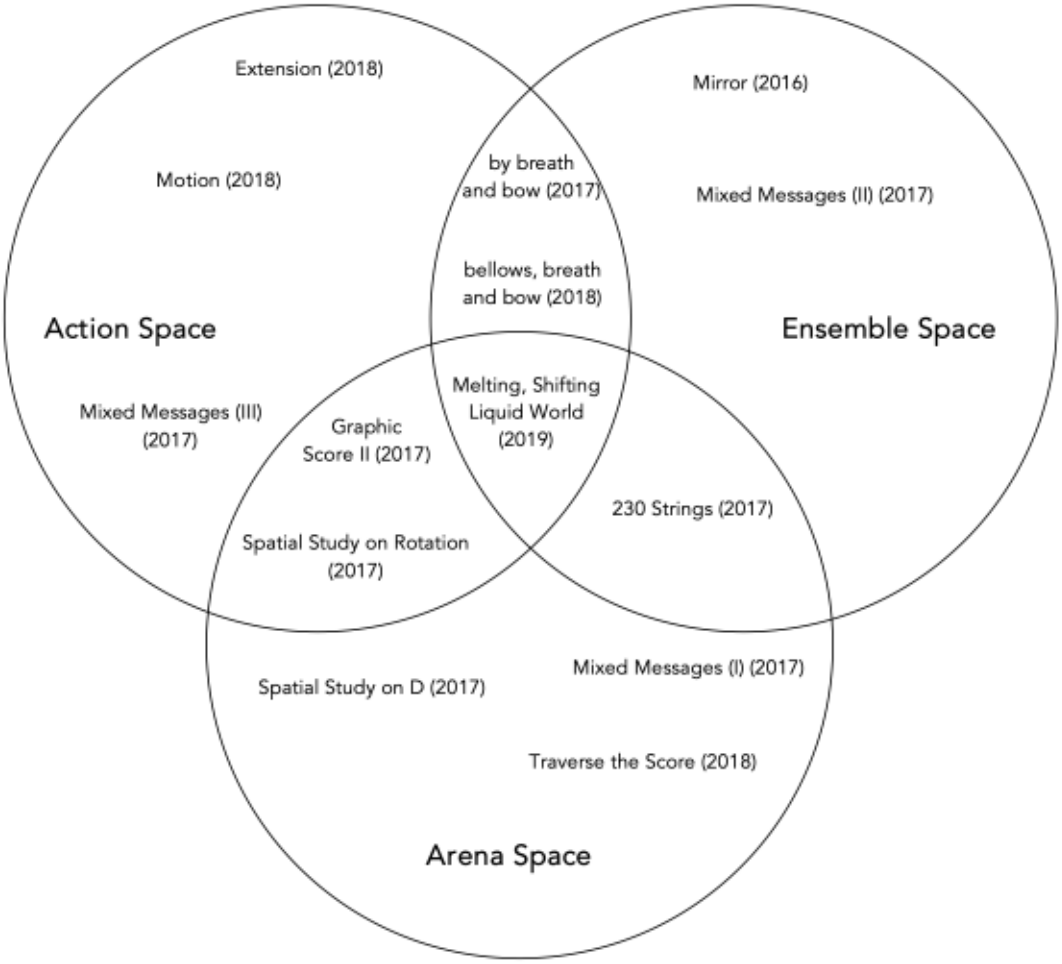
Finally, *Chapter Four: Arena Space* focuses on the impact of spatialisation on the listener. Here, I consider alternative audience placements, the use of bone-conduction technology, different classifications of spatial design in contemporary music, and different listening perspectives afforded by alterations to the construction of the overall spaces of music performance.

The original compositions referenced in this chapter include studies and a concluding, large-scale notated / mixed media work:

- *CoMA Studies* (2017-2018)
    - *Spatial Study on D* (2017) – 6 minutes
    - *Traverse the Score* (2018) – 15 minutes
- *Melting, Shifting, Liquid World* (2019) – Solo Electric Viola, Electronics, String Ensemble [6.5.4.4.2] and Fixed Media delivered over Bone-Conduction Headsets, 32 minutes

Some compositions feature in more than one chapter. This is because many of the original works draw upon, and are influenced by, multiple different threads of the wider research and practice (see Fig. 7).

Figure 7 – Venn Diagram, Showing Pieces in Creative Portfolio by Main Spatial Focus



CHAPTER TWO: ACTION SPACE

"…an actual embodied performer knows any work as a set of actions to be coordinated in particular ways. … the work temporarily becomes not the work. But instead something you do. It is something you do which is while you're doing it, entirely coterminous with who you are."

(Cusick 1994, p.18)

Action Space

I define the Action Space of music as an extension of Gibson's theory of affordances. According to this theory, Action Space is the space of human interaction with objects and is therefore defined by the objects and agents that exist within it. "Animals and humans perceive environmental objects in terms of what they afford for the consummation of behaviour rather than in terms of their objective perceptual qualities (Gibson 1979, p.127, Gibson 1966, 1982)" (Reybrouck 2005, p.25). As soon as you add an object to a space it affords certain types of action to the user and observer. Different objects have different associated functions, action possibilities and purposes, acquired through our embodied, learned knowledge and experience. Musical instruments have the primary affordance, or purpose, of turning human agency into sound.

"In the mechanical universe sound results from two (or more) objects that touch in some way. Energy is transferred and – assuming a medium (usually air) surrounding the objects – the resulting motion sets sound waves in train to any listener" (Emmerson 2007, p.18). In performed music, where the agent executing the action and causing objects to touch or vibrate[9] is human, the manifest Action Space is defined by the

[9] Including the vibration of air columns (blown instruments) or vocal cords (singing).

instrument, and includes the instrument itself, the agent (the performer), and the 'performance-actions' acted on and around the instrument that, usually, result in sound.

Smalley states "…a chain of activity links a cause to a source. A human agent produces [sounds] via the motion of gesture using the sense of touch or an implement to apply energy to a sounding body…From the viewpoint of both agent and watching listener, the musical gesture-process is tactile and visual as well as aural" (Smalley 1997, p.111). My approach to composition reflects this understanding of music performance as multisensory and it seems logical and natural for compositional choices to be borne out of imagined sonic ideas, movement ideas, visual ideas, kinaesthetic ideas, or any combination of these perceivable aspects of sounding-action.

The Action Space of music is therefore the "intimate space of the individual performer and their instrument" (Smalley 2007, p.41) and consists of "physical presence, action and agency" (Emmerson 2007, p.18).[10] Here, there is a direct relationship between cause and effect and between visual action and sound: "…if in a musical discourse event A appears to cause event B then it has done" (Emmerson 2007, p.95).

Musical instruments have varied physical characteristics: shape, form, size, weight and materials, and afford different modes of interaction and types

[10] In *Space-Form and the Acousmatic Image*, Smalley calls what I am defining as Action Space, 'Gestural Space'. The terms 'gestural' and 'gesture' in relation to sound and music have many different meanings that are not restricted to movement and therefore 'Action Space' is a clearer definition for my purposes.

of physical action to performers: bowing, plucking, striking, pressing and blowing. For example, a clarinet is blown, holes on the instrument are covered and uncovered by the fingers, and changes are made to the embouchure in order to change the pitch, whereas the harp is plucked and pitch changes are determined by the fingers alternating between strings and changing the position of the foot-operated pedals. The physical characteristics of instruments and their modes of human interaction are what give sounds their specific timbral qualities. Instruments also have different embedded musical, social and cultural meaning built from an individual's prior experience and knowledge of that instrument. There are therefore several sonic, visual, physical and aesthetic expectations attached to every musical instrument.

Developing and refining a comprehensive knowledge of the sonic possibilities of each instrument and the physical requirements that these different sounds demand of the performer are fundamental to compositional creative practice – both for practical purposes (writing idiomatically) and in order to expand ones knowledge of the available sonic and timbral palette. I have gradually become aware, however, that my interest in the action possibilities of different instruments is not solely motivated by these practical concerns. In fact, visual, theatrical and choreographical aspects of sounding-actions are as important to my creative practice and processes as the varied sonic results that these actions produce. My creative process almost always begins with an imagined visualisation of the performance scenario, which includes the performers performing actions and interacting with their instruments, each other and the audience, in different ways. This imagined scene often precedes the imagining of specific sonic ideas or occurs simultaneously.

The tendency to visualise performance scenarios when I compose links to Dennis Smalley's idea of 'source-bonding', a term he invented for "the natural tendency to relate sounds to supposed sources and causes, and to relate sounds to each other because they appear to have shared or associated origins"[11] (Smalley 1997, p.110). He argues that when we hear a human-made sound without the visual source, we imagine the instrument and the type of action being applied to it by an agent in order to make that sound. Smalley states: "The listener's experience of listening to instruments is a cultural conditioning process based on years of (unconscious) audio-visual training. A knowledge of sounding gesture is therefore culturally very strongly embedded" (Smalley 1997, p.112).

One of the threads of this research therefore focuses on investigating ways of refining and increasing my knowledge and understanding of performers' sounding-action possibilities, on various instruments. A key way of doing this is to collaborate closely with performers as they train to develop an extremely detailed knowledge of how subtle variations to their physical action can generate different types of sonic and visual results. In working collaboratively with these experts as a composer, I can further refine and develop my knowledge and understanding of sounding-action possibilities, which in turn feeds into my ability to imagine, invent and generate compositional ideas. Examples are in pieces *Extension* (2018) and *Motion* (2018), where I closely collaborated with cellist the Amy Jolly, and are explored in sub-chapter *Carnal Musicology – Analysing Physical Action* (p.42) and *Action Mapping and Tracking as a Compositional Tool* (p.54).

[11] This also links to Chion's 'Causal Listening' mode - listening to a sound in order to gather information about its cause (or source). (Chion 2012, p.25)

Classifications of Music-Related Physical Action

In order to consider physical action as an element of composition, it became necessary to seek ways of classifying the different types of music-related physical action by performers. I discovered that the musicologist Rolf Inge Godøy (et al.) had developed a particularly useful classification system for music-related physical action which is divided into two broad areas: 'sound producing actions' and 'sound accompanying actions' (Godøy et al. 2012), with the former being the most important for this research.

'Sound producing actions' can be sub-categorised as follows:

1) *Excitatory Action* - An action or combined actions required to make the sound (transfer of energy from the performer to the object), for example simultaneously pressing fingers down on specific keys of a keyboard in order to make a chord, or drawing a bow across a violin string whilst fingering a specific note on the fingerboard.
2) *Modulatory Action* – Human movements made with the intention of modifying the resonant features of an instrument. For example, shaking the hand to generate vibrato, dampening or choking a cymbal, or applying a mute.
3) *Communicative Action* – Such as cues to fellow musicians or theatrical actions intended to influence the audience.

Godøy also discusses ancillary sound-facilitating actions, meaning actions that help in shaping the sound (articulation, phrasing etc.) (Godøy et al. 2012). However, I categorise these as actions relating to the "mode of

execution" or "form or vitality" determined by the "movement, timing perception of force, spatial aspects and perception of underlying intention" (Stern 2010, p.Cover Notes). For example, striking the piano key forcibly and then immediately lifting the fingers, to generate an accented staccato.[12] I use these classifications of sound-making physical action throughout the rest of the thesis.

In the following sub-chapters, I consider case studies of the applied use of 'sound-producing' actions in four compositions in the creative portfolio: *Extension* (2018), *Motion* (2018), *by breath and bow* (2017) and *bellows, breath and bow* (2018) and illustrate some of the methods identified for analysing and utilising physical action in composition. In *Body-Centred Timing* (p.62) I discuss the use of body-centred rather than metronomic timing. I also consider how physical actions can be categorised into movement sets and mapped across different instruments in the sub-chapter titled *Action Mapping over Different Instruments* (p.65).

Carnal Musicology – Analysing Physical Action

The first two pieces under discussion, *Extension* (2018) and *Motion* (2018), were written for the cellist Amy Jolly, who approached me asking to collaborate in 2017. The imagined Action Space for the composition was immediately filled with Amy's presence as my collaborator, my knowledge of her practice, and cello-specific action-to-sound possibilities. Amy also specified that the collaboration was to be a part of her own PhD research to commission new variations on a theme by Benjamin Britten – his *Tema 'Sacher'* (Britten 1976) – and so the imagined Action Space also

[12] See also "Gestural-Sonorous Objects"(Godøy 2006), and "Images of Sonic Objects" (Godøy 2010).

became filled with Britten's combinations of cello-specific sounds and actions[13].

Whilst composers and performers have been exploring the physical, kinaesthetic and visual potential of music-related action for some time[14], music theory and musicology have only recently found ways to analyse and acknowledge the bodily act of performing as an essential part of music-making and musical understanding[15]. When Amy approached me about this commission, research had led me to read a book called *Boccherini's Body: an Essay in Carnal Musicology* (Le Guin 2006), which proposes *Carnal Musicology* as a new physical and embodied form of musical analysis.

In the book, Le Guin uses knowledge gleaned from her own playing of the cello as the keystone of her original approach to the relationship between music and embodiment, and develops a "historicized critical method based on the physical experience of the performer" (Le Guin 2006). She also highlights the relationship between sight and sound and the impact of this on our understanding of music: "a performance – and body-orientated musicology is positively obliged to account for the visible"[16] (Le Guin 2006, p.35).

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[13] Not to mention Rostropovich's presence as Britten's long-term collaborator and friend.

[14] Lachenmann's *Musique Concrete Instrumentale*, and Kagel's *Instrumentale Theatre* are key examples of this, dating back to the 1960s.

[15] Nicolas Cook's *Beyond the Score, Music As Performance* is a key and comprehensive text documenting this need for musicologists to '*supplant the traditional musicological notion of music as writing*' with a reconceived idea of music as an activity – or music as performance. (Cook 2013, p.Abstract).

[16] Several studies also highlight the importance of visual aspects of musical performance on our understanding – for example "Hearing and Seeing Musical Expression" (Bergeron & Lopes 2009).

Through Carnal Musicological analysis, Le Guin finds Boccherini's compositional processes to be a combination of (1) unconscious kinaesthetic invention composed with cello in hand; (2) conscious aural deliberation composed with the mind; and (3) "the composer-performer contends, more or less consciously, with the self-consciousness attendant upon the near inevitability of being seen" (Le Guin 2006, p.35). In other words, she finds that, for Boccherini, composition combines mental, theatrical / visual, and kinaesthetic processes – aided by his in-depth first-hand knowledge of his instrument, the cello.

It became clear that adopting a *Carnal Musicological* approach to collaborating with Amy could unlock new insights and understanding of Britten's theme and of cello-specific action possibilities. As a non-cellist I could not, like Boccherini, adopt a first-hand experiential approach to physical analysis, so with Amy's expert guidance and insight I decided to develop a method of tracking, mapping and analysing Amy's physical actions when performing *Tema* (Britten 1976), in order to identify physical themes and ideas that might become a starting point for the variations.

Our initial meeting included making several short films of Amy performing the minute-and-a-half theme in a variety of ways[17], which were used as the starting point for a physical analysis of the piece (see Fig. 8). Working closely with Amy enabled me to share her insights as a performer into the practicalities and sensations of playing the theme on the cello. It also uncovered Amy's use of alternative fingerings and bowings to those edited in by Rostropovich, selected because of physical differences

[17] For example: left-hand only, right-hand only, slow motion, etc.

between the two performers, and because of each cellists' varied interpretation of Britten's notated work.
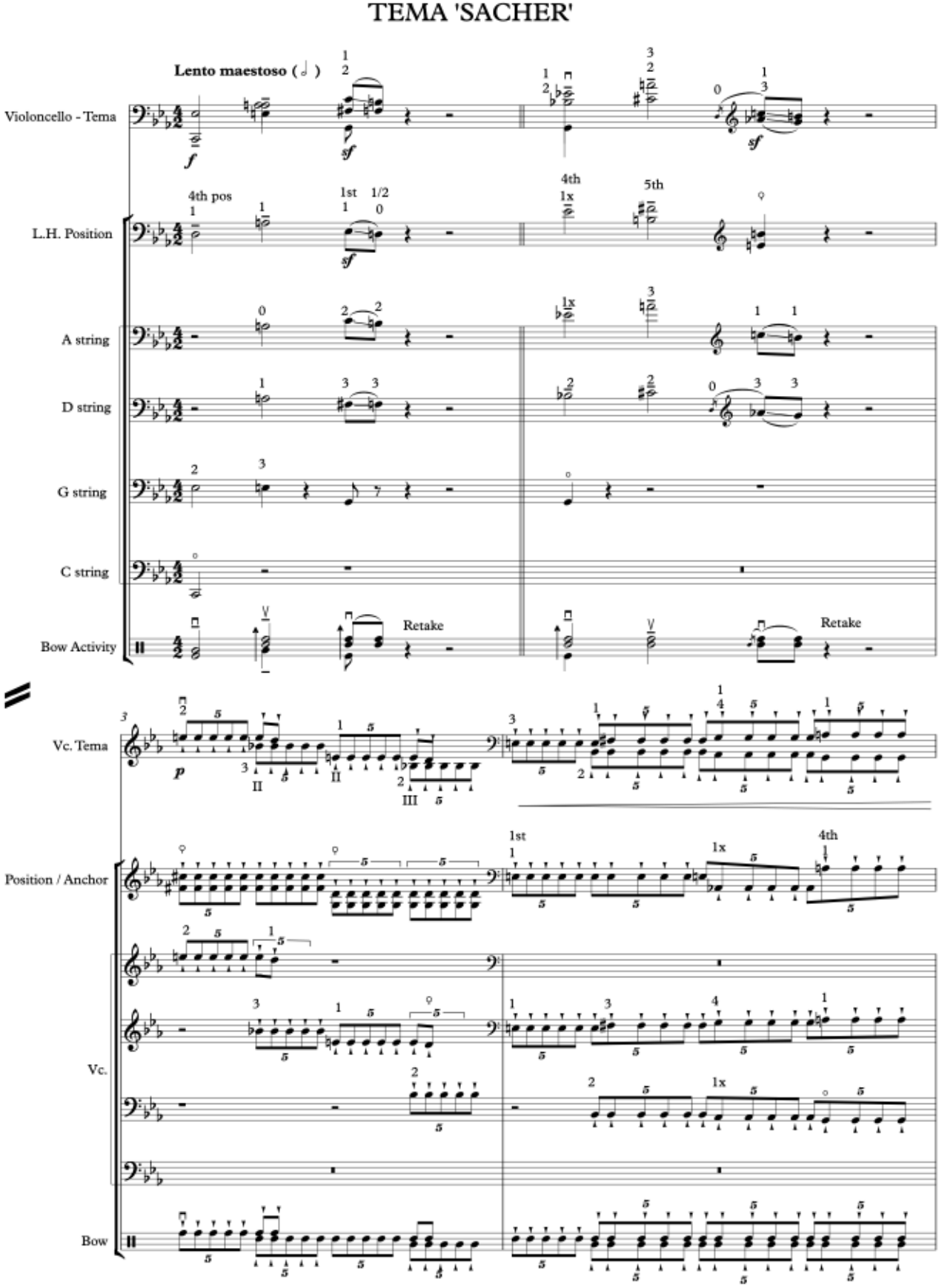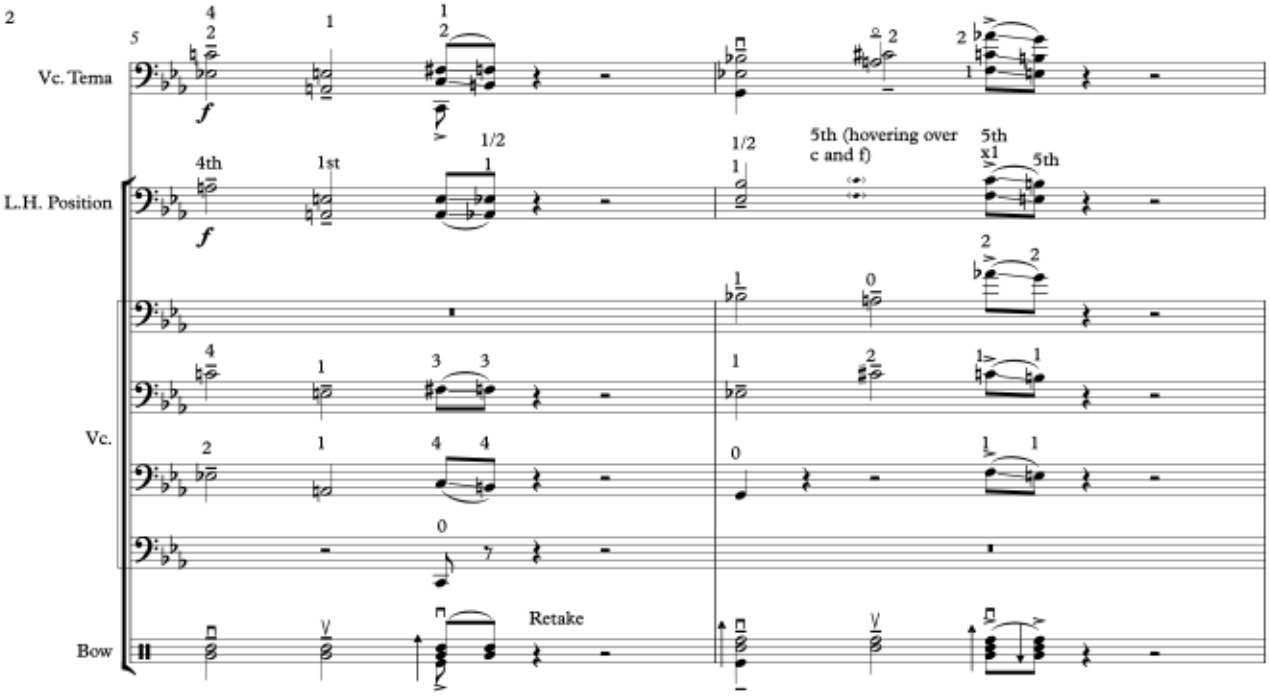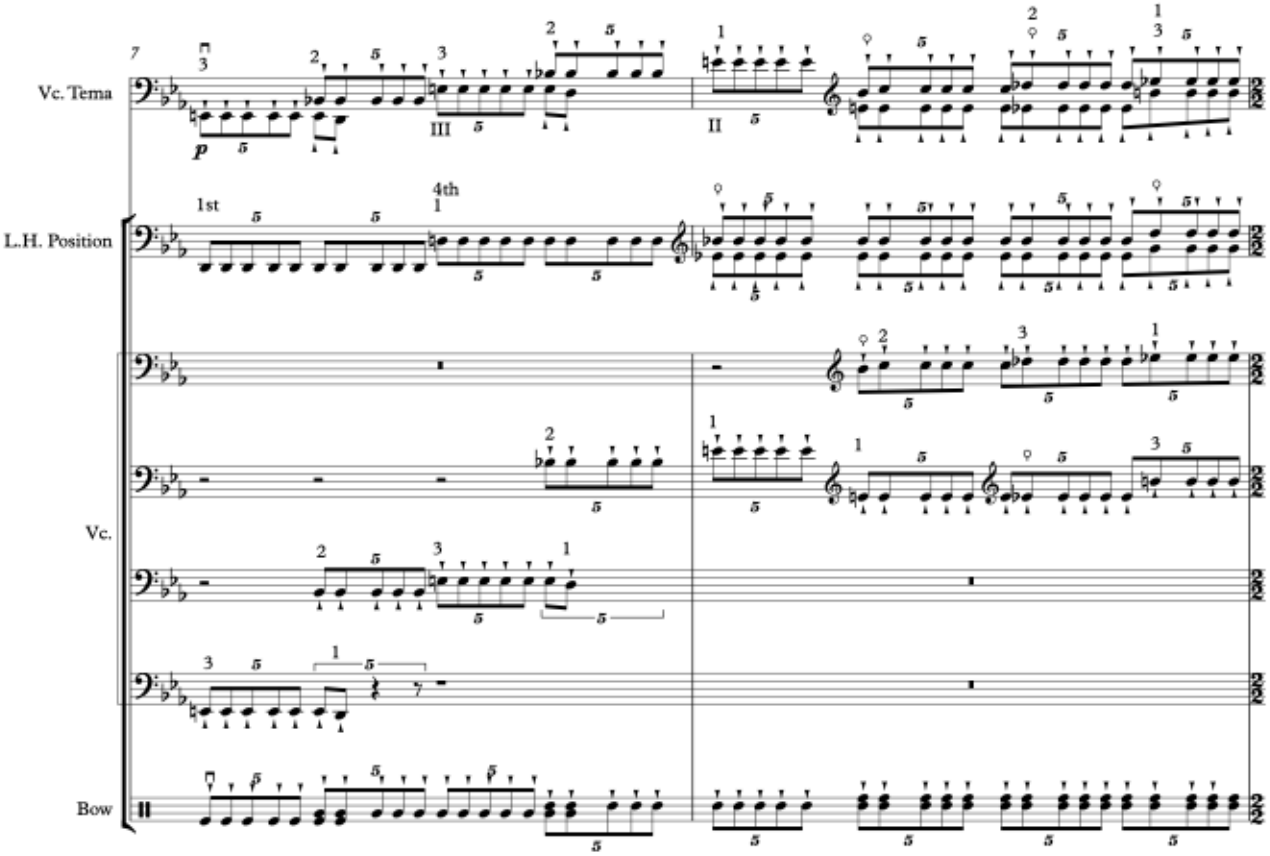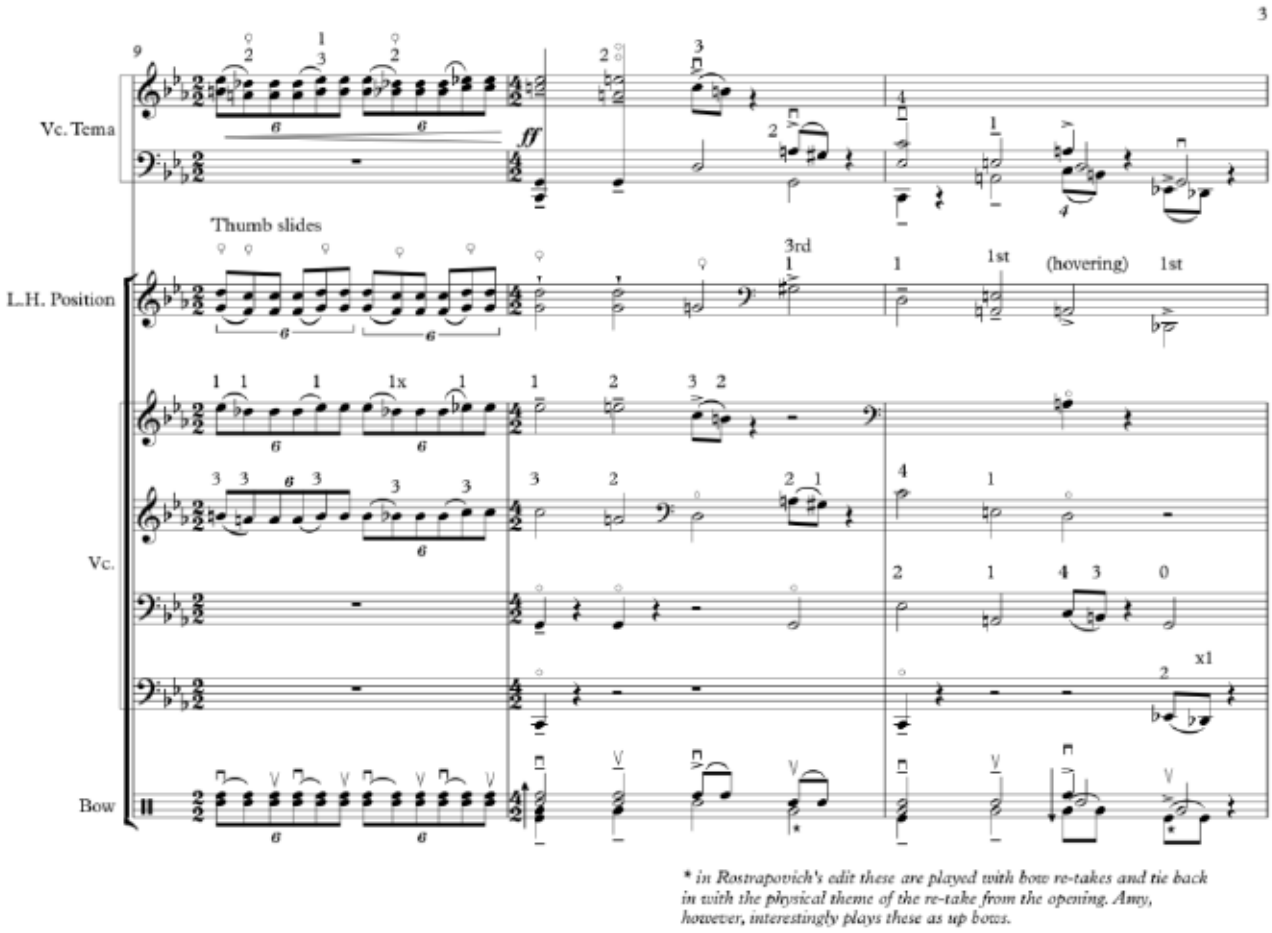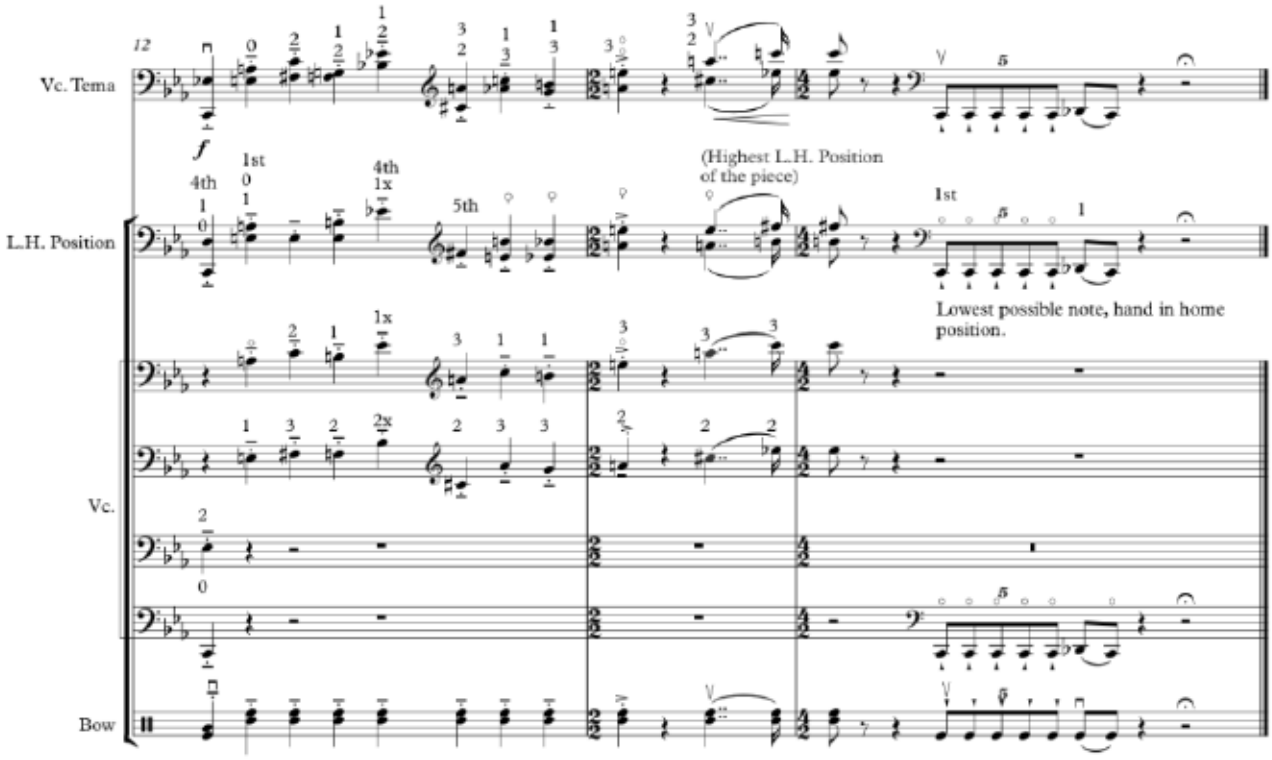


Figure 8 – *Tema 'Sacher'* (Britten 1976): Carnal Musicological Analysis


2
5
Vc. Tema
L.H. Position
Vc.
Bow
4th
1st
1/2
5th (hovering over c and f)
5th
x1
Retake


7
Vc. Tema
L.H. Position
Vc.
Bow
1st
4th
III
II



** in Rostrapovich's edit these are played with bow re-takes and tie back in with the physical theme of the re-take from the opening. Amy, however, interestingly plays these as up bows.*



The initial analysis (Fig. 8) separates Amy's performance actions out into their component parts. The top two staves show the original notation published by Faber Music Ltd (1990) including Rostropovich's edits (fingerings and bowings). The following stave shows Amy's hand positions denoted by first finger or thumb position on the stave (L.H. Position). The following four staves each depict a string of the instrument and show Amy's selection of alternative fingerings. Finally, the bottom stave shows the right-hand bow movements across the four strings (each line of the stave represents a string of the instrument) and bow directions (up and down) are given when relevant.

I realised through making this analysis that the use of standard common practice notation was not the most effective way to depict the spatial and action-based elements of Amy performing Britten's theme, such as hand position and finger placement. I later made a tablature action map, which shows the spatial aspects of left-hand position and fingering much more clearly (see Fig. 9).

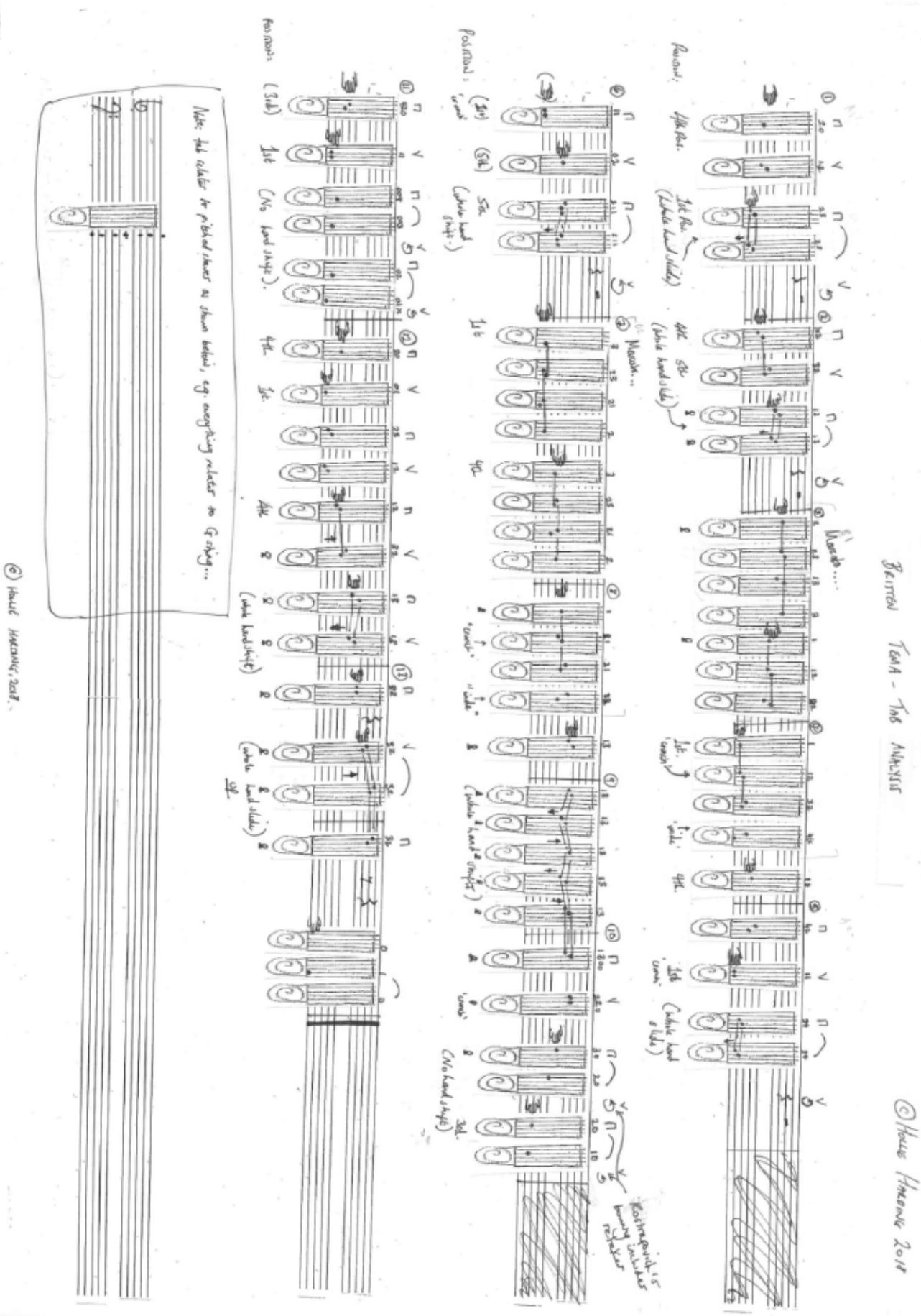


Figure 9 – *Tema 'Sacher'* (Britten 1976): Tablature Analysis

Through these analyses and with Amy's guidance, I noticed the following physical action ideas in *Tema* (Britten 1976) – shown in Fig. 10 and on an annotated copy of the score (Fig. 11):

Figure 10 – Action Mapping and Tracking Findings

Broad Physical Themes	**Examples**
Instrument treated as chordal rather than melodic	Britten rarely uses single notes, consistently writing double stops and chords. This has an immediate impact on the harmony as the tuning of the strings (a perfect fifth apart) and the dimensions of the hand only afford certain note combinations and intervals. The cellist is only able to play two strings for limited periods of time, and if more notes are added, the chord must be broken. Britten makes larger chords by also adding in open strings, which gives a full, resonant sound.
Physically very active and virtuosic	Britten combines chordal writing with constantly shifting left-hand positions - the hand never rests in one position for longer than a bar. This, combined with bow retakes, string-crossings and *marcato* markings in the right hand, leaves little time for the performer or observer to feel settled.
Specific Physical Themes	**Examples**
Position shift glissandos	Highlighted yellow, Fig. 11 (bars 1, 2, 5, 6,

	9, 13) – where the cellists hand position changes with an audible glissando and visible slide.
Stacked to wide finger positions	Labelled close to wide, Fig. 11 (bars 4, 8, 9, 13) - where the cellist's fingers move from 'stacked'[18] positions, to wider stretches.
Extensions	Highlighted red, Fig 11. (bars 4, 9, 13) where the first finger steps out of position in order to facilitate playing a semitone higher or lower, or to facilitate the 2,3 or 4 fingers to play a semitone higher. Extensions can also be where the entire hand / arm moves to a new position on the fingerboard, but the anchor point (usually the thumb) remains in the previous position.
Re-takes	Highlighted in pink, Fig 11. Whilst Amy does not choose to include the later re-takes (bars 10, 11), Rostropovich includes them in his edit, which Amy and I surmised was for theatrical / visual effect. Godøy would define these as *communicative actions*[19] for the benefit of the audience.

[18] '*Stacked*' is Amy's term for her technique of placing her fingers in their closest possible position to generate a reliable and in tune perfect fifth, rather than barring the notes using one finger across two strings, which she avoids as it gives a weaker sound because of difficulties achieving even finger distribution and weight over the two strings with one finger.

[19] Logical bowing would place bar 10, beat 4 and bar 11, beat 4 on an up-bow, which Rostropovich was more than capable of executing, so the re-takes in his edit must be for dramatic effect and to add weight.

Figure 11 – Physical Themes Annotated on Score [redacted]

In the first variation *Extension* (2018), the physical ideas identified in Britten's theme were used to inform compositional choices relating to harmonic and melodic material. I decided to follow Britten's approach and treat the instrument as chordal rather than melodic, and this, combined with an interest in shifts between 'stacked' and 'wide' finger positions, manifests in the harmony of the piece, which centres around fifths (stacked fingers), sevenths and in one case a minor ninth (wider finger spreads in different hand positions on the fingerboard). Building on this 'stacked' to 'wide' idea, Amy also selected certain fingerings to maximise the use of extensions, and accentuate the visual effect of moving from very close to widely spread positions (see Fig. 10 and the included footage of Amy performing the piece).

The position shift glissandi in the Britten recur and are extended and lengthened in *Extension* (2018) (highlighted green, Fig. 12). Bow re-takes also feature and are used to emphasise the phrasing and as *communicative actions* for dramatic effect. The exploration of the physical actions of Britten's *Tema* (Britten 1976) in this variation aimed to be stylistically in keeping with Britten's theme, and the chosen notation was therefore standard common practice notation.

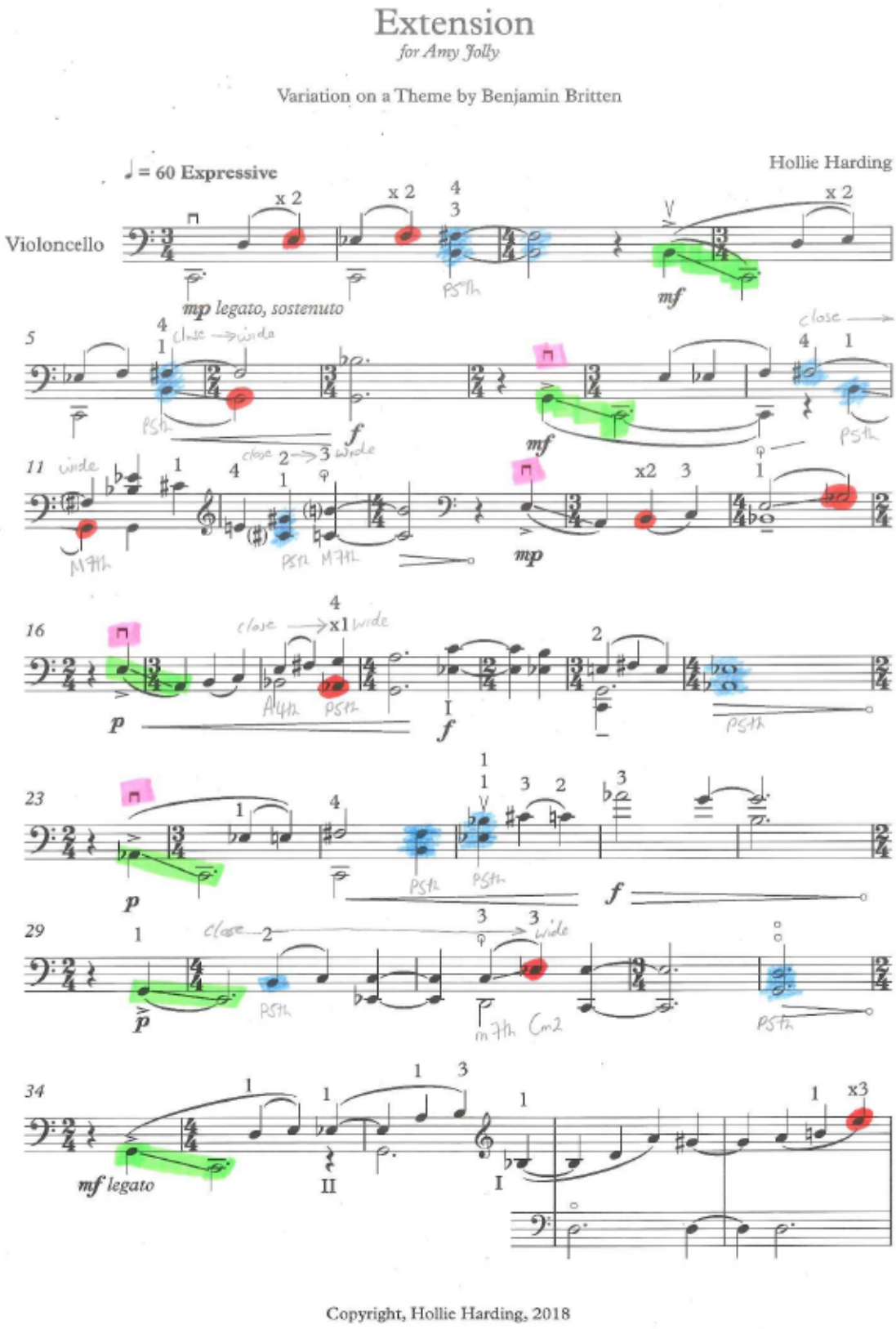
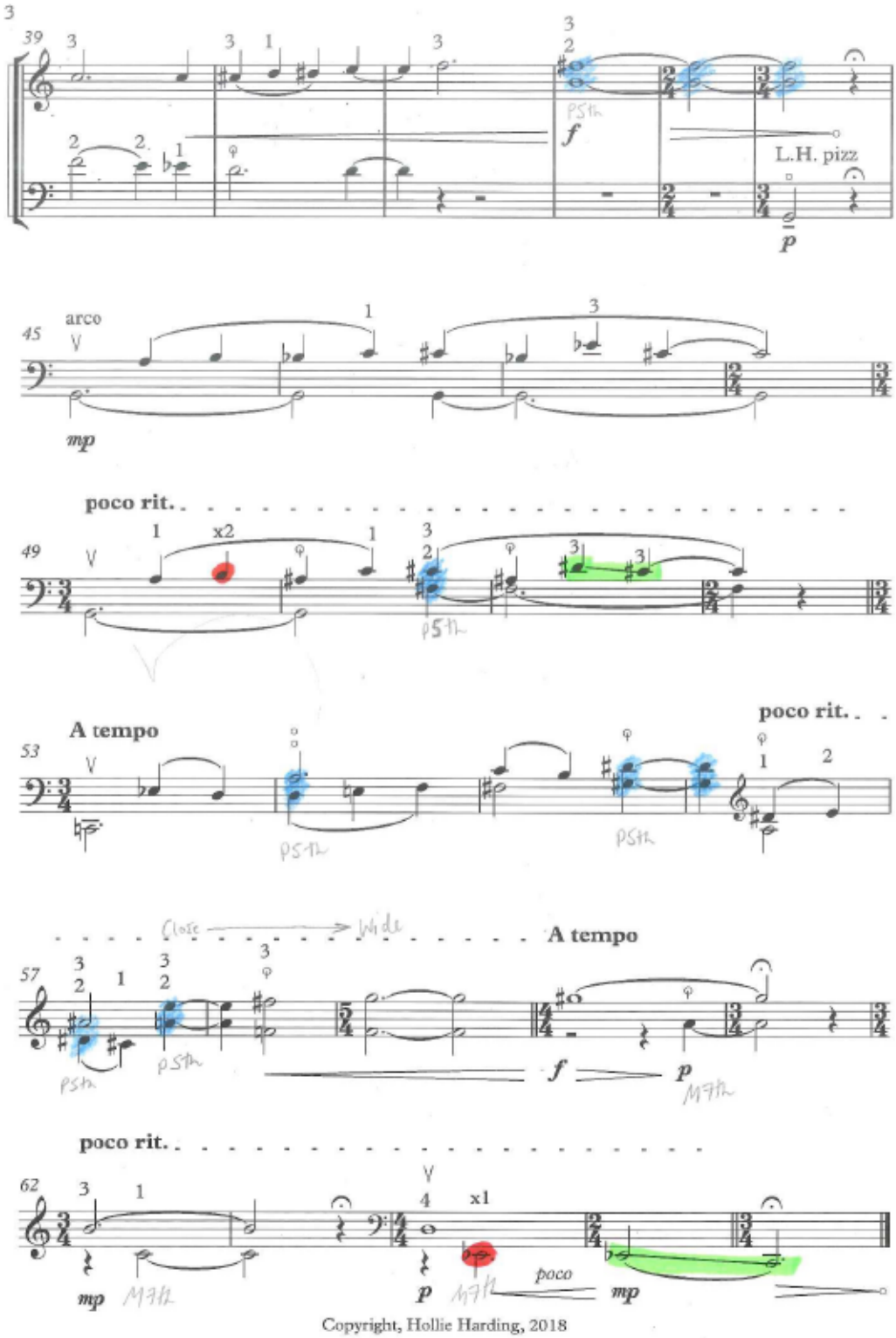


Figure 12 - Annotated Score for *Extension* (Harding 2018)



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With the next variation *Motion* (2018), I took a more experimental and abstract approach to the action material identified in the Britten, in order to bring the physicality of the performer to the forefront. As already mentioned, I identified through the process of documenting analyses that using tablature notation was a much clearer way to show the physical and spatial aspects of the actions of the cellist. This type of notation also "emphasises the way sound is produced, rather than how it should be heard" (Orning 2012), which is how the cellist Tanya Orning describes Helmut Lachenmann's *Musique Concrète Instrumentale*.

Lachenmann himself states that this is music:

> "…in which the sound events are chosen and organized so that the manner in which they are generated is at least as important as the resultant acoustic qualities themselves…listening, you hear the conditions under which a sound- or noise-action is carried out, you hear what materials and energies are involved and what resistance is encountered" (Lachenmann 2008).

Musique Concrète Instrumentale emphasises the various components of sound production in performance, in particular highlighting the kinaesthetic aspects of the action-to-sound-to-object relationship: the energies, resistances and pressures. A relevant example of this can be found in his *Pression* (Lachenmann 1969) for solo cello, where:

> "…the performer is asked to squeeze, press, jerk, slide, hit and stroke various parts of the instrument and the bow. Rather than functioning in a traditional way, the score maps the actions of the performer…an aesthetic direction that, by using traditional instruments in non-traditional ways, avoids classical hierarchical structures such as prioritizing work over

performance and compositional traditions over pure sound" (Orning 2012, p.13)[20].

Lachenmann notates these performance actions by de-coupling the different movements in the body that combine to form the sounds. He separates out the right-hand bow arm action and pressure onto one stave and the left-hand fingerboard action and position onto another (see Fig. 13). In notating the specific physical actions rather than the desired sounds, he shifts the focus towards the performed realisation of the score.

Figure 13 – Extract from *Pression* (Lachenmann, 1969) [redacted]

Helmut Lachenmann Pression © 1972 by Musikverlage Hans Gerig, Köln.
1980 assigned to Breitkopf & Härtel, Wiesbaden. All rights reserved

[20] Orning's "Pression – a performance study" (Orning 2012) referenced here, is a particularly insightful Carnal Musicological account of performing this piece.

I decided that the notation for *Motion* (2018) would therefore best serve the physical focus of the piece, if it combined graphical, tablature and standard common practice notation. I adopted a similar approach to *Pression* (Lachenmann, 1969) and de-coupled the right- and left-hand actions. The right-hand bow stave of *Motion* (2018) is shown at the top above the left-hand pitch stave (see Fig. 14). Bow position is indicated by changes to position of the bow line (reinforced by technical instructions), bow direction is indicated using standard bow markings, and re-takes are given their own symbol, with dotted lines showing when the bow is still moving, but away from the string. All bows in the piece are full bows, and bow pressure is determined by the resultant speed and indicated dynamic, therefore bow pressure indications are almost non-existent.

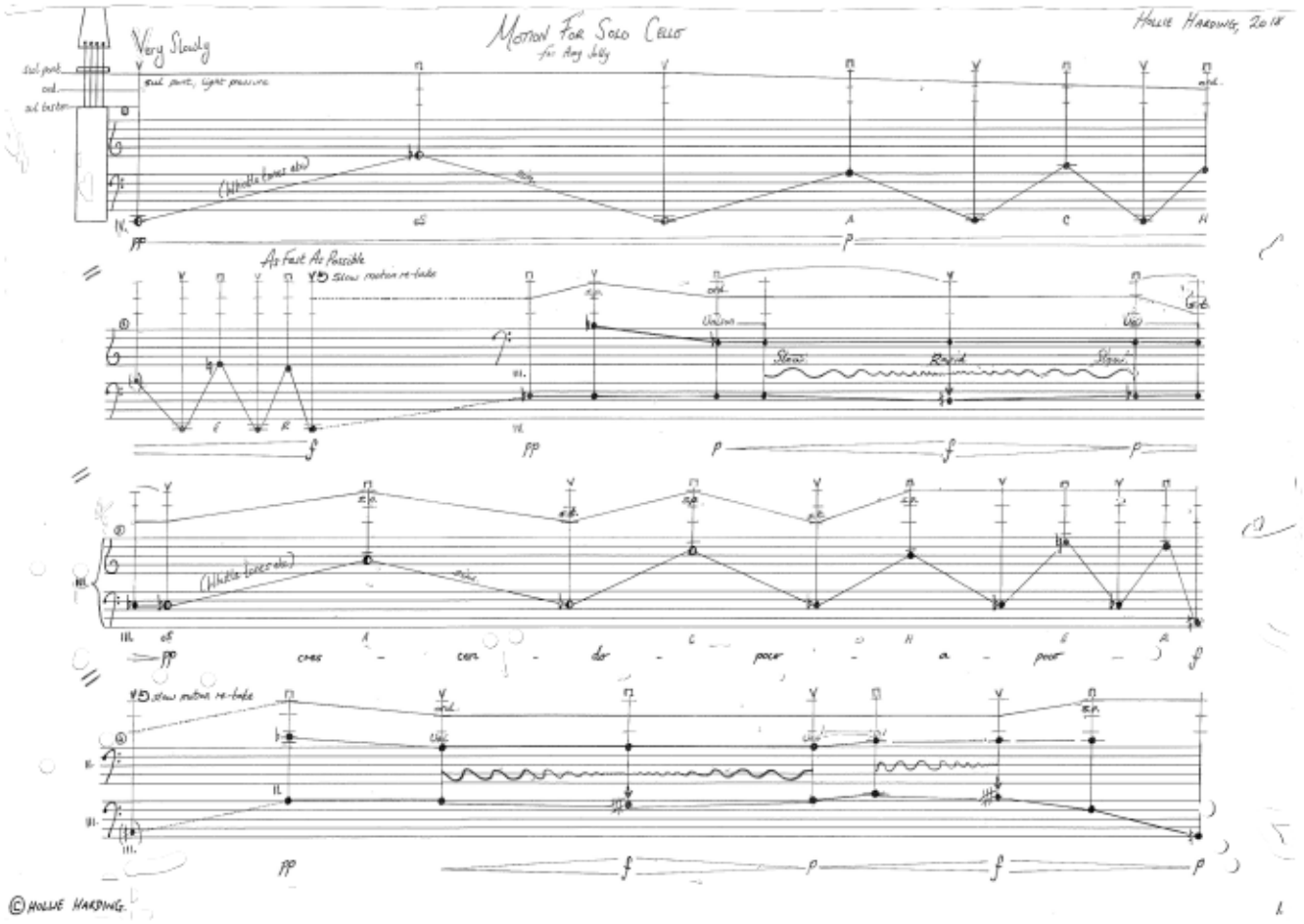


Figure 14 – Extract from *Motion* (Harding 2018)

Body-centred rather than metronomic timings are requested of the performer in *Motion* (2018) which further emphasises physical agency, as the cellist is encouraged to act according to their physical limits when interpreting tempo instructions such as: '*as fast as possible*' or '*slow motion*'. The rhythmic notation is also proportional. There are double stops in the score that are determined by the cellist's maximum hand stretch, rather than being written as specific pitches, therefore intervals will vary according to each performer's hand size.

The 'stacked' to 'wide' finger patterns identified in the Britten theme are further explored in *Motion* (2018), and this pattern can be explicitly seen in the tablature sections of the score (see staves 5 and 6 in the full score). In the sections involving beat tones, the physical finger position required to generate beat tones by detuning unisons is widely spread, in direct contrast to the very close pitches of the sounding notes. The chosen notation reflects this wider spacing of the fingers by depicting the relevant strings of the instrument on independent staves.

I further explore the rapid left-hand position changes of the Britten in *Motion* (2018), firstly featuring this physical movement as voiced glissandi, and later transforming the up-and-down motion sonically, by having Amy play the same pitches in alternating high and low places on the fingerboard through the use of geographically-selected natural harmonics (see performance footage). The piece also plays on the visual and choreographic idea of the cellist's 'closed' and 'open' body positions, which are varied in the middle section of the piece through changes to bow direction (Fig. 15). The bow re-takes feature in the piece beginning

in slow motion, shortening in duration as the piece progresses and changing to repeated 'Breathless' up-bows, in stave 10 (see full score).

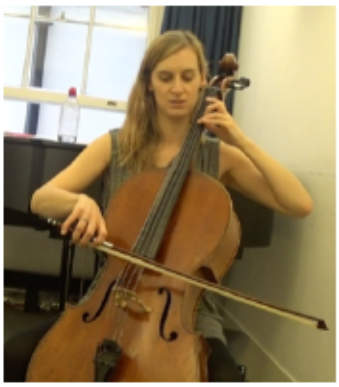
Figure 15 – Cellist Open and Closed Body Positions



Open – left hand in 'home' position. Up bow, right hand extends away from body. Open arms.



Closed – left hand in high position. Bow at heel, left hand close to body. Closed arms.



Alternative 1 – left hand in 'home' position. Bow at heel, left hand close to body.



Alternative 2 – left hand in high position. Up bow, right hand away from body.

This case study of the creative portfolio pieces *Motion* (2018) and *Extension* (2018) is an in-depth example of how *Carnal Musicological* analysis can be used to analyse performers' physical actions, in order to generate ideas and inform compositional processes. As this is an on going thread of enquiry, all of the pieces in the creative portfolio experiment with different applications of the idea of performer action as a compositional tool. Ideas range from *Spatial Study on Rotation* (2017), where sounding objects and sounds were selected because they required a rotating sounding-action from the performers[21], to *Melting, Shifting, Liquid World* (2019) where sounds that emphasise performer's physical agency were selected (for example col legno, sul ponticello, circle bows,

[21] Instruments included: singing bowls, record players, circular cheese graters, children's toys, spiralizers, coffee grinders and marbles in wine glasses, alongside more standard instruments – string players playing circle bows and ratchets.

over pressure). These ideas are also present in pieces written prior to this PhD research including *Suite P* (2012) for solo piano (see Appendix 2 for the score), where different spatial hand movements from the pianist determined the development of harmonic / melodic material.[22] In the remainder of this chapter I will discuss some other specific methods I have identified for using physical action as a compositional tool.

Body-Centred Timing

In *by breath and bow* (2017), written for Ensemble Via Nova, I continue to explore the idea of body-centred rather than metronomic timings, asking the performers to coordinate through the execution of a unison 'breath'-line. This is depicted in the score graphically, and an audio track demonstration is included with the score for rehearsal purposes to help convey the different delivery styles (or modes) and speeds to the performers (Fig. 16).

The unison breath-line aims to highlight the bodily presence of the performers and conjure up intimate spatial references (Hall 1969), as the breathing sounds of others are only normally audible when we are in close physical contact (Fig. 1). I also selected sounds where the agency and energies involved in the sound production are accentuated: circle bows, diagonal sweeps along the fingerboard in the strings, jet whistles and harmonics on the flute, multiphonics on the clarinet. Again, these are all sounds that could be associated with close-proximity listening as they

[22] *Suite P* (2012) explores three action ideas. The first, 'Pedal', focuses on melodic lines moving around a fixed, repeated chord (and hand position). The second, ' Parallel', explores lines moving in opposing directions between the hands. The final miniature 'Pivot' explores contracting and expanding chords, created by each of the pianist's hands rotating around the 'pivot note' D.

highlight the 'noise', resistances and agency involved in sound production.

The shared 'breath-line' is physically manifested in the body in a rising and falling motion, which is accentuated by the string players' bow actions (see documentation footage). The breath is the primary method of human interaction between the flautist and the clarinettist and their instruments: in making this the synchronisation point for the ensemble it also becomes fundamental to the string players.

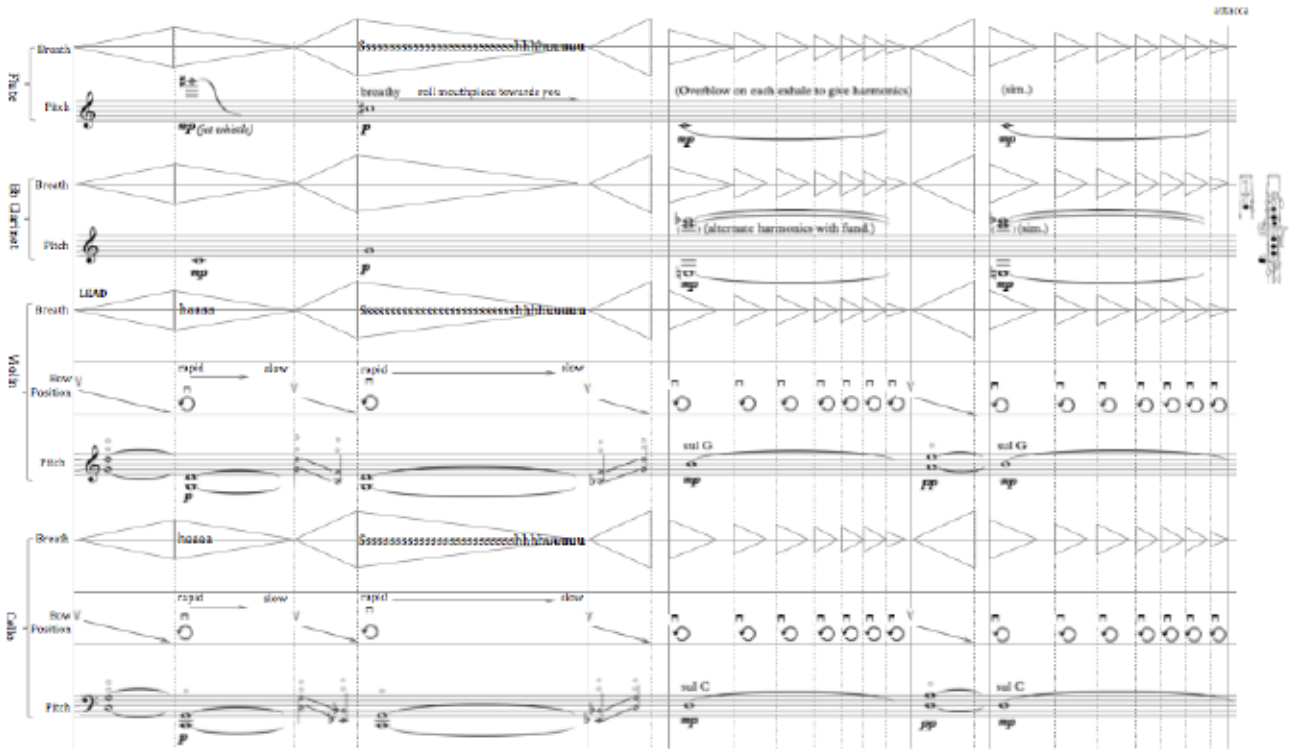


Figure 16 – Extract from *by breath and bow* (Harding 2017)

Sharing timing of breathing is physically challenging and requires practice, and bodily awareness from the musicians so as to avoid hyperventilation. The score therefore requests that the audience and performers participate in a joint sound meditation focusing on breath

such as, Pauline Oliveros' *Teach Yourself to Fly* (Oliveros 1974) directly before performing the piece. This particular meditation promotes active involvement and sound-making from all participants as they make their breathing sounds gradually transform into voiced sounds of increasing volume. The meditation therefore helps participants to focus on very quiet variations to the sounds, and puts the focus onto the synchronicity of breathing of the performers. This type of participatory activity is also one method that I have identified for de-partitioning the Arena Space by bridging the gap between performers and audience.

Contextually, shared breathing is linked to meditation, the expression of shock, and the musical demarcation of rests and upbeats. These characterised aspects of shared breathing are a part of the piece and are included as delivery directions in the score. The in-breath is of equal importance to the out-breath in the piece.

The notation in *by breath and bow* (2017), once again de-couples the actions of the performers – the string players have separate staves for left-hand (pitch), and right-hand (bow action), in addition to the breath-line, and wind players have the breath-line and finger positions (pitch) shown separately. The chosen harmony was selected as a result of its physical realisation on the various instruments involved: for example, no holes covered for the woodwinds is mapped to the open strings (no fingers down) of the violin and cello; all holes covered is mapped to the highest hand position on the string fingerboards, and so on.

by breath and bow (2017) was written as a concert commission for Ensemble Via Nova who are based in Weimar and as a result of

geographical distance and time constraints, I had little time to work with the musicians directly. I would be very interested to develop this piece and the concept further collaboratively, as I feel that with more time, the dramatic and physical ideas of the piece could be greatly expanded.

Action Mapping over Different Instruments

In my second commission for Ensemble Via Nova, *bellows, breath and bow* (2018), I imagined different levels of instrument-specific physical activity from the performers, categorising these into two action sets and noticing actions that have shared physical characteristics (Fig. 17). I then used these different action sets alongside an overall plan for the level of, and type of, activity that would occur in the piece over time, to determine the structure, content and overall choreography of the piece.

Kagel also used the categorisation of instrumental playing techniques as a compositional tool in his early period of *Instrumentale Theatre*. Bjørn Heile writes:

> "Kagel's sketches from the time [1960] reveal that he normally begins by charting the material available – studying the instruments, cataloguing and ordering the playing techniques – before proceeding to invent music that can be produced in these ways. Thus, the physicality and kinesis of playing is not a mere means to produce music but is central to it. This results in a new visual dimension to the music-making, as many instrumental actions are chosen for their kinetic and visual effects as well as for their acoustic results." (Heile 2008, p.35)

Heile goes on to give examples of this process in Kagel's works of the time, such as *Sonant 1960/…*(Kagel 1960) for guitar, harp, double bass

and drums and *Match* for three players (Kagel 1964). He states that *Sonant* (Kagel, 1960) focuses on "the tactile nature of playing", creating "an impression of spontaneity as if the players were exploring the instruments for the first time, trying out different ways of producing sounds and relishing the acoustic sensations…" (Heile 2008, p.37).

In contrast, in *Match* for three players (Kagel 1964) "two cellists compete under the direction of a percussionist referee in a musical game of tennis or table tennis" (Heile 2008, p.46). Heile explains: "The sketches show that Kagel collected string playing techniques and then drew up a table in which he formed pairs of bowing and fingering techniques such as *legno tratto* and *trill* or *pizzicato* and *flageolet* at random, even when these parings are unusual or counterintuitive". Thus Kagel generates material that demands athletic physical feats from the performers derived from an "exploitation of instrumental technique". Heile summarises that in *Match* (Kagel 1964), the instrumental playing has to be regarded as a "fusion of a kinetic action with its acoustic result" (Heile 2008, pp.45-47).

The categorisation of performer action in *bellows, breath and bow* (2018) is focused around different imagined action states for the ensemble, borne out of a similar combined approach to physical action and sounding result. One imagined physical state was very static with minimal, slow movements; the other was, by contrast, frenetic and active (Fig. 17). Where Kagel is said to have used counterintuitive or unusual combinations of technique to demand athletic feats from the performers, I instead look for similarities between various physical actions executed across the different instruments.

Figure 17 – Action Mapping over Different Instruments in *bellows, breath and bow* (Harding 2018)

Instrument	Stillness	Frenetic
Strings	Long slow full bows, slow re-takes, stationary silences, sustained pitches, minimal left-hand movement	Tremolo, string-crossing, marcato, spiccato. Rapid pitch changes in left-hand. Faster tempo.
Accordion	Long slow bellow movement, (fully expanding / closing), fixed unchanging pitches, so hands remain still / fixed in position.	Left-hand vibrato, bellow shakes, repeated key presses, alternative key presses between the hands, and therefore panning them between the two sides of the instrument, more frequent opening and closing of the bellows. Faster tempo.
Woodwind	Long sustained breaths, multiphonics (a fixed hand position that gives unstable / rich pitches), minimal hand movement.	Trills and runs to generate rapid hand movement. Faster tempo.

As I was least familiar with the accordion, I wanted to fully explore the physical action possibilities of the instrument, so I reached out to the accordion player, Romano Viazzani, who gave me a two-hour master class on the instrument. In the master class Romano demonstrated many of the accordion techniques that feature in the piece, such as bellow shakes, left-hand vibrato, and left-hand sustain whilst the right-hand taps out a

rhythm. I found the full body physicality of the accordion to be extremely inspiring, and decided that the accordion should have a prominent role within the piece.

It also felt logical that the accordion was the focus in the work, as the instrument seemed to represent a physical meeting point between woodwind and stringed instruments. The bow action of the string players maps very effectively onto the bellow action of the accordion; down bows equate to opening the bellows, and up bows, closing. The accordion left-hand vibrato and bellow shakes physically map onto the tremolo activity in the strings as they both involve a rapid back and forth shaking arm motion over a small distance, yet the accordion sound is generated by air moving through the reed blocks, linking it to the woodwinds.

The Table in Fig. 17 shows that the woodwinds' frenetic material also consists of rapid oscillating finger motion generated by trills and incessant runs. Their static material, in contrast, features multiphonics selected as they are a rich and complex sonority generated from a static, fixed hand position. I also made a rough graphical plan of the temporal flow of physical action in the piece (summarised in Fig. 18) using this alongside the action categorisations, as a map for the structure of the piece.
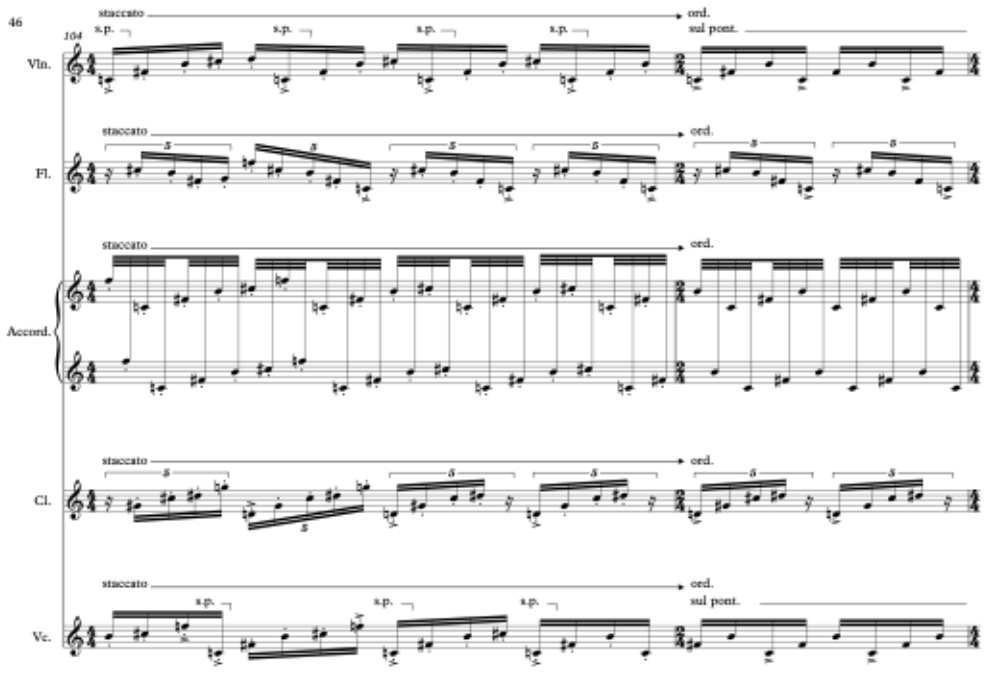
Time	0 1 2 3	4 5 6	7	8 9
Physical State:	Static, immobile, no pulse	Pulsed loops	Most Active	Accel. / Rit. to sustained pitches, no pulse.
Flute	Long held, multi phonics	Arpeggiated patterns Accel. / Phase	Trills	Repeated notes accel. / rit.
Violin	Long held Fluctuation	String crossings / marcato Accel. / Phase	Tremolo	Repeated notes accel. / rit.
Accordion	Long held	Bellow Shakes Accel. / Phase	Alternating reed boxes	Repeated notes R.H taps out accel. / rit.
Cello	Long held Fluctuation	String crossings / marcato Accel. / Phase	Tremolo	Repeated notes accel. / rit.
Clarinet	Long held, multi phonics	Arpeggiated patterns Accel. / Phase	Trills	Repeated notes accel. / rit.
	A	B		C = A + B material

Figure 18 – Activity Plan *by breath and bow* (Harding 2018)

I also considered the spatial orchestration of the sonic material, playing with passing sounds between the instruments in their fixed positions and hocketing melodies between performers, as well as between the two reed boxes on either side of the accordion. For example, between rehearsal marks K and L, the violin, flute, clarinet and cello pass around the same accented pitches at different timings, in a kind of spatial 'phase' (Fig. 19). The opening to rehearsal mark D (see full score) also sees chords from the accordion spatially spreading to include doublings on the other instruments in the ensemble (see documentation footage).

As with the previous commission for Ensemble Via Nova, I had minimal time to collaborate with the musicians before the premiere. This meant that certain imagined physical ideas were not fully realised, for example the synchronised slow motion, timed bow re-takes and slow opening and closing of the bellows by the accordion player, were not fully manifest in the premiere. I am confident, however, that these ideas would work with further time to collaborate with the performers.

Figure 19 – Extract from *bellows, breath and bow* (Harding 2018)



Chapter Summary

In this chapter I have presented a window into the various ways in which I have explored and experimented with compositional ideas in the Action Space of music, specifically looking at four works from the creative portfolio: *Extension* (2018), *Motion* (2018), *by breath and bow* (2017) and *bellows, breath and bow* (2018). In so doing, I have touched upon the work of other composers with whom my ideas and approaches seem to resonate.

The main techniques I have discovered for analysing and working with sounding-action in composition are: (1) action mapping and tracking (2) body-centred rather than metronomic timing (3) the categorisation of action into activity sets and (4) mapping actions with similar qualities across different instruments. I feel that this research is extremely rich and exciting and has opened up many areas for further exploration, beyond the scope of this PhD.

CHAPTER THREE: ENSEMBLE SPACE

"Ensemble space, within which individual [action] spaces are nested, is the personal and social space among performers: a group of performers produces a collective performed space. This is revealed both visually (seeing proprioception at work, and knowing how it works) and in the music (hearing proprioception at work)." (Smalley 2007, p.42)

Ensemble Space

In this chapter, I zoom out from the individual Action Space of the performer, explored in Chapter Two, to focus on the Ensemble Space, with direct reference to the creative portfolio pieces *Mixed Messages* (2017), *Mirror* (2016) and selected studies written for Contemporary Music for All (CoMA). In *Space-Form and the Acousmatic Image* (Smalley 2007), Smalley defines the Ensemble Space as the "personal and social space among performers… revealed both visually… and in the music". The Ensemble Space is therefore the space within which individual performer Action Spaces are nested, and is defined by the presence (aural or visual) and positioning of the performers (Smalley 2007, p.42)[23].

Ensemble Space is generated when two or more performers perform (or rehearse) in the same time period and arena, and conventionally involves intersubjective interaction between performers (or between performers and media) over elements of delivery such as synchronisation and phrasing[24]. This creates a sub-set of physical actions that Godøy terms

[23] Ensemble Space can also include an interaction between a live performer and fixed media and/or live electronics.

[24] Some works do deliberately request that performers do not interact (for example Cage / Cunningham), however these are usually exceptions.

communicative actions (Godøy et al. 2012)[25], introduced in *Classifications of Music-Related Physical Action* (p.41).

When the Ensemble Space is laid out conventionally[26], *communicative actions* are easily heard and seen by all of the performers – the lift of a bow arm, the exaggerated in-breath, a rise of the eyebrows, a slightly accented note. In larger ensembles, cues and overall responsibility for synchronisation[27] traditionally falls to the conductor who beats out the shared time. It is particularly important to consider the purpose of, and need for, these communicative actions in music, usually visual and aural cues, when making variations to the spatial layout of performers in the Ensemble Space, as performer placement impacts directly upon their visibility and audibility.

Altering the spatial placement of performers in the Ensemble Space promotes and requires the development of alternative structures, methods for cueing change, and methods of synchronisation, for example through creating pieces built out of interlinking chains of events rather than fixed metronomic timings. It also requires the exploration of performer independence within large ensembles, as individuals can, for example, independently loop musical content in their own tempi – I discuss these ideas further in the sub-chapter titled *Space and Communicative Action* (p.97), analysing various studies written for CoMA, alongside relevant works by other composers.

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[25] This is not to say that *communicative actions* are not present in solo performance where their function is to communicate with the audience.

[26] All of the performers are seated together on a stage facing the audience, for classical music this is usually in a semi- circle.

[27] Synchronisation and cues are, of course, one of the many responsibilities of the conductor but they are highlighted here as these elements are of most interest to this research.

Conventional Ensemble Space in Western classical music traditionally requests a spatial divide of one performer to an instrument (with the exception of the piano). The Ensemble Space is therefore partitioned into a set of interlocking Action Spaces that are usually laid out side-by-side. The boundaries of these Action Spaces are usually defined by the spatial boundaries of each instrument's physical sounding-actions and in most instances are further demarcated visually, through the placement of a music stand and chair. In *De-partitioning the Ensemble Space* (p.73), I explore some of the effects of removing these conventional partitions on compositional processes, focusing on two pieces from the creative portfolio: *Mixed Messages II – Movement II* (2017) and a particular CoMA study called *230 Strings* (2017).

In the sub-chapters *Partitioning the Ensemble Space* (p.78) and *Offstage, Unseen and Distant* (p.91), I discuss the impact of adding further partitions to the Ensemble Space including the use of unseen performers and instruments, analysing relevant *CoMA Studies* (2017-2018), *Mirror* (2016) *and Mixed Messages – Movement I* (2017). Finally, I conclude that the method of approaching Ensemble Space construction presented in this research is often informed by elements of musical structure. For example, spatial decisions can be related to pitch relationships, to tempo relationships, to concepts of foreground and background or contrasting layers, or to cue structures, as discussed in *Space as a Determinant of Musical Structure* (p.82).

De-partitioning the Ensemble Space

As soon as performers' Action Spaces start to overlap and the conventional partitions of the Ensemble Space are removed, interesting

creative possibilities for collaborative sounding-action emerge. *Mixed Messages – Movement II* (2017) focuses on interchanges between performers in the Ensemble Space by placing the performers close together and having them interact via shared instruments; a set of three cymbals. In this piece the percussionists use *modulatory actions*[28] to influence each other's sounds by 'choking' or holding the shared cymbals after other performers have struck them. The performers face inwards, and are positioned so they are able to look at each other rather facing the audience or a conductor. This sets up a dynamic of interchange and play (Fig. 5). *Mixed Messages - Movement II* (2017) is about this dialogue between the four percussionists over the shared cymbals, as the performers continually dampen and interrupt each other's strikes.

The notation used to represent these *modulatory actions* in the score is modified standard common practice notation (see the shared cymbals' staves in Fig. 20) – which is used to refer to the specific timings that these physical actions must be executed by, by the performers. You can see from Fig. 20 that the layout of the score reflects the physical positioning of the instruments and performers, with the cymbals' staves appearing in the centre between the staves of the performers, who stand opposite one another (see documentation footage).

When writing the piece, I constantly visualised the performers making their sounding and *modulatory actions* in order to ensure that they could execute them practically, within the indicated tempo. Part of the success of the premiere of the piece was due to the added tension that came from the physical challenge it represented for the performers.

[28] As defined in *Chapter Two: Action Space* in the sub-chapter *Classifications of Music-Related Physical Action* (p.40).
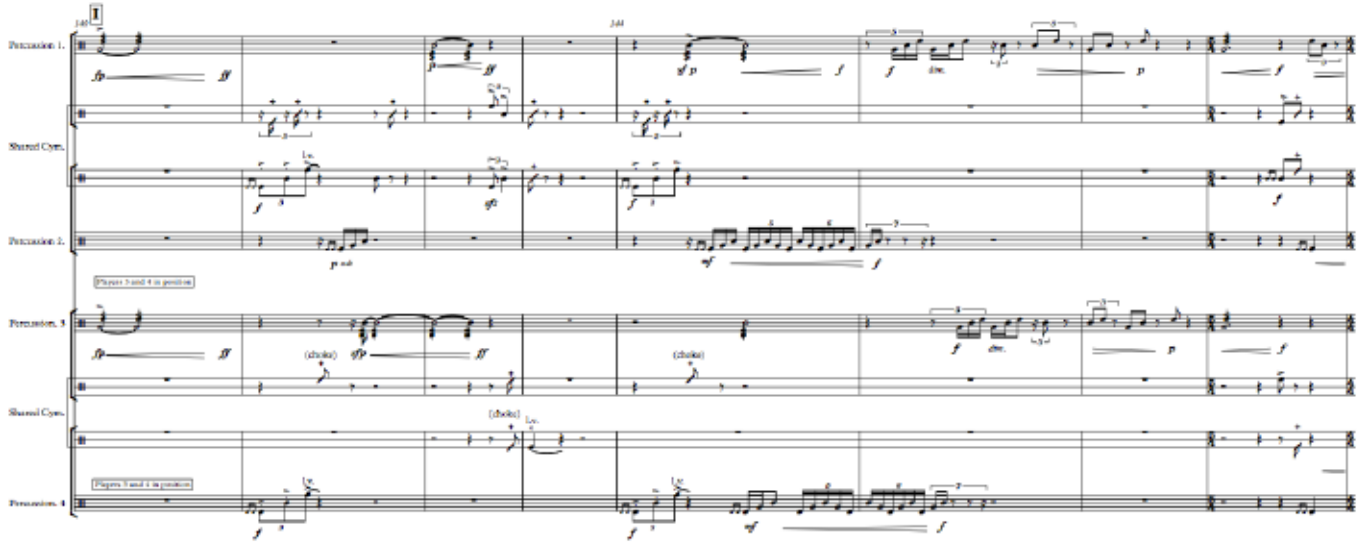


Figure 20 – Extract from *Mixed Messages – Movement II* (Harding 2017)

It is clear that Kagel explored similar ideas, again in the early period of his *Instrumentale Theatre*, in *Transicion II* (Kagel 1959) and *Improvisation ajoutée* (Kagel 1962). *Improvisation ajoutée* (Kagel 1962) is for one organist and two assistants, who pulls the stops. Here, the assistants are of equal importance to the performer playing the instrument: "the assistants do not necessarily support the organist, but perform active, independent roles…Thus…the cooperation between performers, or lack of it, is very much a part of the piece, the social dynamics of musical performance becoming a part of the composition itself" (Heile 2008, p.43).

There is a similar theatrical dynamic of exchange and of power struggle between the performers in the second movement of *Mixed Messages* (2017) that is borne out of dividing the *excitatory* and the *modulatory* actions (Godøy et al. 2012) involved in the sound-making between the different performers. In *Improvisation ajoutée* (Kagel 1962), much of the

theatrical effect of the piece, however, "may well be lost on audience as the organ gallery is usually hidden from view" (Heile 2008, p.44).[29]

Kagel explores a similar performance dynamic in *Transicion II* (Kagel 1959), for pianist, percussionist (who only plays inside the piano) and two tape recorders. The performers:

> "…collaborate for the production of individual notes: the percussionist's task is often to 'prepare' the piano strings in real time, that is dampening them with different materials at different places in the manner of Cagean piano preparation while the pianist is playing. Conversely the percussionist's playing on the strings is dependent on the pianist's pressing down on the pedal or the keys as otherwise the strings cannot vibrate…But rather than co-operate, the players can also get into one another's way…" (Heile 2008, p.25).

In both of Kagel's pieces, *Transicion II* (Kagel 1959) and *Improvisation ajoutée* (Kagel 1962), the performers seem to be struggling against each other and even against the mechanisms of the instruments that they are playing. The collaborative generation of sound from two or more performers playing one sounding-object gives a choreographic tension, which is also sought in *Mixed Messages – Movement II* (2017).

There is a different theatrical feel and aim to the de-partitioning of the Ensemble Space in one of the *CoMA Studies* (2017-18) called *230 Strings* (2017). The piece ends with all of the performers gradually setting down their instruments and congregating around the piano to play their

[29] In fact, Heile states that, "following the use of *Improvisation ajoutée* in his film *Hallelujah* (1968), Kagel substantially revised the piece and withdrew the original version…The assistants are replaced by a three-part chorus…"(Heile 2008, p.44).

previous sustained pitches in cross-rhythms either on the piano keys, or on the piano strings with bow hairs. The de-partitioning of the Ensemble Space here focuses on collaborative interactions between the performers. The piano soloist holds down the sustain pedal to allow the bowed strings to resonate, and also indicates the unified tempo. The players bowing the strings have to gather very close together to access their bow hairs, and the notated cross-rhythms (see Fig. 21) generate co-ordinated, choreographed movements.

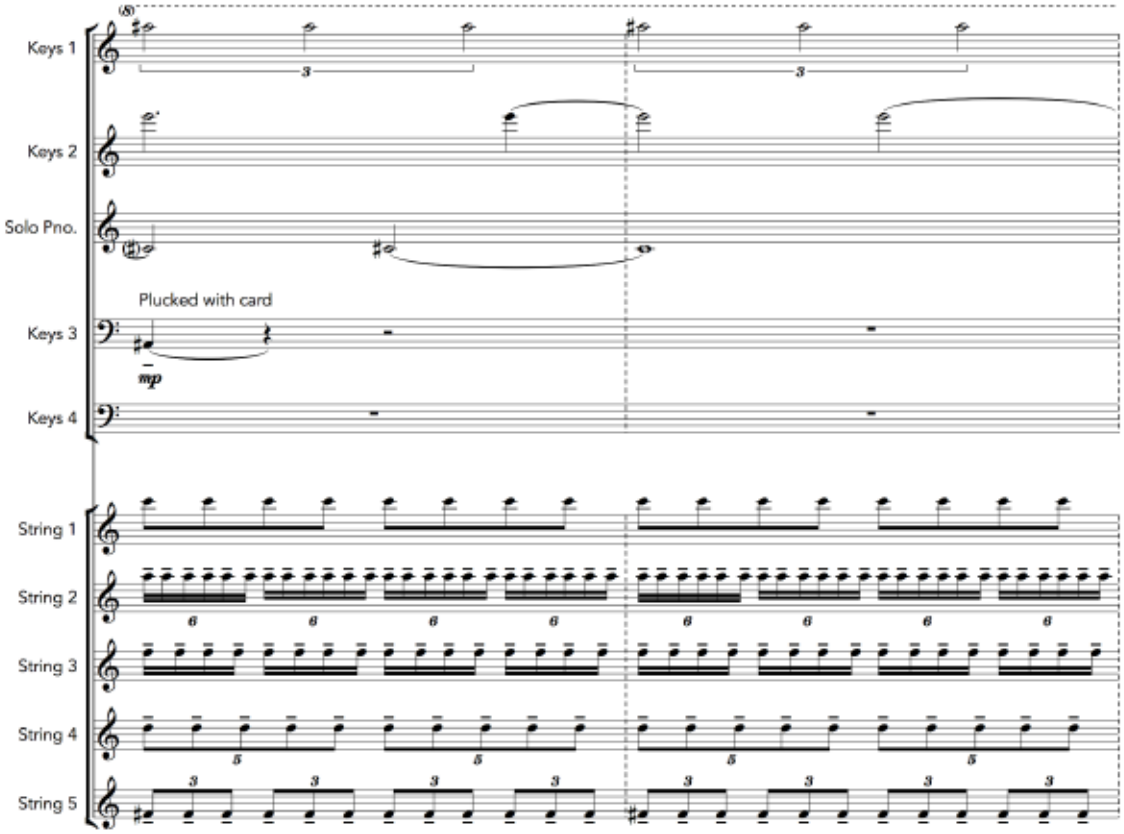


Figure 21 – Cross-rhythms in *230 Strings* (Harding 2017)

One of the players on the piano keys also thrice leans in to pluck a bass string – it is very much a team effort. The visual effect is reminiscent of a collaborative craft activity such as weaving (Fig. 22), the piano becomes the loom, threaded bow hairs and hands repeatedly rise and fall, and participants work together to produce a great volume of sound from one

instrument. By condensing the Ensemble Space onto one instrument in this piece, generating a shared 'Action Space', I aim to highlight the choreographic potential of sounding-action and intersubjective interaction between the performers.

Figure 22 – Weaving and Bowing



Photographers left: Ann Scanlon; right: Chris Tanton

Partitioning the Ensemble Space

In *230 Strings* (2017), the Ensemble Space also has additional spatial partitions structured around specific features of the music. The string players, for example, are set back on the stage furthest away from the audience in a group behind the piano. This made sense artistically as a manifestation of the musical structure since, aside from the piano, there are two groupings of instruments in the piece, the string players and the woodwind and brass players. The string players essentially sustain the harmonic resonances of the piano and are in the background, supporting the piano in the foreground.

Figure 23 – Start and End Positions, *230 Strings* (Harding 2017)

START:



END:



Photographer: Chris Tanton

The woodwind and brass instruments have a more prominent role, aurally and theatrically, than the strings. They begin by playing repeated, sustained interjections on their instruments, seated in one row and split into groups either side of the piano. As discussed previously, throughout the piece all (except the 'High Brass' player who moves to play offstage) put down their instruments and accumulate at either the piano keys or strings for the concluding bowed piano sequence. The woodwind and brass players therefore move from multiple spread out positions in the foreground, to accumulate around and perform on just one, central

sounding-object (Fig. 23). The Ensemble Space for this piece can therefore be thought of as divided into three spatial partitions, each with corresponding groups of performers and associated sonic material (shown in Fig. 24).

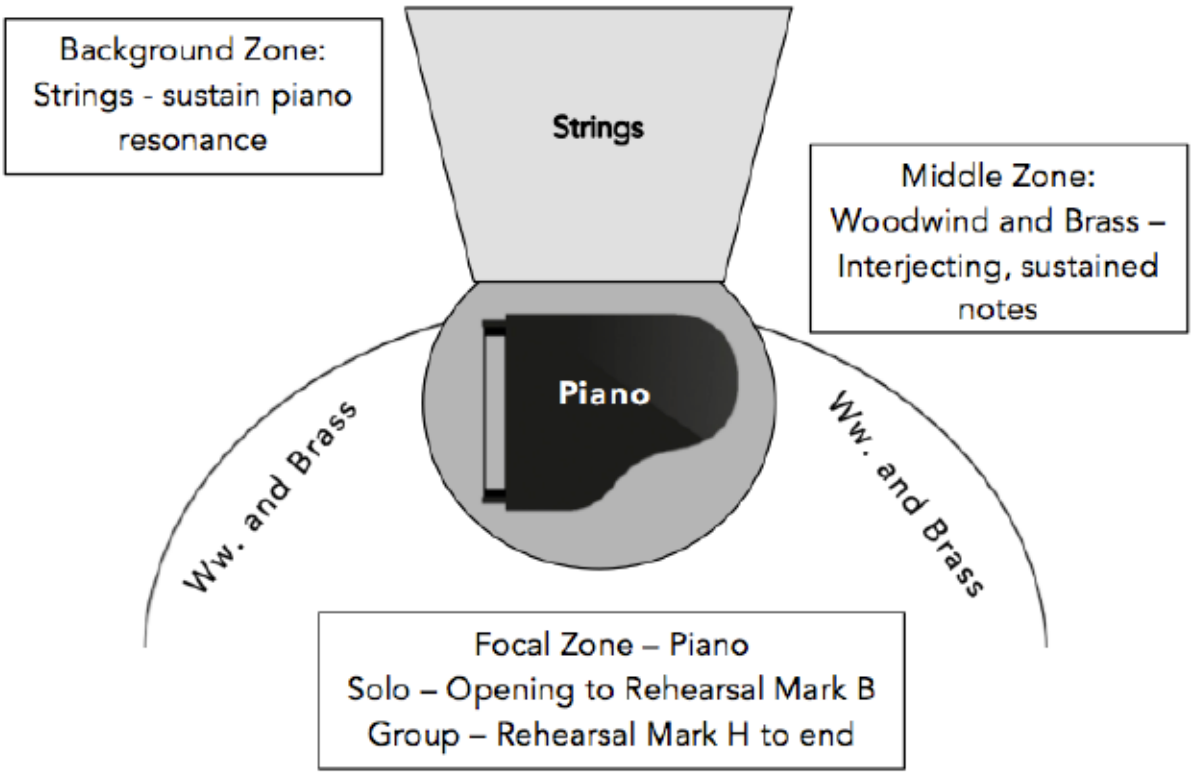


Figure 24 – Spatial Zones in *230 Strings* (Harding 2017)

The addition of partitions to the Ensemble Space in order to differentiate between groups of musicians and different types of sonic material is an idea that has its origins in antiphonal music and polychorality. It has been explored by many composers dating back to Giovanni Gabrieli (1554-1612). In arguably, one of the most comprehensive investigations of the use of space in contemporary music - *Space and Spatialization in Contemporary Music: History and Analysis ideas and implementations* (Harley 1994), Maria Anna Harley explores various approaches to the use of manifest space. She highlights three composers: Gustav Mahler, Charles Ives and Henry Brant, who had the similar artistic aim of using

physical space to distinguish between musical layers (Harley 1994, pp.123–135)[30].

Indeed, Brant, one of the most prolific composers of spatial music[31], makes this point himself in his article "Space as an essential aspect of musical composition" (Brant 1967) finding that (as summarised by Bates) "the perception of different layers of musical material can be enhanced by the spatial separation of the performers" (Bates 2009, p.121). However, in direct opposition to my own interest in the resultant visual and theatrical, as well as aural, implictations of partitioning and departitioning the Ensemble Space, Brant's focus was only on audible results:

> "The spatial elements in concert music, if exploited fully and expressively could make their points much more strongly if the sounds could be heard in complete darkness, without the disturbing and confusing intervention of merely functional visual impressions – such as the appearance and motions of performers and audience, and the décor and lighting of the hall – that are irrelevant to the actual communication of the music in terms of its sound" (Brant 1967).

Further differences in approach to the use of partitions and construction of the Ensemble Space emerge when considering the *CoMA Studies* (2017-18), *Traverse the Score* (2018) and *Graphic Score II* (2017) where the design of the space is used to reinforce aspects of musical structure and notation.

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[30] See Chapter 3 of *Space and Spatialization in Contemporary Music: History and analysis, ideas and implementations* (Harley 1994, pp.117–169) for an in-depth account of the varied use of space by several different twentieth century composers).

[31] "…publisher Carl Fisher lists seventy-six spatial pieces" (Harley 1997) in their catalogue of his work.

In 2017 I led a collaboratively devised performance with CoMA as a part of their 2017 summer school in Orkney, based on *Graphic Score II* (2017). The performance aimed to draw upon aspects of the Orkney islands' geography and history, so the graphic score has a direct spatial relationship to the Ring of Brodgar, a stone circle that we collectively visited, about six miles north-east of Stromness on the mainland. The spatial proportions and layout of the graphic score define the layout and partitions of the Ensemble Space, and a version of the graphic score can be seen etched on the floor at the centre of the space (Fig. 25).

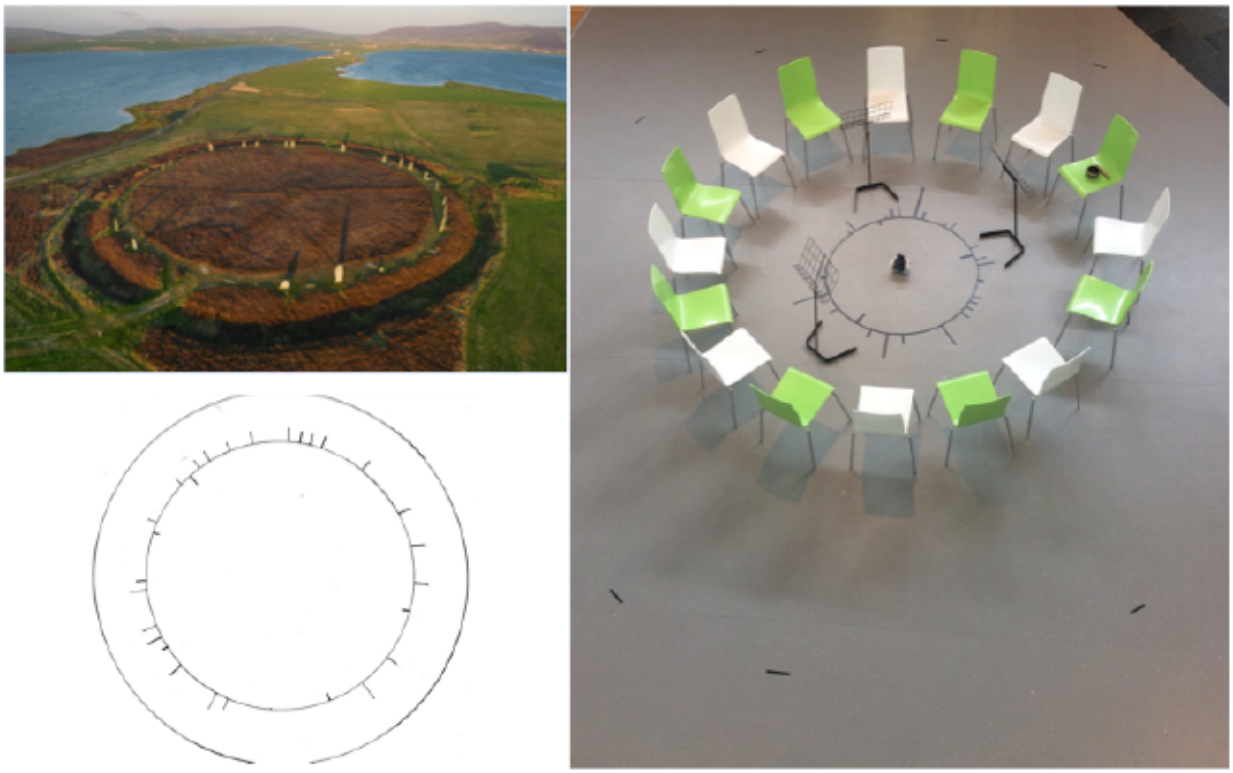


Figure 25 – Top left: The Ring of Brodgar; bottom left: *Graphic Score II* (2017); right: Ensemble Space Set-up for Performance

The performance builds upon different spatial exercises and ideas explored with the group over a week of daily, hour-long workshops,

where performers were asked to, for example, experiment with passing sounds around and across the circle, matching their *mode of execution*, *modality* or *vitality form*. The 'vitality form' of something is defined by Daniel Stern as aspects of "movement, timing perception of force, spatial aspects and perception of underlying intention" (Stern 2010, p.Cover Notes). Players chose to whom they would pass their sounds through *communicative actions* such as establishing eye contact, and through the use of directional gestures.

We also devised rules, and affixed sonic ideas to various partitions of the Ensemble Space, and to various tasks and actions. For example, when walking around the circle, the only sounds permitted were those generated through a rotating sounding-action. Another example of this is the physical act of laying down the music stands towards the end of the performance (making a reference to the fallen stones of the Ring of Brodgar) mapped onto downward glissandi in the sound. Cues for change were also linked to the performers' geographical positions and motion.

Thus in this performance, the construction of the Ensemble Space is connected directly to musical structure, to the graphic score and to compositional ideas. Further, it makes manifest the 'spatio-vertical' relationship of pitch[32], and plots sonic materials and cues for change onto manifest pathways and localisations. These aspects of the piece were built into a choreography memorised by the project participants over the course of the workshops, and therefore do not fully exist in a notated form. Our written performance instructions and notes are, however, included with the graphic score in the creative portfolio, for reference. In

[32] Discussed from the perspectives of music theory and aesthetics, by Harley in Chapter 2.1 of *Space and Spatialisation in Contemporary Music* (Harley 1994, pp.55–75).

the final section of the piece, we also interpreted the lines of the graphical score at the centre of the performance, as a notation for rhythm.

An example of another piece that follows a similar approach to the construction and design of the Ensemble Space around elements of musical structure is *Pas de cinq* (Kagel 1965). In this piece, five actors "walk along lanes constructed to form a regular pentagon", "covered with the most varied kinds of materials for example sheets of metal, plastic and wood" (Kagel 1965), in the order, direction, tempo and rhythm indicated in the score (Fig. 26).

Figure 26 – Extract from *Pas de cinq* (Kagel 1965) [redacted]

Heile states:

> "Five mute players walk in different patterns outlining a pentagon. In doing so, they are to execute certain rhythms with their steps, complemented by the use of walking sticks. To add timbral variation, the stage floor is carpeted with different materials. This leads to possibly the closest union of kinetic movement and resulting music in Kagel's instrumental theater…" (Heile 2008, p.53)

In both *Pas de cinq* (Kagel 1965) and *Graphic Score II* (2017), spatial rules for the delivery of sounding-action create a performance scenario where localisation and motion can determine the type of sonic material performed.

Traverse the Score (2018) also aims to create a similar performance scenario or environment for the performers and audience. The initial concept for the piece was to create a navigable score that both performers and audience could explore, for a set of interconnected spaces, with each space having an associated tempo and pitch set. Each participant would therefore have a unique aural and theatrical experience based on their chosen pathway through the interconnected musical spaces, experiencing multi-layered tempi and sounds from a variety of perspectives and a variety of proximal and distal viewing / listening positions.[33]

Traverse the Score (2018) was originally written for realisation at 'The Ditch', a warren of interconnected dilapidated rooms and corridors in the basement of Shoreditch Town Hall (Fig. 27). The original plan was for each room to have its own associated pitch centre and tempo delivered via a visual metronome. However, it turned out that this space was not

[33] See *Chapter Four: Arena Space* for more detailed discussions of space and audience perspective.

available, and given that there were only three interconnected rooms dedicated to the workshop, I adapted the original idea and instead placed multiple tempo stations in each of the rooms and wrote slightly different notated material for each space (Fig. 28).[34]

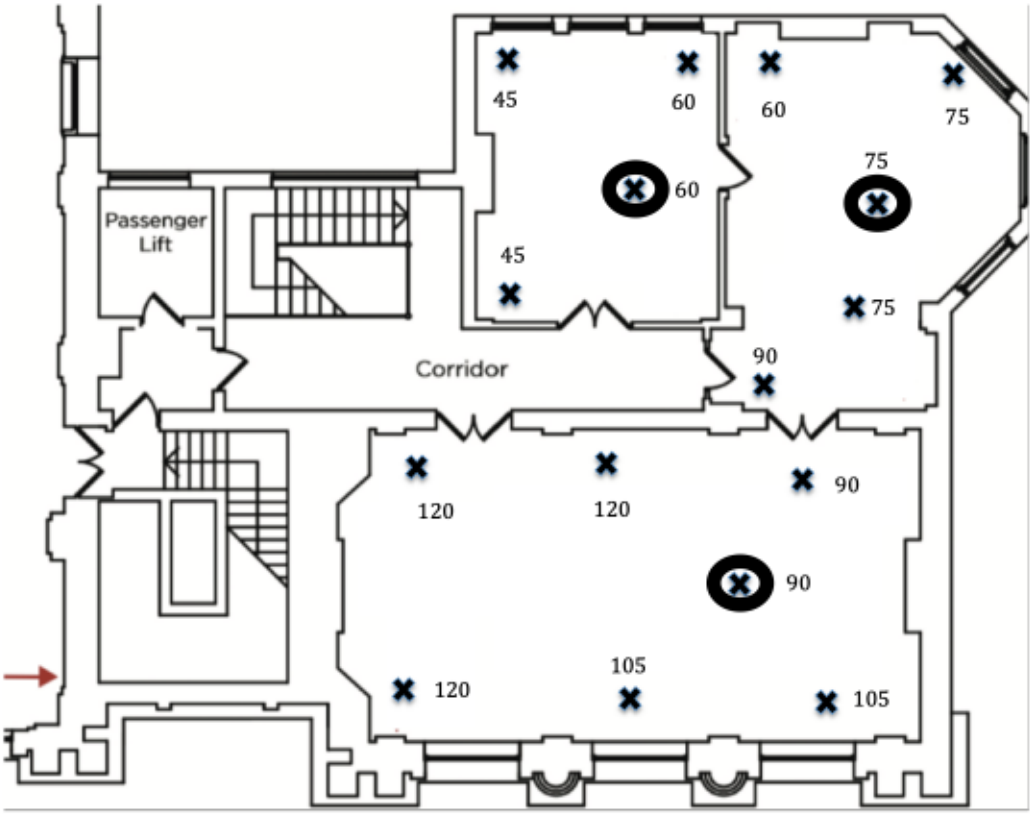


Figure 27 – 'The Ditch', Shoreditch Town Hall

Some stations had metronomes attached to them, which alternated between visually, and later audibly, indicating the tempo, and some stations were without metronomes. At stations without metronomes the players could perform the given material in their own tempo, indicated by instructions such as; "*Choose one note from those indicated below and play it for as long as possible at the marked dynamic using one breath or one bow*".

[34] I am hoping one day to be able to realise this piece in the intended location, as I think it would work more effectively when set in a larger, more complex and intriguing location.

Figure 28 – Shoreditch Town Hall Committee Rooms, Tempo Stations Plan for *Traverse the Score* (Harding 2018)



The performers were free to roam around and between the interconnected spaces and stations, playing from scores that were slightly different in each of the rooms. Thus parameters of the musical structure such as tempo relationships and foreground and background layers of musical material were made manifest for performers and audience in space, as well as in time.

At rehearsal mark 6 in the score, the different rooms are also allocated different major triads that are each a semitone apart. The spatial separation allows these triads to be heard as separate juxtaposed tonal centres, rather than as a cluster – which is how they would sound if voiced

by participants sharing the same spatial localisation. This aural phenomenon reinforces another key finding by Henry Brant (Brant 1967), paraphased by Bates (Bates 2009), who identified that:

> "Spatial separation is equivalent to pitch separation but allows for greater complexity as material in the same harmonic range which would merge if produced from the same location, can be separated into distinct musical lines if the sources are separated in space"(Bates 2009, p.121).

Many of my ideas relating to the construction of the Ensemble Space around aspects of musical structure can be seen in a sketchbook of ideas kept throughout the research, called *Space Forms* (2016-2019) (Appendix 1). The ideas presented in *Space Forms* (2016-2019) focus on an inter-relationship between musical structure and the construction of the manifest Ensemble Space. Some sketches, for example, propose mapping out the relationships between pitches (Hz or intervals) onto physical distances between sound sources (see p.4 *Location by Pitch*)[35] (Fig. 29).

Other sketches are concerned with musical parameters such as the speed of action, allocated to different zones or pathways in the Ensemble Space (p.2 *Layered Tempo Zones* and p.3 *Tempo Zones, Connected Spaces*). Similarly, categories of physical action and musical material can be plotted onto specific spatial zones (see p.6 *Zones and Transitions* and p.7 *Action Zones*) and pathways (p.8 *Tempo Lines*). These sketches can be

[35] Henry Brant discusses experiments with the vertical spatial realization of chords in his "Space as an Essential Aspect of Musical Composition" (Brant 1967, pp.232–233)

layered and combined in many different ways, and can be applied to stationary or moving performers.

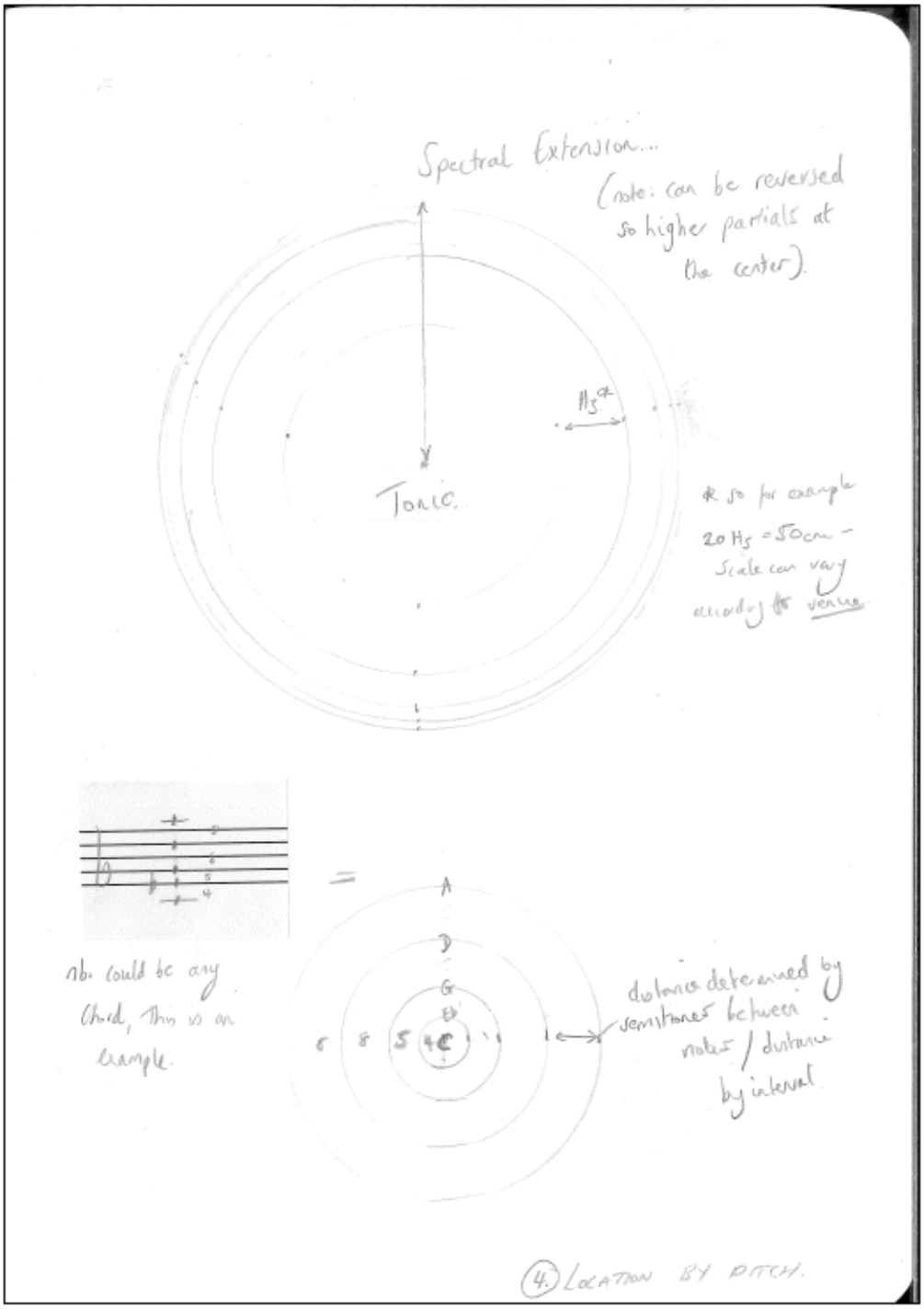


Figure 29 – *Location by Pitch* in *Space Forms* (Harding 2016-2019)

Another spatial device presented in *Space Forms* (2016-2019) is the idea of distance thresholds (p.5 *Distance Thresholds*). Distance thresholds can

be allocated to fixed or moving points in space, and they can be allocated to objects, architectural features, performers or audience members. Distance thresholds can be used to generate changes to performers' sounding-action relationships in many ways, for example distance or proximity to a threshold could generate changes to speed, timbre, pitch or delivery style. Cues for change can also be spatially triggered. An established example of a spatially triggered cue for change is the 'sweep', where the conductor sweeps his hand across the ensemble to generate a corresponding panning cue of change from the performers, which occurs as his hand passes each performer.[36]

In *Space Forms* (2016-2019), I propose that spatial cues could also take the form of spatially localised markers for mobile performers: "when you reach marker x, do y" and so on (see p.6 *Zones & Transitions*) or they could relate to the movement of others, for stationary performers: "when person x reaches point y, do z". These markers could also apply to the positioning of the audience – for example when an audience member reaches a specific point in space, or crosses a particular threshold, it can cue an event, or change in the sound.

Whilst many of the sketches in *Space Forms* (2016-2019) are yet to be realised, they offer further insight into some of the ways in which I explore the construction of the Ensemble Space in my compositions. In summary, this approach uses the layout and set up of an Ensemble Space as a three-dimensional, spatial realisation of aspects of the musical structure of a composition – cues, tempi, action, layers, and so on.

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[36] A technique used by Stephen Montague in *Dark Sun - August, 1945* (Montague 1995), *Intrada 1631* (Montague 2001) and *Dead Cat Bounce* (Montague 2015).

Offstage, Unseen and Distant

The Ensemble Space is not restricted to the visible, and can be expanded to include hidden, pre-recorded and distant performers and sound sources. Historically, the idea of offstage sound has been explored by many composers for varying aesthetic reasons – for example: to evoke the supernatural through disembodiment (Mahler, *Symphony No. 2* (Mahler, 1894)), or to better distinguish between foreground and background layers and give the acoustic quality of distance (Ives, *The Unanswered Question* (Ives, 1908)) (Harley 1994, pp.123–135).

I have noted that Henry Brant, along with many composers historically interested in the spatialisation of music, wanted to remove the physical presence of the performers from the equation entirely, in order to accentuate the acoustic effects of spatiality and remove any references to physical agency (see *De-partitioning the Ensemble Space* (p.73)). The desirability of visually source-less sound is linked to a general movement at that time, towards the objectification of sound, in particular the early explorations into what became known as Acousmatic Music by Pierre Schaeffer, which was, of course, closely linked to the development of recorded music and associated technologies.

In contrast, my explorations of the Ensemble Space in this research demonstrate an interest in the changes that spatialisation affords to sounding possibilities; the ways that performer physical agency can be highlighted, and the theatrical and choreographic potential of musical performance. This resonates with similar influences to those of Mauricio Kagel, whom Heile describes as "…picking up a thread from the pre-war avant gardes…by developing new forms of music theatre which call

attention to the inherent theatricality of music performance". Heile goes on to state that: "The ghostliness of performances of electronic music may also have been an important catalyst in re-evaluating the physicality of performance, elevating it from a barely tolerated irritation to an indispensable element of the work itself" (Heile 2008, p.34). My use of offstage spaces, hidden and visible performers, and sound sources echoes this sentiment, and seeks to highlight the dramatic potential of the absence and presence of agency, as well as the acoustic effects of distance.

In *Mirror* (2016), the first piece written as part of this research, for example, the ensemble is split into two groups, one seen and one unseen. This idea was borne out of a theatrical idea relating to the source text for the piece, *Mirror* by Sylvia Plath (Plath 1961). I imagined an unseen, acoustically distant ensemble reflecting and expanding upon the sonic material of the visible performers and instruments on stage: a kind of ghostly ensemble through the looking glass (Fig. 30).

The acoustic qualities of distance were also particularly important to Charles Ives who states:

> "It is difficult to reproduce the sounds and feeling that distance gives to sound wholly by reducing or increasing the number of instruments or by varying their intensities. A brass band playing *pianissimo* across the street is a different sounding thing from the same band, playing the same piece *forte*, a block or so away" (Ives 1933, p.191) .

Similarly to Ives, this un-reproducible timbral quality of distance, and a resultant enhanced sense of foreground and background layers of music,

was what I aimed to achieve through the changes to the spatial placement of performers in *Mirror* (2016). Ives said that "music seems too often all foreground" (Ives 1933, p.194). The disembodied nature of offstage, unseen sound sources also creates a new unseen Action Space, juxtaposed against the one that is in view on the stage. Harley argues that Mahler and Ives saw this unseen presence as a musical metaphor for the supernatural, or for heaven and God (Harley 1997, pp.123–135), and it is interesting that in *Mirror* (2016), the offstage area also refers to something 'other worldly'.

In the performance of *Mirror* (2016), however, the acoustic quality of distance did not fully translate to the audience for a number of reasons. Between the seen and unseen ensembles there was a dividing curtain: the curtain was placed so as to obscure the audiences' view of the unseen ensemble, and to dampen their sound. The dividing curtain did not dampen the sound sufficiently and this, combined with the fact that the seen ensemble was facing away from the audience,[37] meant that the distant acoustic quality did not come across (Fig. 30). Many of the spatially-conceived orchestrations, where sounds pass between instruments in the seen space to the distant unseen one and vice versa, also did not come across as clearly as intended because the musical material between the ensembles overlapped both rhythmically and harmonically, and was too similar to be able to localise to specific placements (as can be noted in the accompanying recording from the premiere).

[37] A decision taken for practical reasons, as both groups could then see the conductor through the gap in the curtain, thus removing the need for a video link, which was not available at the venue of the performance.

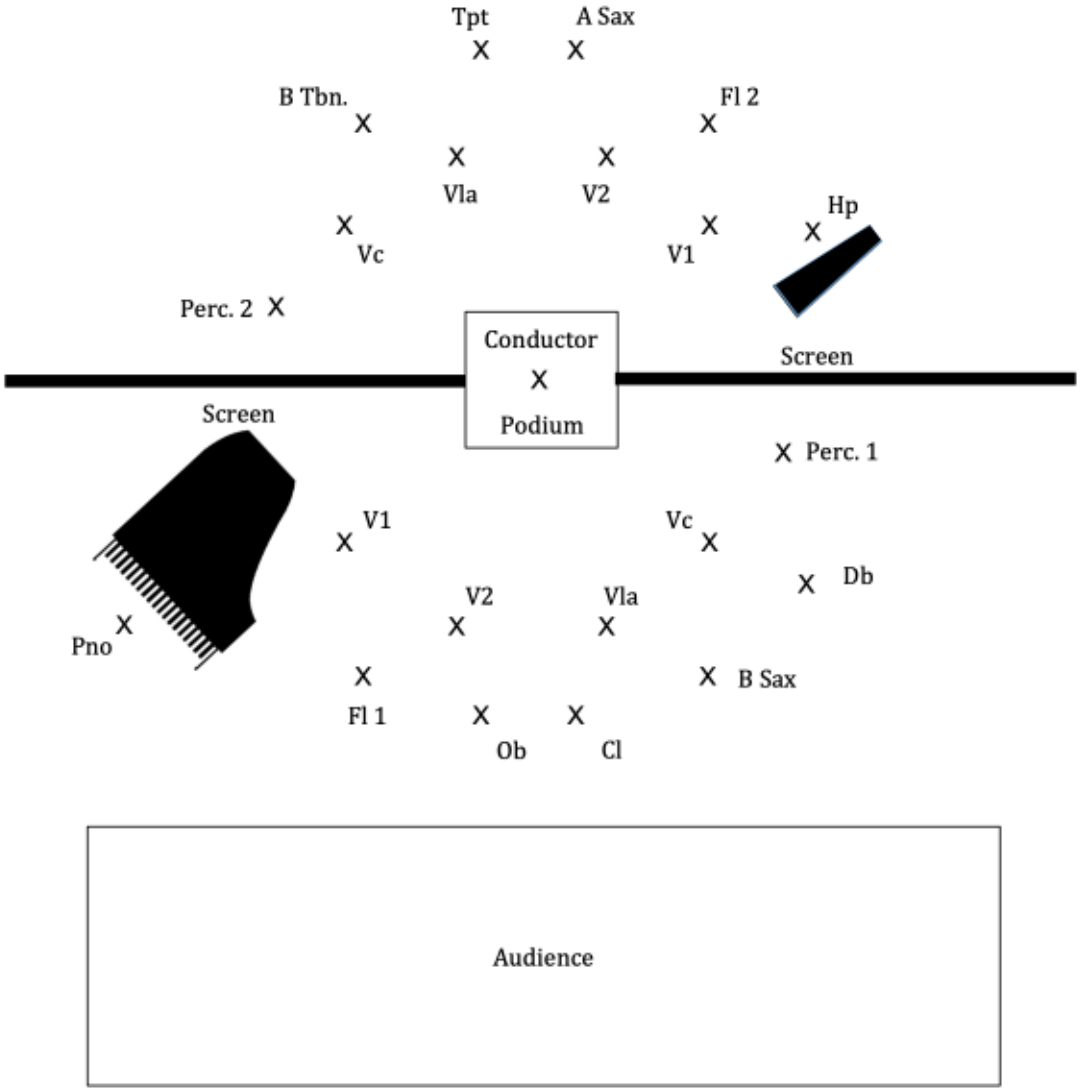


Figure 30 – Stage Plan for *Mirror* (Harding 2016)

It would have been more arresting to have highly contrasting musical material, for example a high-powered, fast-moving, frenetic sound world emerging from the hidden ensemble, whilst the ensemble in view played very slow moving and physically static sounds.[38] In hindsight, the instruments placed in the offstage positions in *Mirror* (2016) were also too familiar to ignite curiosity. The fact that the sounds from the unseen ensemble were borne of expected vocal and instrumental sources that Smalley rightly asserts would be "assumed and known in advance" (Smalley 1997, p.111) by a typical audience could also have contributed

[38] An effect used by Stockhausen in his *Trans* (Stockhausen 1971) where the visible rows of string players barely move, whilst hidden woodwind and brass players execute much more active material.

to the lack of impact. The removed visual and physical actions of the unseen ensemble are easy to infer, as all of the sounds are strongly *source-bonded*. Nevertheless, I believe that the fundamental concept of the piece has value, despite these issues with practical realisation.

De-coupling the action-to-sound relationship is another effective compositional possibility in the unseen Action Space, where mime and obscured or unseen sound sources can generate sound-without-action, and action can exist without sound. Georges Aperghis' *Les Guetteurs de son* (Aperghis 1981), translated as *The Sound Watchers*, is a relevant example of this:

> "*Les Guetters de Sons* is a trio for percussion that creates an intriguing world of sensory experience by playing with the perceptual schism between the auditory and visual realms: though the performers appear to strike their drums, these drums often stubbornly refuse to produce sound. These silent or empty gestures become compositional elements in their own right and challenge our notions of expectation and perception" (Duker accessed June 2017).

The performers play their bass drums with foot pedals so the visual impetus for this sound is removed, given the focus is on the hands. Indeed, Aperghis requests that the musicians' bodies are absolutely immobile and "only the arms, hands and fingers move" (Aperghis, 1981).

As already mentioned in *Constructing the Performance Scenario* (p.25), I explore a similar idea with cowbells mounted on foot-pedals in *Mixed Messages – Movement III* (2017), in order to accentuate the 'missing' physical action in the hands. This movement also features mime where the physical action is presented without a sounding result.

The practical issues experienced with *Mirror* (2016), highlighted the need for practical testing of spatial and physical ideas with musicians in the Arena Space of the performance. This need was also identified by the prolific spatial composer, Henry Brant, who "warns about the danger of conceiving 'visual aspects of music space' on paper without practical tests in the performance space" (Harley 1994, p.112). It became clear, through writing *Mirror* (2016), that a more practical long-term exploration of the Ensemble and Arena Spaces of music with musicians would be beneficial to my research. This experience is what led me to approach CoMA so as to investigate the possibility of working with their ensemble over an extended period of workshops and rehearsals, in order to experiment with ideas and develop new 'open score' spatial works and studies (some of which have already been discussed).

CoMA is a perfect ensemble and community within which to explore spatial and physical ideas, as the participants are extremely enthusiastic, open-minded and experimental. As an amateur ensemble with a community focus, they have extensive rehearsal periods and meet on a weekly basis for several months before a performance, which allows for the continued experimentation and exploration of ideas. Open scores for CoMA also have to reflect the fact that – "All CoMA ensembles have a different make-up and music written for them must take this on board. The piece can either be freely-scored, i.e. it doesn't matter whether an accordion, sax, bassoon and double-bass turns up to play it...- the work can still be performed; or it can have rather more fixed scoring, but still be flexible" (Burrell 2004, p.12).

It is through working with CoMA that I was able to consider the role and purpose of *communicative action* (see *Classifications of Music-Related Physical Action* (p.41) for definition) in performances where players are spatially spread out, and to consider alternative temporal relationships and ways of structuring cues for change between performers. It is logical that when performers are positioned closer together, so that their Action Spaces overlap, they are able to interact more freely and dynamically: proximity means clarity of visual and aural cues. *Communicative actions*, in this kind of set-up, can be based on touch, or minute changes in facial expression.

When musicians are more conventionally seated and partitioned, and each has their own instrument, *communicative actions* manifest as more exaggerated physical movements or detectable aural cues. As the distances and instrumental forces scale up, the need arises for a conductor to synchronise and cue events. It therefore follows that when performers are moved even further apart (in many cases without direct sight lines to one another) new musical structures, methods of synchronisation, ways of establishing tempi and *communicative actions* are required. There is a clear connection between the sounding-action and *communicative action* possibilities afforded by having performers positioned very close together or very far apart. This correlates directly to Edward Hall's *proxemics*; dynamic types of space and spatial interaction based on biometric concepts (explored in *Constructing the Performance Scenario* p25).

In the creative portfolio compositions where performers are spread out around the Arena Space: *Spatial Study on D* (2017), *Spatial Study on Rotation* (2017) and *Mixed Messages – Movement I* (2017), I have experimented with coordinated cues for change that are given visibly as large down beats by a conductor in the sight-lines of all involved. These visual conductor cues have to be extremely large visual gestures, on the scale of semaphore, which can sometimes be theatrically inappropriate if the musical material is not changing significantly.

Aural cues are also possible, for example the striking of a Tibetan Bowl in *Spatial Study on Rotation* (2017) (at Cue U), or spatial cues, such as the physical passing of pitches from wine glass players to string players (at Cue S). It became apparent through rehearsing with CoMA that gradual cues for change such as Cues 1 to 5 of *Spatial Study on D* (2017) could also be coordinated very effectively by the performers autonomously, through concentrated listening across the spatial divide. However, this only works with certain types of musical material where distinct timbral changes are occurring without the need for rigid synchronisation.

As a result, the tempi of the looped bars for each player in *Spatial Study on D* (2017) are, for the most part, defined by each performer independently (Fig. 31) – an approach that links to Lutosławski's technique of, '*aleatory counterpoint*' (Gieraczyński 1989) where he introduced "chance elements into a compositions rhythmical structure while strict organisation of dynamic levels is maintained" (Culture.pl accessed January 2019)[39]. Thus, "although specifying the precise melody played by each instrument in a given passage, Lutosławski affords the

[39] A technique first seen in his work *Jeux Vénitiens* (Lutosławski 1961)

performers freedom to decide on the tempo of their respective lines, culminating in a blurred coalescence of animated sounds and textures"(Thomas May accessed January 2019).

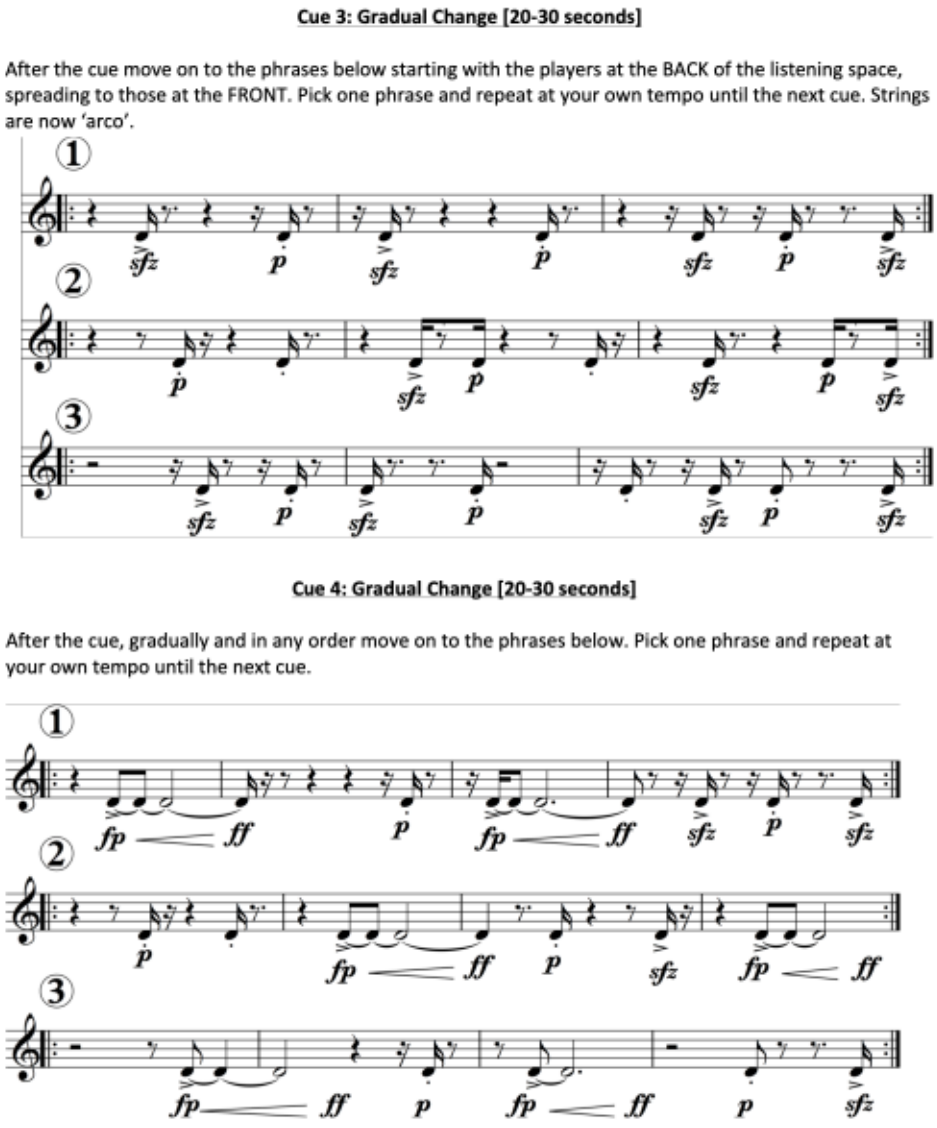


Figure 31 – Extract from *Spatial Study on D* (Harding 2017)

Lutosławski found that this controlled aleatoric approach enriched "the rhythmic aspect of the composition without increasing the difficulties for performers" and "allowed free, individualized play on the instruments in the orchestra". Creating a "special 'frail' texture with rich and whimsical

rhythms…quite impossible to achieve in any other way" (Gieraczyński 1989, p.8). In *Spatial Study on D* (2017) and *Melting, Shifting, Liquid World* (2019) aleatoric 'loops' are used for a similar purpose to Lutosławski's, to allow independent playing from individual performers within larger ensembles. The practical fact that the use of independent tempi demands no common division of time for all the performers removing the need for a conductor and visible *communicative action* between performers, also makes these techniques key tools and structural devices for performed spatial composition. There is also a link between the decision to invite performers to adopt their own tempi by using this 'controlled aleatoric' approach, and the use of body-centred timing explored in *Chapter Two: Action Space*.

One section of *Spatial Study on D* (2017), however, requested that the conductor beat out a shared tempo, added in order to achieve a panning effect between players on the two sides of the room (Cue 6). Accurate synchronisation proved difficult to co-ordinate and on reflection did not work in the premiere, as there was little difference in the sound and rhythm to the previous free-tempo aleatoric loop. I deduced that this was due to the distance impeding conductor visibility and creating time lag.

Regarding this problem, Henry Brant, in his article "Space as an Essential Aspect of Musical Composition", states:

> "Whether the spatial separation is small or great, it will cause a deterioration in the rhythmic co-ordination (keeping together) of the separated groups, and hence in their harmonic connection. At the same time, if the music is so written that the separated groups are in a contrasted polyphonic-rhythmic relation to each other, the separation will enhance contrapuntal

> clarity and distinctness to a marked degree." (Brant 1967, p.233)

Nevertheless, I found that the musical structure of *Spatial Study on D* (2017), which combines a series of aleatoric loops, with an overarching cue structure where down-beats signify progression to the next section, to be an extremely effective way of constructing spatialised music. I have also encountered this approach in other spatial pieces, including *Bee Haven* (Weeks 2017) and *Venetian Sky* (Weeks 2018) both written for CoMA by James Weeks.[40] In *Bee Haven* (Weeks 2017), Weeks removes the need for a conductor altogether, by setting cues to fixed points in time and having performers follow stopwatches. Weeks says:

> "…pretty much all my spatialised pieces…start from the basis that individuals are working separately from each other, or are working within small groups that are themselves separate from each other…in all these pieces the notation is read separately by each individual or separate group, and I tend to work in different material types which they can move between independently, ad lib., or choose their own fixed ordering. In all these pieces there is never any strict synchronisation within the piece: often participants keep track of time with a stopwatch, and there are loose timings given for them to spend on each type of material, or a specific moment in the piece to begin doing something else". [41]

The development of affordable technologies (stopwatches, headphones etc.) has opened up further possibilities for the synchronisation of performers over large distances. In *Outside in* (2012) (Appendix 4) a piece written prior to this research, for example, I experimented with delivering

[40] See Appendix 3 for a short interview with James Weeks about his spatial works for live performers conducted in January 2019.

[41] A technique also used by Paul Newland in one of his works for CoMA, called *Husk* (2012).

individual click tracks to performers over wireless headphones, allowing them to synchronise when spread out over the Arena Space and offstage areas. However, whilst this was an excellent practical solution, I disliked the aesthetic effect of having performers rigidly following metronomes in order to stay in time, as it detracted from their ability to play expressively and with sensitivity. In *Melting, Shifting, Liquid World* (2019) however, I explore the use of open-ear, bone-conduction headsets with a 'navigation track' rather than a click-track for the soloist. This navigation track controlled elements of synchronisation between the electric viola and electroacoustic fixed media parts, as well as prompting the soloist / director to deliver cues to the ensemble at specific timings (explored in more detail in *Chapter Four: Arena Space*).

Examples of other composers writing works using headphones to coordinate performers who are spatially separated include Alwynne Pritchard's *Stamp Club Report 1980* (Pritchard 2018) and Marina Rosenfeld's *Teenage Lontano* (Rosenfeld 2008). In both of these pieces, instead of the headphone audio being a metronome or navigation track, performers listen to audio scores. In Pritchard's case, the audio score tells participants which physical mechanisms to investigate in the body – conceiving of sound as a means of vibrating the body. The performers are spread out across the Arena Space, and face in different directions, each wearing headphones and ear defenders and perform with their eyes closed. Pritchard finds that the denial of the senses of sight and sound liberates the participants and allows them to be 'in the process' and less performative. In coordinating the process through the use of an audio

score, Pritchard removes the need for any *communicative action* between the performers entirely.[42]

In contrast, in *Teenage Lontano* (2008):

> "Rosenfeld laboriously transcribed and interpreted Ligeti's orchestral score [Lontano (Ligeti 1968)], creating a new digital score more than twice as long as the original. With shared pairs of earbud-style headphones distributed to them mostly in pairs, the teenagers were able to sing along to Rosenfeld's voice in one ear, while mainly hearing their own voices and the voices of their immediate neighbors in the other" (Marina Rosenfeld accessed January 2019).

What is clear from this sub-chapter is that an alternative approach to musical structure and direction is demanded when writing works that request the spatialisation of performers over distance, largely due to the need to develop alternatives to *communicative actions*. I found that aleatoric techniques such as Lutosławski's '*aleatory counterpoint*' work particularly well for practical as well as aesthetic reasons as they allow for performer independence within a larger musical structure. New technology such as bone-conduction headsets also present new and exciting ways to communicate information to performers in spatially spread positions, as they enable structural information to be delivered remotely, without impeding on a performers ability to hear themselves and others in the ensemble.

[42] Information gathered in an informal interview with Alwynne Pritchard in Ytre Arne, Bergen, July 2018.

Chapter Summary

In this chapter I have discussed the creative investigations into the Ensemble Space of music performance taken in this research, focusing on (1) the partitioning and de-partitioning of the Ensemble Space; (2) manifest spatial realisations of elements of musical structure; (3) the relationship between spatialisation and *communicative action*; (4) techniques for synchronisation and cueing change; and (5) the use of offstage, distant and unseen performers and physical actions. I have found that the sonic results of spatialisation are just one facet of my interest in space as a parameter of composition, and my motivations for using varied performer placement often have deeper theatrical or structural meaning. This research has opened up many threads of enquiry for future works and has allowed me to identify some of the deeper motivations behind my construction of performance scenarios and use of space in performed music.

CHAPTER FOUR: ARENA SPACE

"…it is music itself which is charged with linking [action], ensemble, and arena space, and in a 'good' performance this relationship is more than a mere link: the three spaces become integrated, despite any physical separation of ensemble space and the audience in the wider arena."

(Smalley 2007, p.42)

Arena Space

In this chapter I zoom out of the Ensemble Space to consider the Arena Space. I concur with Smalley's definition of the Arena Space as "the whole public space inhabited by both performers and listeners…The ultimate purpose of performance is to transmit music from gestural [action] and ensemble space to be perceived in arena space" (Smalley 2007, p.42). The most important distinguishing feature of the Arena Space is that it contains the audience, and the audience perceives the music performance through their spatially situated senses. This chapter therefore focuses on the listener.

The Arena Space is greatly influenced by the venue, the positioning of the performers and audience within the venue, and by the customs, conventions and social dynamics at play. Just as the Ensemble Space has traditional spatial conventions[43], so does the Arena Space of music performance. In Western classical music, there are certain spatial conventions: (1) there is a partition between the performers and audience, usually demarcated by a stage (or stages); (2) the audience is usually seated; and (3) the seating is usually fixed, facing the stage, which is

[43] Discussed in *Chapter Three: Ensemble Space*.

usually at the front, and is where most of the action occurs[44]. Many of these spatial conventions are reflected in the architecture and construction of concert halls and other venues typically used for music performance.

In *The Imaginary Theatre of Musical Works* (Goehr 1992), Lydia Goehr discusses how the conventional Arena Space of music performance, the concert hall, was designed with a certain type of music, audience and social dynamic in mind:

> "…audiences were asked to be literally and metaphorically silent, …But such attention was possible only if the music was performed in the appropriate physical setting. For how could one listen attentively and in silence if there were distracting elements all around? Performances had not only to become foreground affairs but they also had to be cut off completely from extra-musical activities. It was with these sorts of ideas in mind that concert halls started to be erected as monuments and establishments devoted to the performance of musical works" (Goehr 1992, p.236).

In her book, Goehr explores what she regards as the conceptual imperialism of "the musical work" and its "conceptually dependent ideals of compliant performance, accurate notation, and silent reception" (Goehr 1992, p.253) emerging from the romantic aesthetic around 1800. She asserts that concert halls were, as a result of this aesthetic, specifically designed with certain social behaviours and conventions in mind, namely: silent, attentive listening with musicians as the primary focus (therefore

[44] Also, since Richard Wagner, lighting in the audience auditorium is darker than the stage during performance, emphasising the distinction between audience and performer space (Shaw-Miller 2004, p.216).

seated on the stage) and extra-musical activity removed, so as to allow the audience to focus on the sound (Goehr 1992).

By this rationale, many of the venues that house music performance today and the associated behaviours within them, are structured around nineteenth-century ideals, conventions and listening practices that can sometimes be restrictive to composers who envision different perspectives to a front-on, silent, seated set-up. Contemporary composers have therefore consistently sought to devise new ways of constructing the Arena Space of music performance, to reflect their aesthetic and perspectival foci, both within the standard concert hall, and beyond.

Interest in the tangible parameters of music such as spatialisation and physical action often requires practical testing and experimentation with performers, on-site rehearsal, performance-specific direction and decision-making. Many aspects of performances of this type cannot be notated, are un-predictable and have to be adapted to suit new settings and performers: For example, the timing of performers walking between fixed points will differ from venue to venue, with different room dimensions, performers and orientations. These collaborative types of practice reflect a different methodology to the nineteenth-century 'Werktrue' model that Goehr discusses. I also consider alternative methods of sharing music performance with audiences to the 'Werktrue' model through, for example, using new technology and removing

traditional spatial partitions, in order to open up alternative listening perspectives and perceptual experiences.[45]

In *Space and Spatialization in Contemporary Music*, Harley introduces a classification scheme for spatialised music (Fig. 32). This scheme is used to explore various types of Arena Space construction in the creative portfolio, in comparison with works by other composers this can be found in *Construction of the Arena Space (below)*. Physically de-partitioning the Arena Space by removing the stage (as in *Spatial Study on D* (2017)), or removing fixed seating (as in *Traverse the Score* (2018) and *Melting, Shifting, Liquid World* (2019)) are two key strategies identified in this sub-chapter. I also note that the traditional concert hall set-up is preferable for certain pieces, particularly those where the clear visibility of the performer(s) is an essential part of the piece.

In *Listener Space and Perspective* (p.119), I explore how variations to audience and performer placement and movement in the Arena Space can offer alternative perspectives on the sound and action taking place. I also consider *Proximal and Distal Layers of Sound* (p.131) focusing on the multi-layered mixed media approach to listener space adopted in *Melting, Shifting, Liquid World* (2019). In *Sound Movement for Static Performers* (p.137), I examine the various sound-movement patterns for static performers used in the creative portfolio, and consider how these relate to other composers' movements of sounds in performed music. Finally, I conclude the chapter with a summary of my findings (p.143).

[45] This is not to say that alternative approaches cannot also be explored within a conventional concert-hall set-up.

Composers interested in the spatialisation of music performance, such as Ives, Brant, Xenakis, Stockhausen, Musgrave and Birtwistle, have been exploring different types of Arena Space design for some time. Harley introduces a classification scheme for spatialised music (Fig. 32), "limiting a potential infinity of patterns to a few manageable basic models" (Harley 1994, p.207). I have found this scheme to be particularly useful when considering the approaches taken to Arena Space construction within the creative portfolio, and as a result I have sub-categorised the pieces in relation to her different categories (see Fig. 33).

The first category of my table (Fig. 33): "Enclosed space of the concert hall, with vocal and instrumental sources and static audience and performers" – includes the creative portfolio pieces that focus predominantly on performer physical action as a compositional tool[46]. Here, the music has been written with the traditional nineteenth-century concert hall Arena Space in mind. Spatial effects such as sounds passing between performers are present in these works, but are restricted in scope to the stage (i.e. phasing, hocketing). These pieces tend to have a strong visual component. *Mixed Messages – Movement II* (2017), for example, focuses on the percussionists' interactions over shared cymbals; *bellows, breath and bow* (2018) maps the rate and type of performer physical action over time and across varied instruments; and *Mirror* (2016) features one seen and one unseen ensemble.

[46] Discussed in *Chapter Two: Action Space*.

Figure 32 – Harley's Classification of Spatial Designs

(Harley 1994, pp.210–211) [redacted]

Figure 33 – Pieces in Creative Portfolio, Classified by Spatial Design

Enclosed space of the concert hall, with vocal and instrumental sources and static audience and performers *by breath and bow* (2017) *bellows, breath and bow* (2018) *Mixed Messages – Movements II* and *III* (2017) *Extension* (2018) *Motion* (2018) *Mirror* (2016) – two ensembles in dialogue or antiphony (one hidden one seen). *Spatial Study on D* (2017) – performers spread out across the Arena Space around seated audience
Enclosed space of the concert hall, with vocal and instrumental sources, mobile performers and static audience *230 Strings* (2017) *Spatial Study on Rotation* (2017) *Mixed Messages – Movement I* (2017)
Enclosed space of any other kind, with vocal and instrumental sources, mobile performers and static audience *Graphic Score II* (2017)
Enclosed space of any other kind, with vocal and instrumental sources, mobile performers and mobile audience *Traverse the Score* (2018)
Enclosed space of any other kind, with mixed sound space (electroacoustic and vocal-instrumental), mobile performers and mobile audience *Melting, Shifting, Liquid World* (2019)

Spatial Study on D (2018) is the exception in this first category of the table, as the performers in this work are placed in static positions, spread out across the Arena Space, rather than appearing solely on the stage in front of the audience. Here, the conventional concert hall is de-partitioned, and performers stand and sit in and around the audience. This altered construction of the Arena Space, is intended for an altered perceptual approach to the listening experience for the audience – one where audience members can choose between multiple sound sources, and prioritise which to hold in the foreground and which to put in the background.

Many other composers have written works that require performers to be placed in alternative static positions around the concert hall, motivated by a range of different aesthetic and artistic interests, reflecting the affordances of spatialisation, for both the composer and for the listener: Xenakis and Stockhausen, for example, in works such as *Gruppen for Drei Orchester* (Stockhausen 1955-57) and *Persephassa* (Xenakis 1969), place the performers around the audience in order to explore the spatial movement of sound as a compositional parameter[47]. In contrast, composers such as Brant, Mahler and Ives use a variety of fixed spatial placements of performers, in order to give clarity to different musical layers. I selected these examples of affordances of performer spatialisation as they also feature in the creative portfolio.

The next two categories in the table (Fig. 33) include works where players are required to move about the Arena Space, in and around a static audience, as part of a performance. There are two main types of

[47] See sub-chapter *Sound Movement for Static Performers* (p.136).

performer movement in this category; the first requests changes to player position on the stage as a part of the 'choreography' of a piece; the second involves performer movement off stage and into other areas of the Arena Space.

The movement of performers on stage is a common spatialisation technique that features in several well-known compositions, including Pierre Boulez's *Domaines* (Boulez 1968) where the solo clarinettist approaches six different spatially separated groups of musicians on the stage in order to initiate their material or *cahiers*. Another example is Harrison Birtwistle's, *Verses for Ensembles* (Birtwistle 1968-9), during which virtually all of the performers have "numerous movements around the stage" that "are rigorously scripted throughout the piece's half-hour span in a series of diagrams in the score" (Rupprecht 2015, p.352). Birtwistle explains that these spatial elements visually underline the structure of the piece for the audience: "different kinds of music are attached to different ensembles, who play them in a sort of 'territory'" (Birtwistle & Lorraine 1997, p.12).

In *230 Strings* (2017), in contrast, the same sound material moves from multiple spread woodwind and brass instruments to one instrumental source: the piano. However, I concur with the implication of Birtwistle's and Boulez's approaches, which is that spatial or choreographic events can help to frame the listening experience. This idea also resonates with Reybrouck's understanding of music as experiential[48] where he states that "events…behave as basic building blocks of understanding. They

[48] Discussed in *Chapter One: Context*.

function as units in perception and memory, calling forth an 'ecological approach' to memory phenomena" (Reybrouck 2005, p.4).

Such physical 'events' can be seen in *Spatial Study on Rotation* (2017) where, at Cue S, the offstage wine glass performers approach the on-stage string players, and "hand over" their wine glass pitches in a kind of strange ritual. The wine glass performers then return to their starting positions around the audience and take up their woodwind and brass instruments to play sustained notes, whilst performing axial rotations in their fixed positions[49]. This "handing over" of the pitches and the axial rotations transforms the timbre of the sounds. However, the physical acts of passing the sound, and performers rotating on the spot, also dramatically frames the listening experience.

Whilst Harley agrees "all spatial arrangements may be enriched by the inclusion of the movement of the musicians or the audience", she finds that many spatial composers including Brant and Xenakis were not interested in the symbolic, choreographic or narrative use of performer movement in composition. They "…expressed a dissatisfaction with the use of performer's movement in music as too slow to be expressive and too theatrical – turning the listener's attention away from the auditory and towards the visual" (Harley 1994, p.213).

She continues, "When the importance of the musicians' actions overshadows that of the sonorous results of these actions, music is transformed into musical theatre". The underlying implication of her statement is that the inherent theatricality of the movement of performers

[49] This type of movement was also used by Iannis Xenakis in his *Eonta* (Xenakis 1963).

can detract from the acoustic effect of performer mobility, as it transforms the work from "concert music" and into "musical theatre". In my own explorations I have found that this is not necessarily the case, and that performer movement within the context of a piece (be this perceived as theatrical or otherwise), can aid the communication of the sonic material and the musical structure, and can help to frame the listening experience for the audience (this was also implied in the aforementioned approaches of Birtwistle and Boulez).

Other composers, such as Benedict Mason, clearly embrace the theatre of musicians' movement, following the lineage of Kagel's *Instrumentale Theatre*. Mason's 'sound theatre' spatial work, premiered at the BBC Proms called *Meld* (Mason, 2014) is one such example, conceived for the particular geometry of the Royal Albert Hall. During the 45-minute performance, the "singers and instrumentalists migrate from level to level in carefully choreographed fashion…They eventually reached the stage and the arena" where they "seemed to be gathering…for an out-of-kilter ceilidh"(Clements 2014). This "ceilidh" section sees the choir execute dance-like rhythmical movements whilst making sound, implying that visual and theatrical elements are at least as important, in this work, as the sounds themselves.

Whilst I do not request dance-like action from performers, inclusion of physical instructions to 'walk and play', 'freeze' and 'change position' in *Melting, Shifting, Liquid World* (2019), *Spatial Study on Rotation* (2017), *Mixed Messages (2016), Graphic Score II* (2017) and *230 Strings* (2017), are often informed by an underpinning choreographic plan that has symbolic, conceptual or theatrical personal meaning. In *Melting, Shifting,*

Liquid World (2019), the performers were also directed to stand and sit in specific identical postures, with blank facial expressions to add to the immersive 'theatre' of the piece, through characterisation. These theatrical elements expand and compliment the altered acoustic effects and perceptual experiences afforded by the alternative placement and movement of performers during the course of a work.

When performances of compositions take place in enclosed venues other than the concert-hall, without fixed seating and staging, composers are able to fully construct the Arena Space of the musical performance. In *Graphic Score II* (2017), for example, I was able to create an Arena Space that fully replicated and realised the shape and dimensions of the graphic score (Fig. 25). In this Arena Space construction, there is still a defined performance area or stage at the centre, around which a standing audience gather. The performers can be both static and mobile during the performance, with specific rules attached to their varied spatial positions and pathways.

In *Traverse the Score* (2018) and *Melting, Shifting, Liquid World* (2019), the use of performer movement expands to also include the mobility of the audience. Both pieces took place in non-traditional concert hall settings and in both instances I was able to select the venue within which the performance would be situated. *Traverse the Score* (2018) required interconnected rooms for the audience and performers to navigate during the performance. *Melting, Shifting, Liquid World* (2019) took place in the Great Map space at the National Maritime Museum (Fig. 34). I chose this venue because it is beautiful and iconic, there is strong link between the venue and the wider theme of the work (climate change and ocean

pollution)[50], and it is in effect a large blank canvas on which to build a performance scenario from scratch.

Figure 34 – Great Map, Arena Space



National Maritime Museum, Great Map, 16th March 2019
Photographer: Lidia Crisafulli / Copyright: Trinity Laban.

Melting, Shifting, Liquid World (2019) is the final work composed as a part of this PhD research, and is also the most complex in terms of Arena Space design. The piece incorporates performer movement (for the upper strings) between three different static positions, and in two places (rehearsal mark I and rehearsal mark VV), the performers also walk and play. There are a limited number of audience seats included for accessibility purposes. However, the majority of the audience is encouraged (via audio instructions and stewards) to move around during the piece and experience the sounds and sights of the performance from

[50] See Appendix 5 for more details in the Programme Book.

a variety of listening and viewing positions. The usual partitions that separate the audience and the performers, such as staging and fixed seating are removed[51]. The first section of the piece (up to rehearsal mark J) was also memorised by the upper string players so as to avoid the use of music stands, which would usually visually partition the space.

Melting, Shifting, Liquid World (2019) is the only work in the creative portfolio to include what Harley describes as a "mixed sound-space" (Fig. 34), as it combines acoustic instrumental sound sources with two different types of electroacoustic sound. The first layer of electroacoustic sound is delivered over the in-room quadraphonic speaker system, and the second is delivered directly to the audience over bone-conduction, open-ear headsets (explored in greater detail in *Proximal and Distal Layers of Sound* (p.131)).

In this brief summary of the varied classifications of spatial designs presented within the creative portfolio, I have observed how a composer's initial construction or conception of the Arena Space of a musical performance can impact upon all other compositional possibilities. Decisions relating to the Arena Space construction determine the specific nature of the sonic, theatrical and visual affordances of a performance. They also shape and inform the perceptual experience for audience.

[51] For practical purposes the soloist was positioned on a small riser so as to be visible to the ensemble for cue delivery. The performers also required music stands for the second half of the work, as the material was too complex for them to memorise in the time frame.

Charles Ives acknowledged that the use of spatialisation in composition affords the listener a more active role:

> "As the eye in looking at a view may focus on the sky, clouds or distant outlines, yet sense the color and form of the foreground, and then by observing the foreground, may sense the distant outlines and color, so in some similar way, the listener can choose to arrange in his mind the relation of the rhythmic, harmonic and other material" (Ives 1933, p.193).

Of great interest is Ives' awareness of the importance of human perception and cognition for the experience of listening, and his understanding of the fact that the listener in a composition of juxtaposed simultaneous spatial layers, "has a rather active part to play" (Ives 1933, p.196). His idea of listening as an *active* rather than *passive* experience resonates with later work from composers such as Pauline Oliveros, who discuss at length the role of cognition on listening[52] and the difference between hearing and actively listening.

In *Spatial Study on D* (2017), all of the performers in the ensemble select passages of music to loop in their own tempi. The material is mostly homogeneous and built out of different articulations of concert pitch D4, selected as it is suitable for all of instruments in the ensemble to play. The requested spatial separation of the performers highlights the timbral qualities of the instruments, the differences in articulation and the microtonal differences in tuning. These parameters become the developmental parameters for the listener, as an alternative to harmony

[52] See *Deep Listening: A Composer's Sound Practice* (Oliveros 2005).

or melody. The sound surrounds the audience, with performers situated on all sides, close to and far from, in front of and behind the listeners, who are seated in a standard concert hall position in fixed pews, facing the front. The scattered localisation of the performers allows the listeners to change their focus, and direct their attention towards the different sources of sound from their fixed, seated position.

Following Ives, the listener in this scenario has a very active role as they can choose where to focus their attention, and can choose which of the multiple performers to listen to and bring to the fore perceptually within the overall texture. In *Spatial Study on D* (2017), embodied qualities of the human hearing system are highlighted as a result of the spatialisation of performers. Interaural differences such as differences in timbre, timing and volume between the two ears become a feature of composition and of the listening experience.

Ives also noticed that mobility of the listeners might enrich their experience of the music further, "for example a shift in aural perspective brings about interesting changes in the perception of music heard while walking (Ives 1933, p.192)" (Harley 1994, p.130). In *Traverse the Score* (2018) and *Melting, Shifting, Liquid World* (2019), two works in the portfolio where I was able to construct the Arena Space of the performance fully, this shifting aural perspective is explored. This was achieved by removing the fixed audience seating, thereby allowing the audience freedom to move around and experience the performance from a variety of perspectives, making the listening experience more self-directed.

In *Traverse the Score* (2018), the performers and audience navigate various interlocking rooms. This creates timbral shifts, and shifts in foreground and background layers of sound as the listeners and different instrumental sources change location. The aural effect of changing listener perspective on a shifting sound environment was persuasive in the workshop (3rd March, 2018). I also noticed that a fluid approach to listener and player positioning and movement brought about a change in social dynamic during the performance. As the audience was able to move and circulate the space autonomously, pausing when something caught their interest, the experience felt more closely linked to that of an art gallery or installation[53]. *Traverse the Score* (2018) also seeks to create less separation between audience and performer, as everyone is an active participant. The notated music, conventionally hidden, is also on display for audience members to view during the performance.

A willingness to allow the audience to move during a performance is relatively rare in relation to 'concert music'. Harley finds that most "composers of contemporary 'concert music' rarely allow their audiences to wander around" as "this type of motion is excluded in principle, as a source of acoustic disturbance: the music requires a container of silence for its proper appreciation" (Harley 1994, pp.219–220). She goes on to quote Xenakis:

> "The problem is that when people move around they cannot listen in the same way, they do not concentrate on the music. They do no know how to pay attention while

[53] This effect is also observed by composer Freya Waley-Cohen and director Robbie Jacobs, in a film about Waley-Cohen's immersive and site-specific work *Linea* (Waley-Cohen 2014) performed in the Princess of Wales glasshouse at Kew Gardens (Matilda Hay 2015).

> walking and they do not notice the fact that when they change position they have a different aural perspective caused by the difference in locations. Besides, they are distractive, they annoy other people who are listening, when they move" (Xenakis 1992; 9-10).[54]

This container of silence and stillness is a prerequisite for many composers and audience members who find that it is necessary in order for the concentrated appreciation of acoustic music. Portfolio works conceived with this type of reception in mind, for example, *by breath and bow* (2017), might include very quiet dynamic markings where a noisy audience member could obliterate the sound of the performers. In *Motion* (2018) where the visual aspects of the piece are as important as the sonic, fixed forward-facing seating and a stage are essential, in order to enable audience members view the performer.

In *Traverse the Score* (2018), these issues of silent and still reception are circumvented by the fact that everyone is moving as a part of the performance and the Arena Space itself spans several rooms. Exploration and movement are a necessary part of the performance and reception of the work. The multi-room set-up also affords the acoustic quality of distance and the different dimensions, shapes, fixtures and fittings of the interconnected rooms, and the positioning of performers within them, creates subtle acoustic differences as sounds reflect and diffract in different ways.

Harley found that Cage also requested the mobility of the audience in his multi media pieces such as *Musicircus* (Cage 1967), *Reunion* (Cage 1968)

[54] Whilst Xenakis appears to have been very opposed to moving audience, he was often moving the sound in relation to an assumed static audience position (either via walking musicians or through multi-channel sound diffusion).

or *HPSCHD* (Cage 1967-1969) where, "the spectators are free to wander around and experience various aspects of the whole event, or perceive one of its elements from different aural and visual perspectives" (Harley 1994, p.222). The Arena Space construction presented in these pieces reflect Cage's multiple conception of listening – that is to say each listener will have a unique experience, and there is no one singular conception of the work. *Traverse the Score* (2018) and *Melting, Shifting, Liquid World* (2019) differ from Cage's approach as they request the execution of predetermined sonic events in a unified overall timeline. The listeners are therefore able to perceive elements of the music from different self-directed aural and visual perspectives by moving through and changing position in the Arena Space, however the overall conception of the piece remains the same.

In *Traverse the Score* (2018), the performers progress through the notated elements over a unified overall timeline and according to a cue structure, delivered by the director. Chance elements within the material are restricted to the performers' chosen route through the interconnected spaces, their chosen self-directed tempi, and the selection of pitches from specific chords. The piece could be regarded as both 'concert music' as it uses a fixed score and timeline, and as an 'installation' as it allows for multiple different listening and viewing perspectives. However the notated music remains very simple in order for it to be participatory.

In *Melting, Shifting, Liquid World* (2019) there is, again, a central score and the solo electric viola conveys the unified timeline to the ensemble via audio and visual cues. This timeline is communicated to the soloist via an audio navigation track that consists of verbal instructions, rehearsal

marks and (at times) a click track, played back via a rolling sequence-based timeline, over an open-ear bone-conduction headset. The navigation track also links to electronic effects, plug-ins and pre-recorded elements, with programmed automation. The audience experiences a separate electroacoustic part delivered over bone-conduction headsets, which is also synchronised to the electric viola via the manual triggering of MP3 players following a strict set of timings on a stop-watch (see *Notes on Production* in the score). Hence, the overall musical structure for *Melting, Shifting, Liquid World* (2019) is the same for each listener, with the unique elements of the experience being limited to their self-directed choice of listening position and movement about the Arena Space during the performance.

In order to circumvent some of Xenakis's problems identified with audience movement, namely that the audience are unaware of their own changing aural perspectives, it was important to inform the audience about this directly. Therefore, prior to performances of *Melting, Shifting, Liquid World* (2019), the audience are encouraged, via audio instructions delivered over the open-ear bone-conduction headsets to move around the Arena Space and to explore, listen to, and view the performance from a variety of different perspectives.

The amplification of the electric viola and pre-recorded elements over the quadraphonic speaker system and bone-conduction headsets also, to some extent, circumvents Xenakis's issue with audience movement disturbing the listening experience, as the noise level can be higher in this kind of set-up than with acoustic instruments. I postulated that audience curiosity about the unusual venue, and the inclusion of bone-conduction

headsets (Fig. 35) would also help them to explore alternative ways of listening to the sound, and would open them up to the immersive nature of the performance, and this proved to be the case during the performances.

Harley observes that in works where performers and audiences are mobile, often:

> "…the division of performers and audiences disappears, the musical notation gives way to written instructions, and the supratemporal musical work is replaced with a process or an action which cannot be repeated twice in the same way. The increasing mobility of participants in such "musical" situations is associated with profound changes in the understanding of music, its artefacts, and its social contexts" (Harley 1994, p.222).

I found this to be the case in the *CoMA Studies* (2017-18) where audience and performer mobility, required expansions of standard common practice notation through in-room performer direction and written-instructions. The notated material in these studies also remained relatively simple, though this was largely because they were written for amateur performers, rather than being as a result of the works including performer and audience spatialisation and mobility.

I became interested in what might happen if the complexity of the notated material were to increase, to the extent that it might be more comparable to the complexity of 'concert music'. I was interested in how this might affect practicalities of realisation, the listening experience for the audience, and the social dynamic between performers and audience. Thus, in *Melting, Shifting, Liquid World* (2019), the idea of fusing 'concert

music' and 'installation' is further explored, as the piece combines the elements of a complex fully notated score and multi-layered fixed media parts, with freedom of audience movement.

Figure 35 – AfterShokz Bone-conduction Headsets on Audience Members



National Maritime Museum, Great Map, 16th March 2019. Photographer: Lidia Crisafulli / Copyright: Trinity Laban.

There are two fixed seating positions for the ensemble in *Melting, Shifting, Liquid World* (2019). The first position, in place from the opening to just after rehearsal mark I, locates the upper strings, seated in chairs spread out across the Great Map facing the electric viola soloist at the centre (Fig. 36). The second position, after rehearsal mark I, sees the performers placed in a circle. At the start of the piece the audience enter the space and can move in and around the performers.

The acoustic string-based sonic environment prior to the solo electric

viola entry at rehearsal mark E is built out of 'controlled aleatoric'[55] loops, of varied white noise, wood and distorted sounds that emphasise agency, centered on the pitch G (Fig. 37) – with ice cracking and white noise sounds overlaid onto this via the bone-conduction headsets.

Figure 36 – Upper Strings Position One

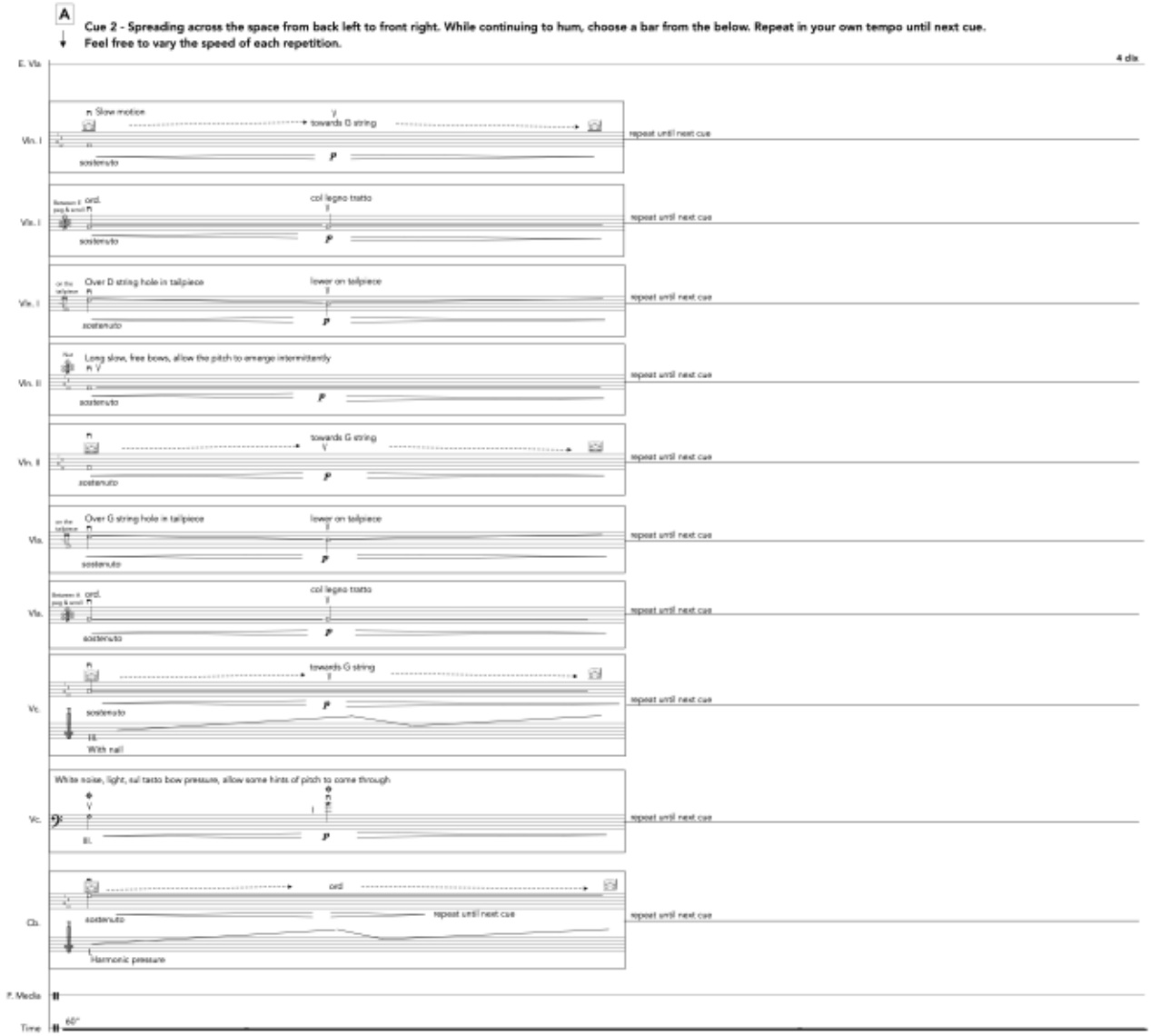


National Maritime Museum, Great Map, 16th March 2019.
Photographer: Jacob Whiting

In this opening section, there are five cues given by the soloist / director that prompt the performers to gradually progress onto their next 'looped' bar – a progression that is staggered by seating position, sweeping across from the performer at the back left to the performer at the front right of the space. Similar to *Spatial Study on D* (2017), the effect is that of a sonic environment that slowly develops and timbrally changes around the audience, who are surrounded by performers on all sides, in both near and far positions in relation to their changeable localisation.

[55] Discussed in *Chapter Three: Ensemble Space - Space and Communicative Action* (p. 96).

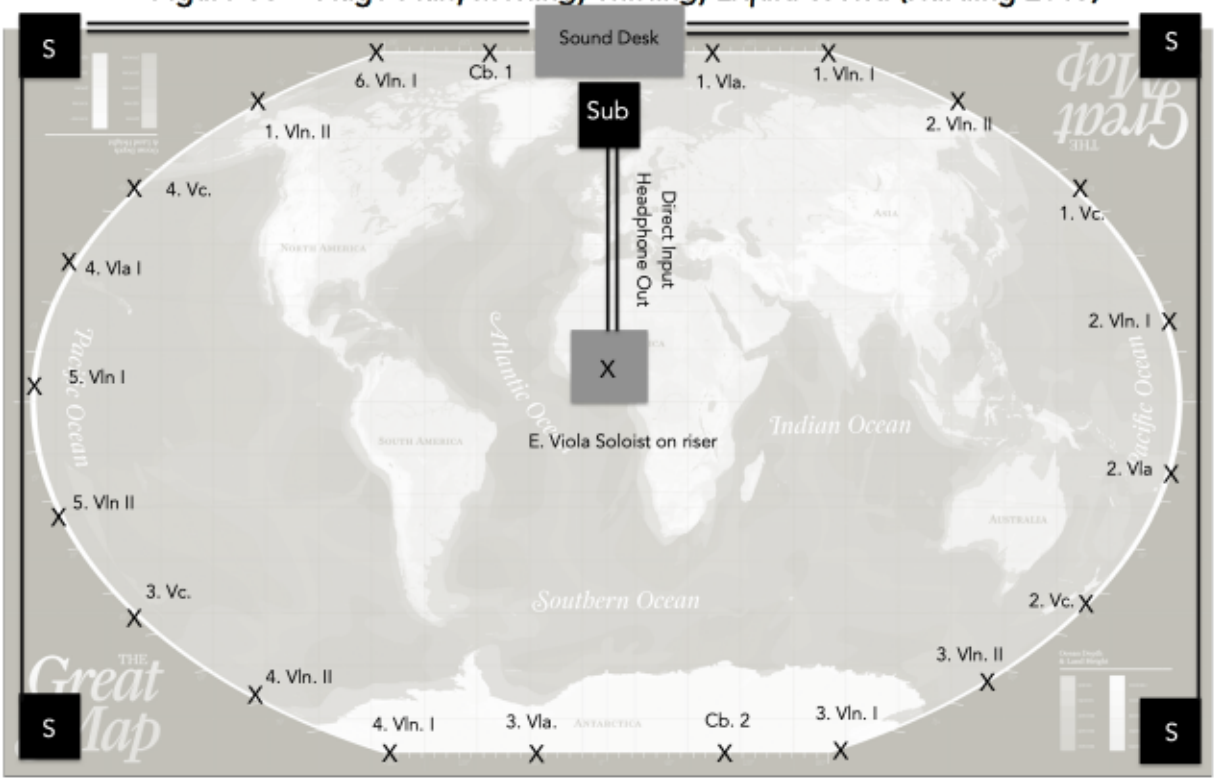
Figure 37 – Extract from *Melting, Shifting, Liquid World* (Harding 2019)



In the fifth bar of I, the upper strings rise out of their seats and circulate the space, playing the notes of a fixed chord with varied tempi, using circular bows and independent crescendi and diminuendi envelopes. This creates a dynamic changing timbral texture around the listeners, with static harmony; again, spatial placement and sound movement become the developmental parameters for the listener. The changing position of the performers at this point also reinforces the concept of shifting listener perspective for the audience.

The second static performance position in *Melting, Shifting, Liquid World* (2019) is required from rehearsal marks M to VV. Here, the upper string players join the cellists and bassists in a circle configuration around the edge of the Great Map, surrounding the audience (Fig. 38). When the performers are in this position, sounds are passed between the performers and around the circle[56]. As well as opening up opportunities for passing sounds around, the alternate seating position offers a different aural, physical and visual experience for the audience as the performers move from an open seating configuration, where the audience can move in and around the performers freely, to an enclosed position where the performers surround the listeners.

Figure 38 – Stage Plan, *Melting, Shifting, Liquid World* (Harding 2019)

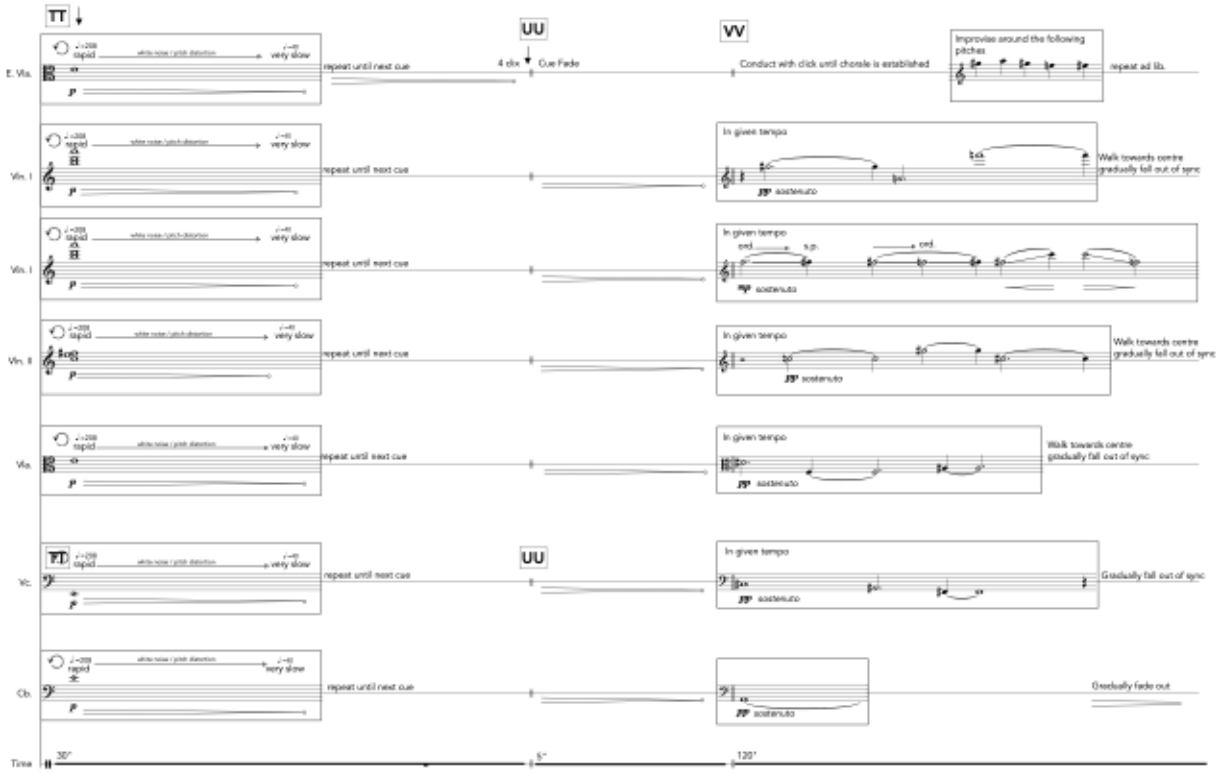


Lower strings remain in this position throughout

Upper Strings:
Position One - Opening to 4 bars after Rehearsal Mark H all Upper Strings should be seated in chairs spread-out across the space inside the circle, facing the central podium so as to see cues for change. They must memorise the music up to this point.
Position Two - As shown above
Position Three - Rehearsal Mark VV requests performers memorise the music and slowly walk to a position surrounding the soloist by rehearsal mark WW.

[56] This is explored further in *Sound Movement for Static Performers* (p.136).

Figure 39 – Chorale from *Melting, Shifting, Liquid World* (Harding 2019)



The concluding section of *Melting, Shifting, Liquid World* (2019), is a chorale made up of melodic loops of varied lengths that temporally shift in relation to each other and combine in different ways with each repetition (Fig. 39). The upper string players, again, walk and play at this point, slowly moving towards the centre of the space and through the audience to join the electric viola soloist, forming a group at the centre of the room (see Fig. 40). A symbolic and theatrical narrative of 'unification' motivates the performers movements for this concluding section of the work.

Figure 40 – Final Upper String Position



National Maritime Museum, Great Map, 16th March 2019
Photographer: Lidia Crisafulli / Copyright: Trinity Laban

Proximal and Distal Layers of Sound

In *Melting, Shifting, Liquid World* (2019), I explore the idea of multiple layers of juxtaposed, spatially separated sound. Sounds can happen (1) very close to the listener, delivered via the open-ear, bone-conduction headsets; (2) at a mid-distance from localised points in space from the acoustic performers in the string ensemble; and (3) far from the listener via the speaker system which transmits the solo electric viola part and the in-room fixed media.

These three layers of sound roughly correspond to layers of interpersonal space identified by Edward Hall in his theory of 'proxemics' (see *Constructing the Performance Scenario* (p.25)). The bone-conduction headsets are situated in Hall's 'intimate' spatial zone, as the audience wears them and sound manifests as both an aural and physical phenomenon. Indeed, in a review from the premiere performance, the bone-conduction element was described by Simon Cummings as "a peculiarly intimate form of listening in which the sound appears to be

materialising inside one's head as if from nowhere" (Cummings, accessed April 2019). The electric viola and acoustic string ensemble reside between the listeners' 'social' (between 4 and 10 feet) and 'public' spaces (between 10-22 feet) (Fig. 1). The amplifiers are placed furthest away from the listeners both physically and metaphorically; apart from the electric viola, the sounds transmitted here are visually source-less, and are often digitally processed, therefore further removed from perceived natural or acoustic sources.

The headsets work via "bone-conduction transducers" which, "guide micro-vibration through the cheekbones to the inner ears, delivering sound without plugging or covering [the ears]" (AfterShokz accessed February 2019). During initial experiments with the technology I realised that low frequency sounds and sounds with a lot of inherent motion, such as the beating produced by slightly differently pitched sine tones, or the bubbling of a boiling kettle, generated more significant vibration in the headsets but were aurally harder to perceive. This guided my selection and creation of sonic material, as the sensation of the vibrations helped the listener to localise sound to the headset, as opposed to assuming the sound was coming from the in-room sources such as the PA. However, high frequency sounds, such as the clicks and pops of cracking ice were much more audibly present.

In the headset spatial layer, I experimented with episodes of sounds that generated maximum vibration, and moments of minimal vibration, where the origin of the sound is more obscure, making the boundaries between the different spatial layers blurred for the listener. The overall aim was to create an expansive immersive experience for the audience in which

sounds could swell, recede and swirl around the space.

The composer Tarek Atoui also explores the physical manifestation of sound-as-vibration for the audience. I was fortunate enough to participate in his project called *WITHIN*, as a part of *Infinite Ear* at Bergen Assembly in October 2016. In an interview called *When We Met*, included in the project documentation *Deaf Experience and The Transformation of Hearing* (Bergen Assembly, 2016), Atoui explains the origins of his approach:

> "In 2010, I wanted to create a performance that articulated my work on body, sound and composition in a different way. I called it *Below 160*, a performance that mainly used bass and sub-bass frequencies under 160 Hz, and focussed on the physical quality of the sound…The first time I presented *Below 160* in 2011, the performance took place in front of a hearing audience. What I learned from this performance is how much our ears condition our perception of sound and that we tend to neglect its physical and tactile manifestations". (Bergen Assembly 2016, p.6)

Atoui goes on to explain that he then decided to share a performance of *Below 160* (Atoui 2010) with deaf and hard of hearing audiences, who spontaneously joined in with the performance. This was a transformative moment for him, leading him to propose the development of several new tactile instruments that could be "perceived and played by both a deaf and a hearing person"(Bergen Assembly 2016, p.7), as a new chapter of his project *WITHIN*: "a collaborative project investigating how deafness can influence the way we understand sound performance, its space and instrumentation" (Bergen Assembly 2016, p.10).

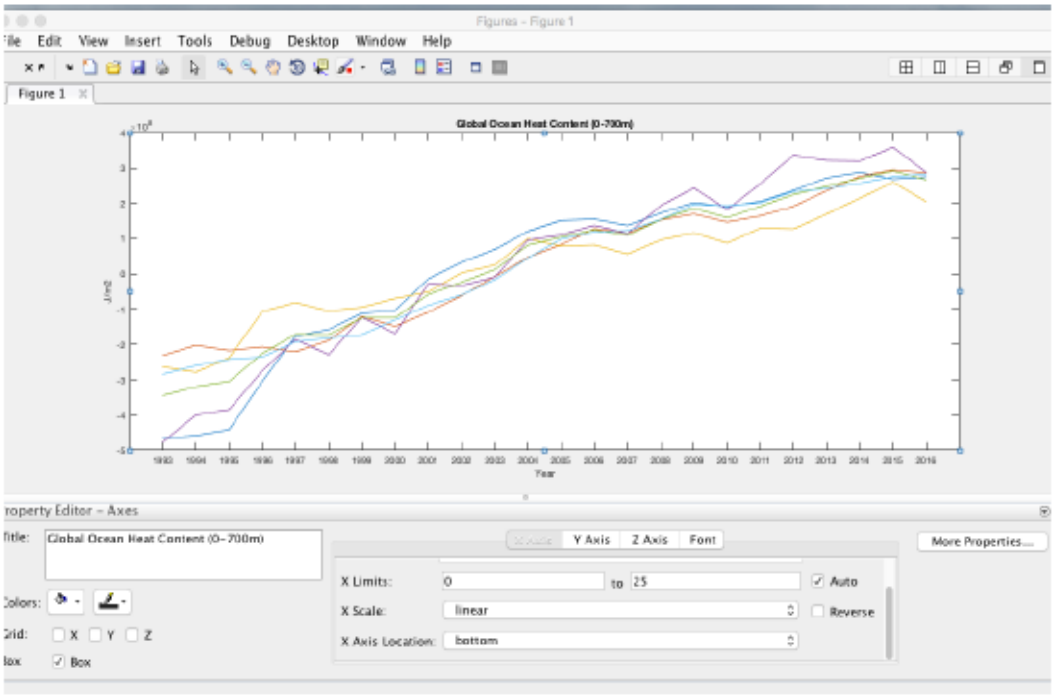
Tarek uses physical vibrations as one way to expand "notions of listening

beyond the aural" (Bergen Assembly 2016, p.10). His approach in *WITHIN*, of creating new instruments and performing collaborative compositions with deaf and hearing participants, is quite different to the use of bone-conduction headsets in *Melting, Shifting, Liquid World* (2019), which centres on the concept of layering sounds. We do, however, share a common interest in the physical and visual aspects of sound, and the impact this might have on listening perspectives and perceptual experiences.

The sound world of *Melting, Shifting, Liquid World* (2019), falls into three main categories that often merge and cross between different spatial layers and sound sources. The first sound world is pitchless sound, which encompasses field recordings of Arctic Sea Ice (provided by the renowned field recordist Chris Watson), white noise, water sounds, vocal sibilant and fricative consonant sounds and noise-based sounds from the live strings. The live string instrument material includes techniques that accentuate the physical agency involved in sound production such as *snap pizz, col legno* and circle bows, which aid the listeners in localising the sound. Noise and distortion are also encouraged through the digital manipulation of the electric viola using granulation, compression and changes to equalisation.

The second sound world incorporates sonic interpretations of Ocean Monitoring Indicators. The data set that I selected to use within the piece covers the rise in global ocean heat between 1993 and 2016, and includes the mean heat measurements along with the five different sets of measurements from which this mean heat is derived (Fig. 41).

Figure 41 – Global Ocean Heat Data



This was interpreted sonically, by scaling the heat measurements into audible frequencies (Hertz), using the data to determine the tuning and pitch inter-relationship of six sine waves. I found that reducing the scale of pitch interpretation made the rising trajectory of the pitch of the sine tones much more gradual and less obvious to the listener, reflecting the nature of the slow cumulative changes to the temperature of the ocean, over time. The reduced pitch scale also created smaller, microtonal differences between the sine tones that in turn generated beating patterns (vibrato), which oscillated at different rates over time, and through manipulation, between left and right ears. When delivered over the headsets, the beating manifested as an aural and a physical sensation for the wearer.

The third and final sound world in the piece is melody and harmony primarily delivered by the acoustic strings and electric viola, but also emerging in the electroacoustic parts from pre-recorded processed fog-horns, and from in-room machinery[57]. The harmony of the piece generally centres on fixed drones or pivot notes (for example G is the pitch centre from the opening to rehearsal mark I) that slowly change as the piece progresses. The rate of harmonic change remains relatively slow throughout, though there is an increased rate of change from rehearsal mark RR to the end. The static nature of the harmony aims to lay into relief the volatile and evolving timbral and spatial textures, which change at a faster pace.

The electric viola has two main melodic solo 'refrain' sections: rehearsal marks E to J, and NN to QQ, which lead into cadenza-like passages, involving rapid string-crossings and bow motion in combination with fragile left-hand harmonics, generating volatile timbres with overtones and distortion. These two sections bookend a more turbulent, heavy and gestural middle section to the piece that builds into an expansive electroacoustic 'solo' (rehearsal mark HH) delivered across the bone-conduction headsets and quadraphonic PA.[58]

Thinking of these three sound world categories in relation to the different spatial layers in *Melting, Shifting, Liquid World* (2019), it is clear that there is a fluid relationship between the sound world category and its placement, with a few exceptions. These exceptions were important in

[57] During the electro-acoustic solo at Figure HH, a steam-powered rowing machine was turned on. The machine generated an oscillating glissando melody that I transcribed into the Violin I. b) part at rehearsal mark VV.

[58] Further information about *Melting, Shifting, Liquid World* (2019) can be found in the Programme Book, Appendix 5.

order to keep some distinction between the different spatial layers in the piece. The sine tone data sound and vocal sounds (poem etc.) are only ever transmitted via the headsets, the acoustic strings are only ever live and never appear in pre-recorded forms (processed or otherwise) over the PA or headsets. The electric viola is clearly separate from the acoustic string sound in the room, but occasionally appears in the headsets in both clean and manipulated forms.

The movement of the electric viola sound between the furthest spatial zone (the speakers) and the closest (the headset) also became an interesting sound motion device. This can be experienced between rehearsal marks FF and NN where the marcato material from the electric viola is played back electroacoustically in a series of fragments[59] (at the same octave and an octave up) that bounce around the quadraphonic PA and between the left and right channels of the headsets. Changing the placement of the same or very similar sounds, also accentuated the movement of the sound across the different spatial layers, for the listener.
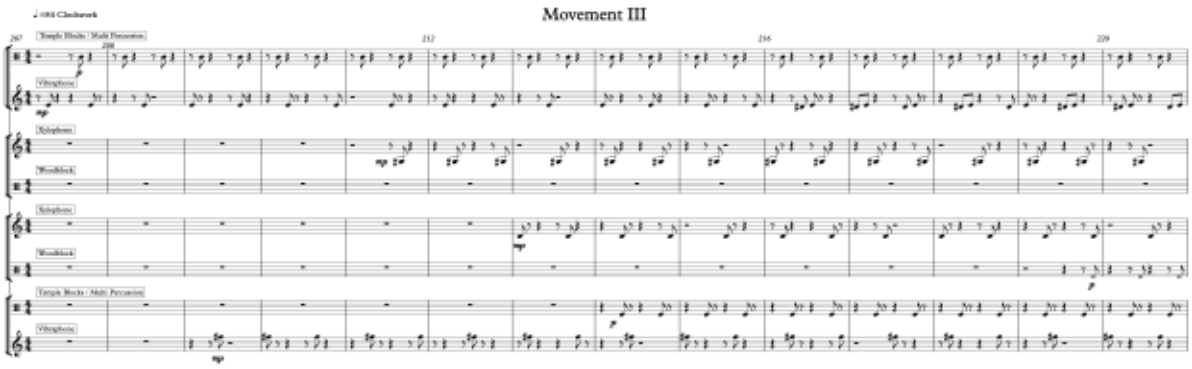
Sound Movement for Static Performers

Moving sonic images can be created both by moving performers, and by static performers placed across the Arena Space. Harley finds that the movement of sound between static musicians in spatial compositions may be *discrete*, meaning that it "may proceed stepwise - if a musical phrase is presented successively in one ensemble of performers after another" (Harley 1994, p. 217). Alternatively, it may be *continuous*, "an interesting method of creating continuity of motion introduced in instrumental music

[59] Produced using a granulator to generate randomised playback of fragments of the electric viola material.

of the post-war avant-garde, involves ensemble dispersion, dynamic shading and temporal overlapping of sounds" (Harley 1994, p. 217). Harley links *discrete* sound motion back to "the Venetian school of polychorality in the late renaissance (or even earlier, cf. Carver 1988)"(Harley 1994, p.217). The examples cited from contemporary composers include the motion of sound from the front to the back of the hall (and vice versa) resulting from successive entries of the trumpets and trombones in Henry Brant's *Millennium II* (Brant 1954), and John Tavener's vertical direction of motion from high to low, suggested by the alternation between high gallery and ground level groups of instruments, in *Ultimos Ritos* (Tavener 1972) (Harley 1994, p.217).

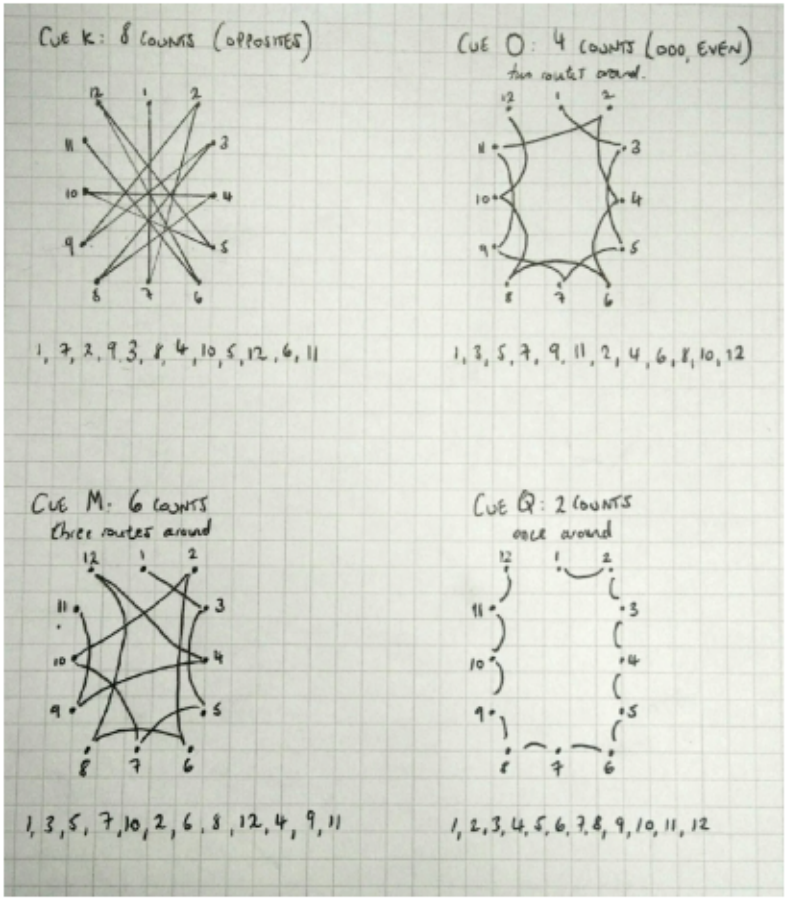
Figure 42 – Extract from *Mixed Messages – Movement III* (Harding 2017)



In the creative portfolio the technique of *discrete* sound motion can be seen in many of the works. For example in *Movement III* of *Mixed Messages* (2017), notes of the melody hocket between the performers, moving up and down their instrumental line in quick succession (Fig. 42). Similarly in *Spatial Study on Rotation* (2017), the performers stand in a circle around the audience, resonating wine glasses by rotating / spinning marbles inside them. The pitches of the wine glasses are different, as is

the spatial pattern of the performer entries at each separate cue. The aim was to progress the movement of the sound from opposing positions in the space, occurring at a slower pace, to a full rapid circular rotation of the sound around the audience (see Fig. 43).[60]

Figure 43 – Rotation Patterns in *Spatial Study on Rotation* (Harding 2017)



In *Melting, Shifting, Liquid World* (2019), the circular rotation of the same sound across different performers occurs at rehearsal marks M and N in the upper strings, marked '*Circle Pan*'. Here they pass the same note, with the same articulation and dynamic shaping, in quick succession along to the upper string player to their left (first C5, then A4 and G4). This sound movement technique also occurs later for the full ensemble at rehearsal

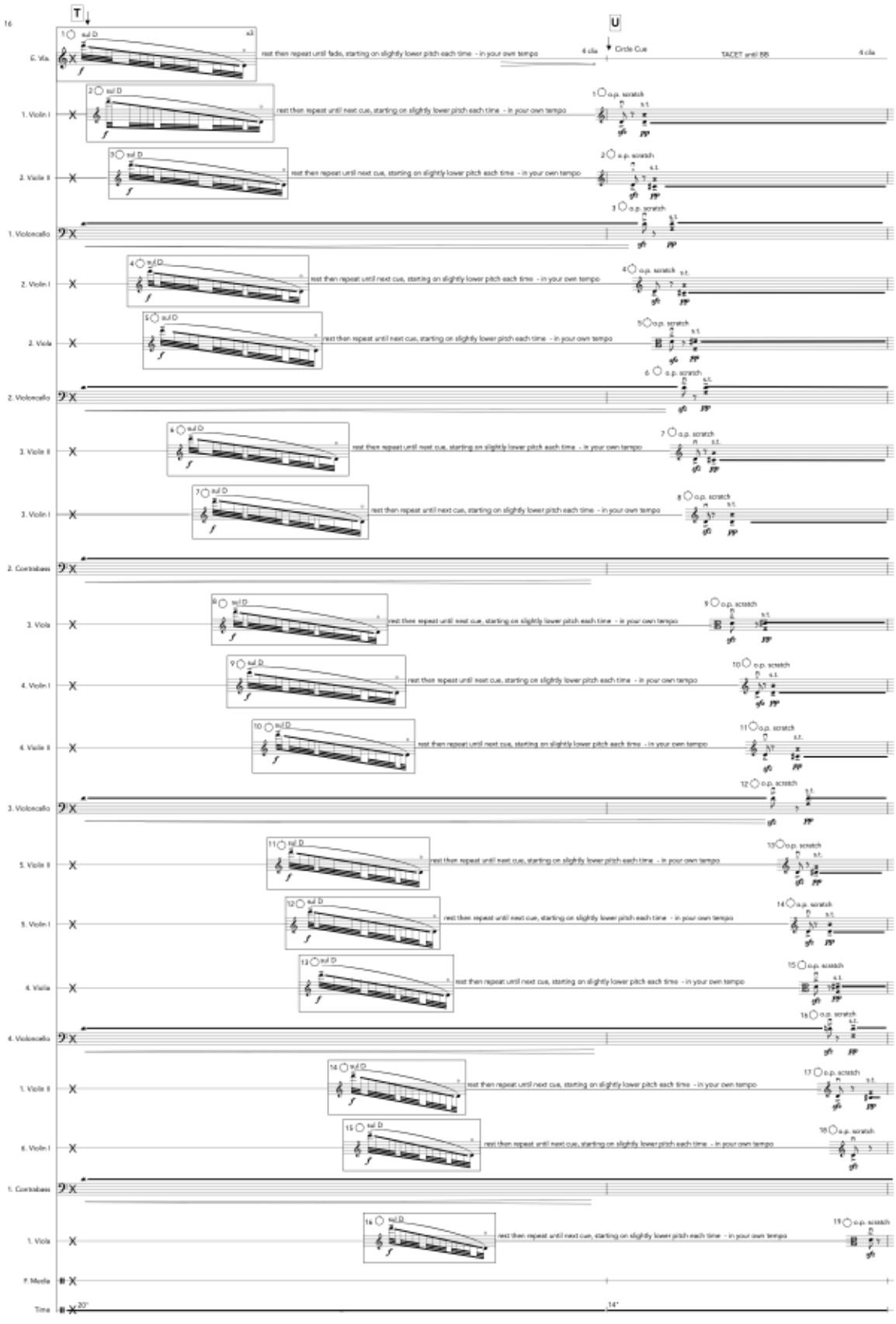
[60] Xenakis also extensively explores sound rotation around the audience in his *Persephassa* (Xenakis 1969) for six percussionists.

mark T (Fig. 44). At this point in the score it became useful to change the layout of the staves to reflect the performer seating position, therefore as the gesture moves diagonally down the page, so too the sound moves consecutively around the circle.

Harley attributes the first use of *continuous* sound movement to Stockhausen, where, for example, in the middle section of *Gruppen for Drei Orchester* (Stockhausen 1955-57) – "stationary instrumental groups…successively play sounds of the same pitch and timbre with similar dynamic envelopes (crescendo – decrescendo). The sound seems to rotate in space gradually shifting from one instrumental ensemble to another" (Harley 1994, pp.217–218).

I consider Harley's idea of *continuous* sound movement in a slightly different way within some of the works in the portfolio. When multiple performers of the same instrument, loop the same or similar musical material, with similar dynamics and gestural shaping in their own tempi from spread positions across the Arena Space, it generates a continuous, immersive sonic environment where those sounds with matching dynamic shape or envelope, and generated via a similar physical impetus, appear to be continuously moving between the varied performers' localisations. This effect can be heard in *Spatial Study on D* (2017) where, for example, the snap pizzicatos at Cues 9 and 10, appear to rebound around the room, and between the different string players. I also explore this idea extensively throughout *Melting, Shifting, Liquid World* (2019).

Figure 44 – Extract from *Melting, Shifting, Liquid World* (Harding 2019)



In many places in *Melting, Shifting, Liquid World* (2019) the order and timing of performer entries are determined by their position within the Arena Space. For example the opening textural looped cues (opening to rehearsal mark C) spread, 'from the back left to front right' of the space. Likewise, from rehearsal marks E to H, upper string entries are determined by their proximity to the soloist with those nearest playing an echo of the soloists' last note of the phrase first, ending with the performers on the outer edges of the Arena Space[61] (see documentation footage).

Harley finds that many composers have experimented with a circular configuration of performers, surrounding the audience. She states that this arrangement allows for more "spectacular spatial effects to arise". She finds that composers use the circle formation for a variety of aesthetic reasons ranging from "dramatic and expressive climaxes in purely musical compositions (*Persephassa* (*Xenakis* 1969))", to serving a "programmatic purpose (e.g. the apocalyptic trumpets of the Last Judgement in Berlioz's Requiem op. 5 (Berlioz 1837)". She continues, discussing Schafer's *Apocalypsis. Part Two: Credo* (Schafer 1976) "the idea of immersing the listeners in stationary, circular sound-fields may have quasi-mystical overtones, as this design serves to evoke other-worldly stillness and to induce a state of contemplation" (Harley 1994, p.226).

The construction of a circular Arena Space that surrounds the audience in the second half of *Melting, Shifting, Liquid World* (2019) is motivated by a

[61] A motion selected, as it is reminiscent of the way ripples propagate away from a disturbance in water.

desire to immerse and enclose the audience in a changing sonic environment that they can contemplate, and move around and within. This sonic environment emphasises the embodied nature of listening, through both the movement of sounds around and across the ensemble, and through the placement of sounds across the proximal and distal listening spaces or layers.

Chapter Summary

In this chapter I have considered various different approaches to Arena Space design and construction in the creative portfolio, and in the work of other composers. I have discussed sound movement for static and moving performers and for static and moving audiences, reflecting on how this can offer alternative viewing and listening perspectives for the audience.

This chapter illustrates that the initial conception and configuration of the Arena Space of music performance influences all other compositional possibilities. Decisions relating to the construction of the Arena Space determine the available sonic, spatial, theatrical and visual affordances for the composition, and also directly inform the perceptual, perspectival and social experience for the audience. By this rationale, the initial construction of the Arena Space becomes fundamental and crucial to compositional processes.

CONCLUSIONS

Whilst *Melting, Shifting, Liquid World* (2019) is the most significant work of this research in terms of duration, scope and complexity, it is clear that I arrived at this piece as a direct result of the practical and artistic research undertaken through the creation of the other works presented in the creative portfolio. In writing *Extension* (2018) and *Motion* (2018), for example, I discovered a method through which to map and track performer physical action, and gained a greater insight into how minute variations of physical action could affect sound. I also discovered ways of working with body-centred rather than metronomic timing and explored the plotting of physical action as part of musical structure through writing *by breath and bow* (2017) and *bellows, breath and bow* (2018).

Through working with CoMA throughout 2017-18, I gained confidence in directing aspects of performance such as performer movement and choreography: for example the co-ordinated bowing of the piano in *230 Strings* (2017) or the passing of sound from wine glass performers to stringed instrument performers in *Spatial Study on Rotation* (2017). In writing these pieces and through wider research, I discovered that the inclusion of alternative performer placement, performer movement and choreography could shape and guide the listening experience for the audience and reinforce elements of musical structure. In *Melting, Shifting, Liquid World* (2019) these ideas can be traced through to the use of multiple performance positions for the upper string players, walking and playing, the synchronised 'freeze' moment (rehearsal mark J) and to the prescribed unified postures and facial expressions of the performers.

It was through working with CoMA that I also began to research and

develop ways to counter some of the logistical issues of working with performers distributed across space, including the use of 'controlled aleatoric' loops, and creating pieces built out of interlinking chains of events, rather than using synchronised metronome markings / timings. These methods and tools came to determine the structure of the notated materials of *Melting, Shifting, Liquid World* (2019).

Through pieces including *Spatial Study on D* (2017) and *Traverse the Score* (2018), I explored how de-partitioning the Arena Space through performer spatialisation could afford the audience a more active, self-directed listening experience. I learned that this type of Arena Space construction gains further significance when the audience are mobile, as it creates a three-dimensional sound-field that the audience members can explore from multiple different listening and viewing perspectives.

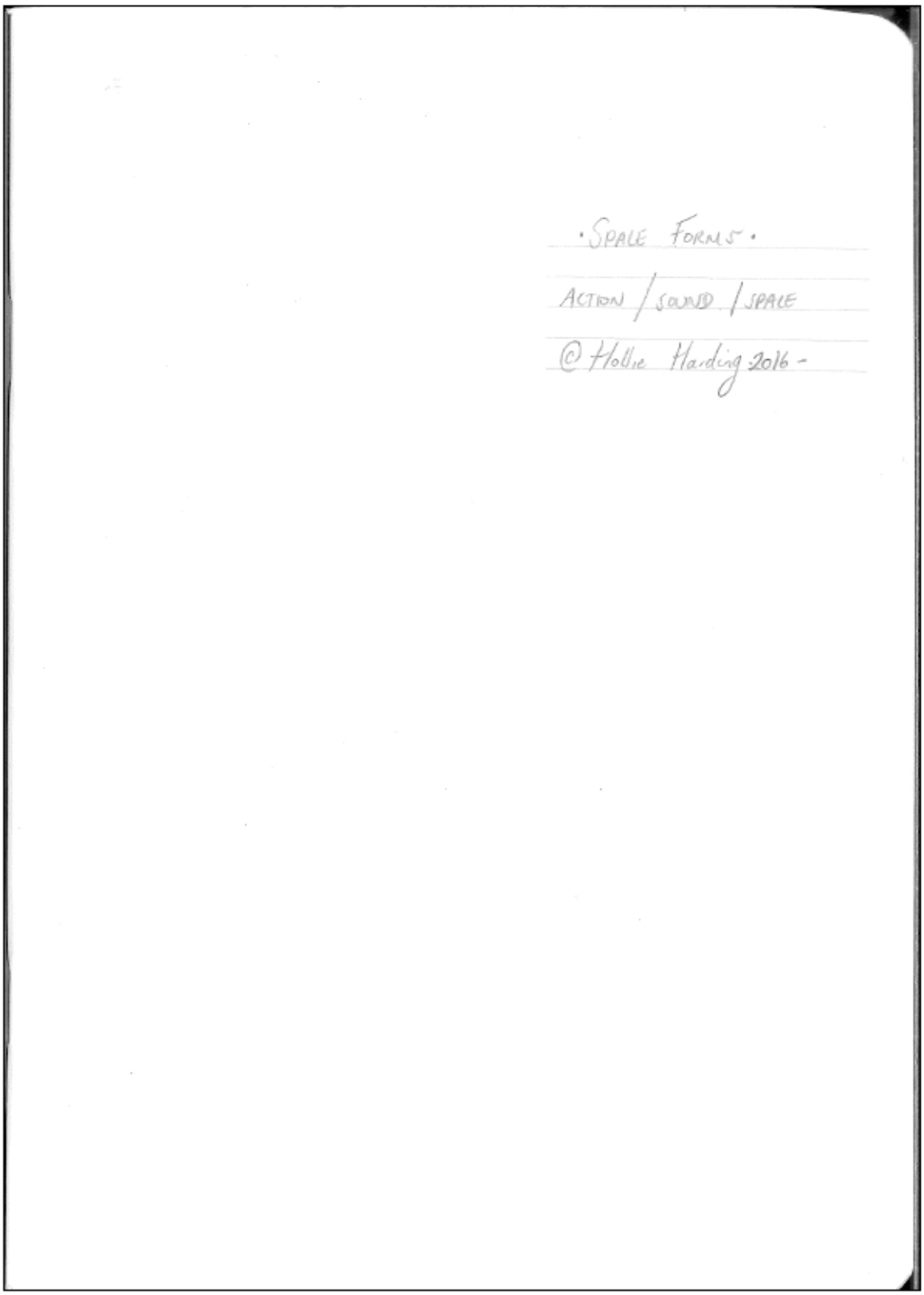
In *Melting, Shifting, Liquid World* (2019) the idea of a musical performance as a sound-field is expanded further through the inclusion of multiple layers of sound from acoustic sources, a quadrophonic speaker system and bone-conduction headsets. These multiple sound layers relate back to one of the starting-points of this research enquiry, which was Edward Hall's theory of 'proxemics'. The bone-conduction headsets reside in the 'intimate space', the string ensemble in the 'social space' and the speakers in the 'public space', furthest from the listener. In a sense, the research has come full circle, in that these dynamic types of personal space shape the research enquiry, the thesis and the overall compositional approach, and in turn, are fully manifest for the audience in the concluding work.

The research has demonstrated that new exciting possibilities can emerge from approaching compositional processes holistically, and from considering pieces of music as live performed experiences shared with embodied audiences. Concerns with event production, spatialisation, setting, physical action and visuals, can often be seen to be 'extra-musical', superfluous or outside of the composers' domain and therefore not warranting of attention. This research demonstrates significant evidence to the contrary, finding that these parameters can be of great importance to compositional processes, and can be a huge source of inspiration and creative energy.

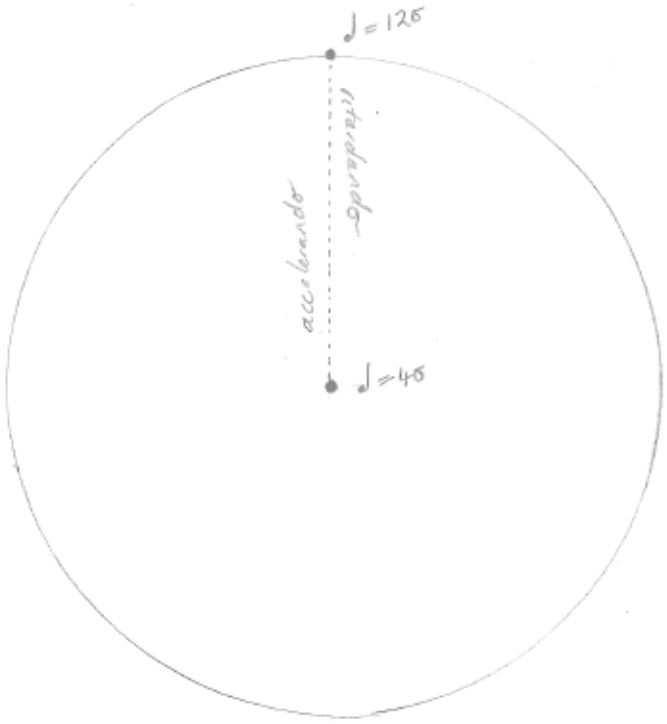
Further, I have found applying a deliberate and thorough strategy to constructing the spaces of musical performance in compositions to be a richly rewarding methodology. Considering the different dynamic types of space within performed music has ultimately enabled me to uncover new methods for generating musical material (action mapping and tracking), new means by which to share those materials with an audience (new listening perspectives), and has expanded my ability to realise, imagine and construct different performance scenarios.

APPENDICES

Appendix 1: Space-Forms – Sketchbook



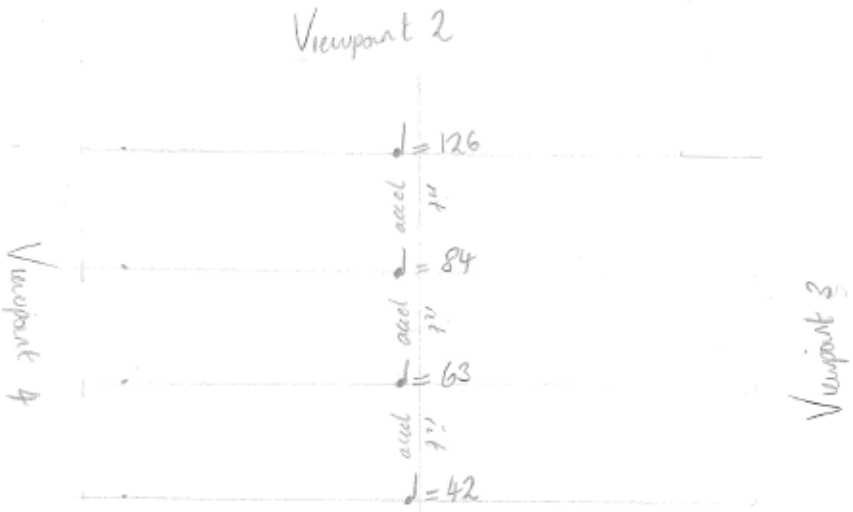
Can be inverted, ie: faster tempo at the centre & slow at the circumference. Players can be moving or fixed.



Free Tempo

① TEMPO ZONE, CIRCULAR

Chosen viewpoint determines the relationship between tempo and distance. Viewpoints 1 & 2 will see layered tempos, Viewpoints 3 & 4 will see them side by side. Players can be moving or fixed.



* Tempos should be related
the order could be varied

② LAYERED TEMPO ZONES

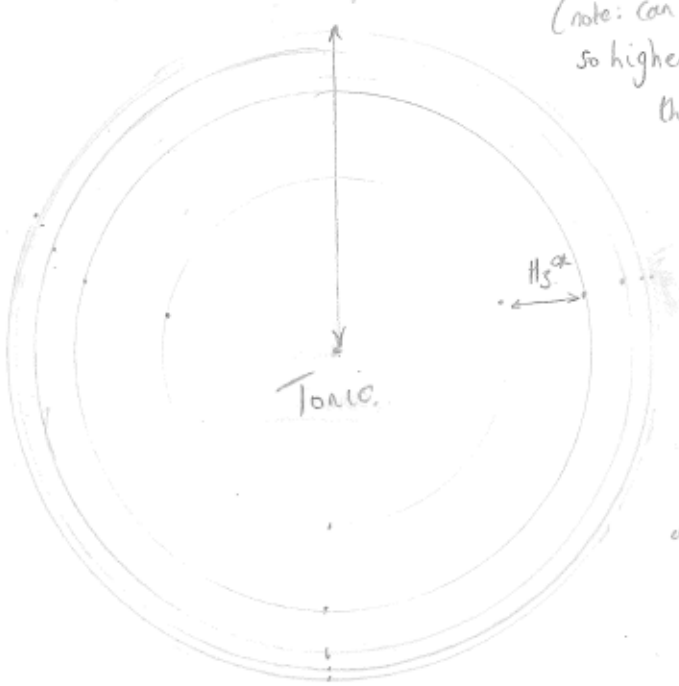
The audience can be 'roving' through the spaces, or situated in a fixed position in one of the rooms. Tempo could also be substituted for Action or Mode.



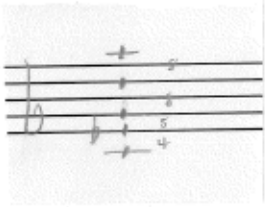
(3) TEMPO ZONES, CONNECTED SPACES

Spectral Extension...

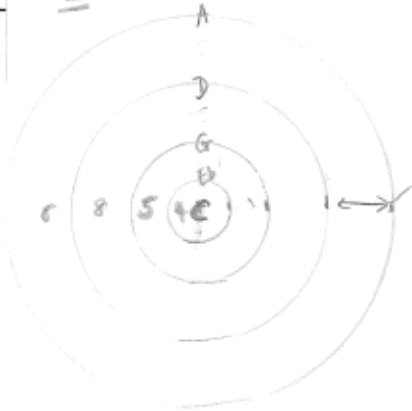
(note: can be reversed so higher partials at the center).



* so for example 20 Hz = 50cm - Scale can vary according to venue



=

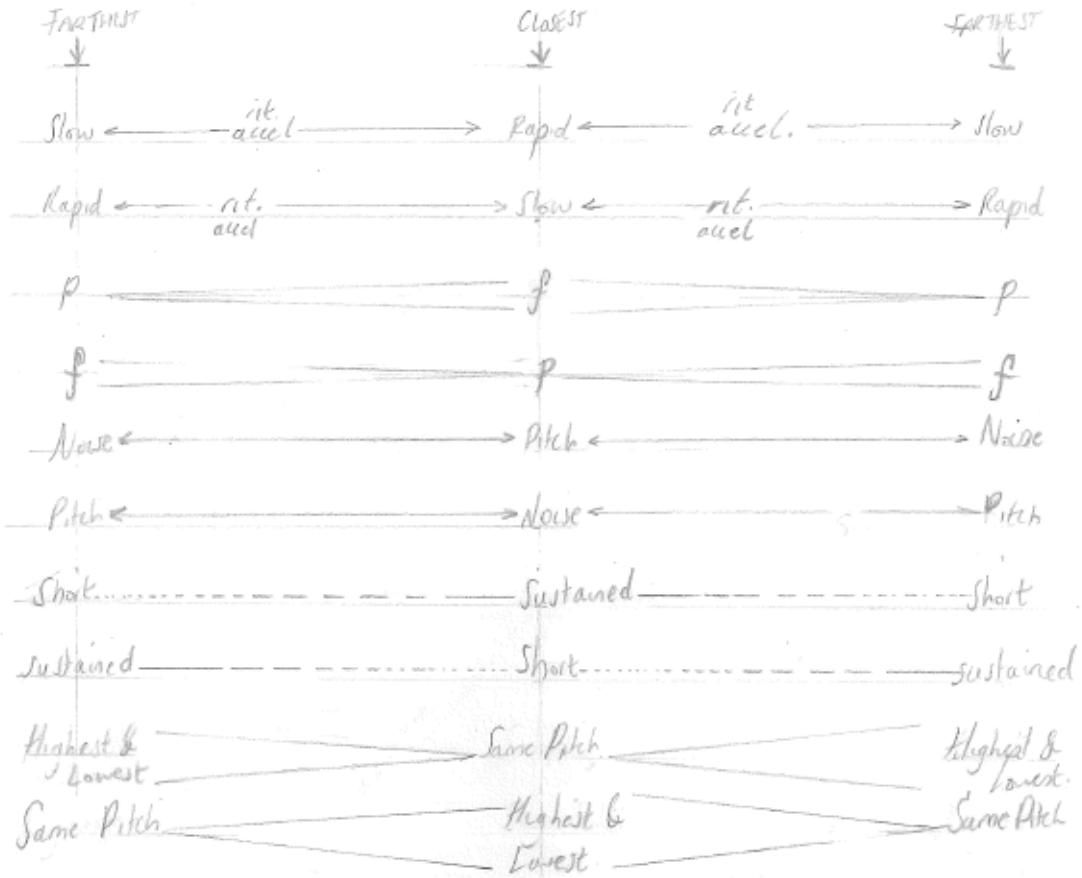


nb. could be any chord, this is an example.

distance determined by semitones between notes / distance by interval

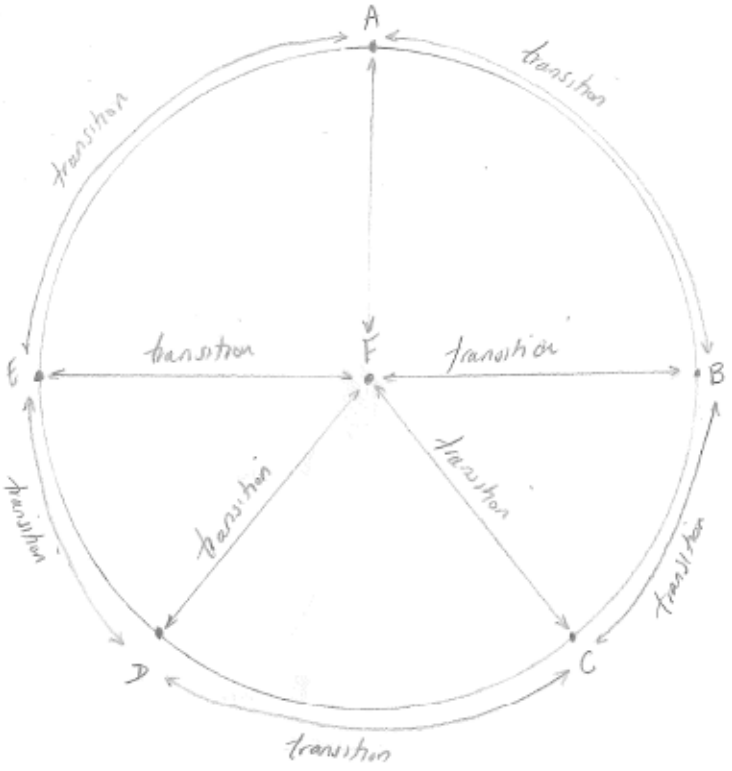
(4.) LOCATION BY PITCH.

Distance between two points (objects, performers, walls etc) determines the threshold for change. The below can be combined, or seperate...
(see (12.) for example)



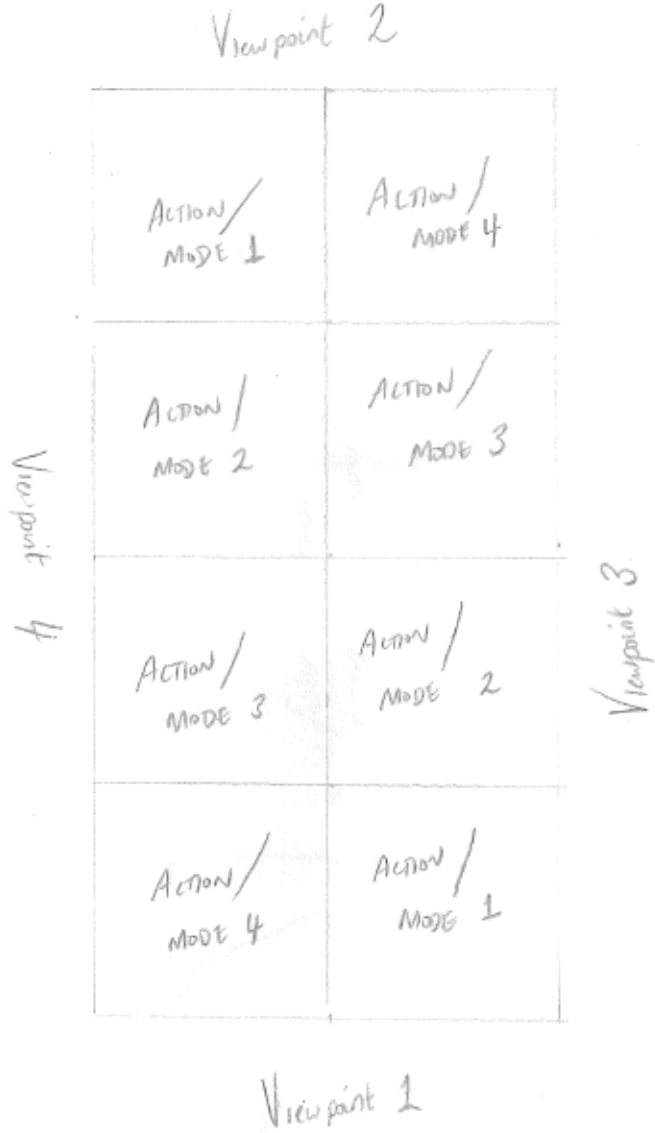
(5) DISTANCE THRESHOLDS.

Letters can represent cues, particular action categories, tempos or pitches. Where letters are action categories / tempo / rhythms / pitches, the movement between zones should be a 'transition' between the different requirements - a process whereby one 'direction' changes into another.



(6) ZONES & TRANSITIONS

Areas are demarcated & distinct. Lines represent the thresholds of the different zones



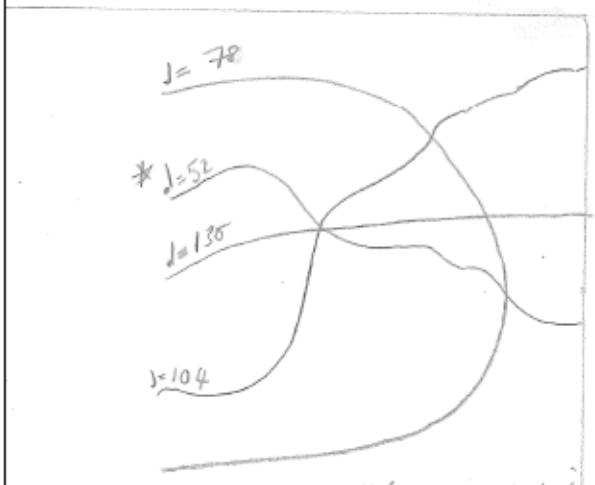
(7) ACTION/MODE PARTITIONS

The tempo lines are marked out in the space, deviation from the line results in rubato, as shown below...

* Multiple tempo lines can be mapped out in the space.

→ Lines could also be defined musical materials, so different pathways have different associated melodies.

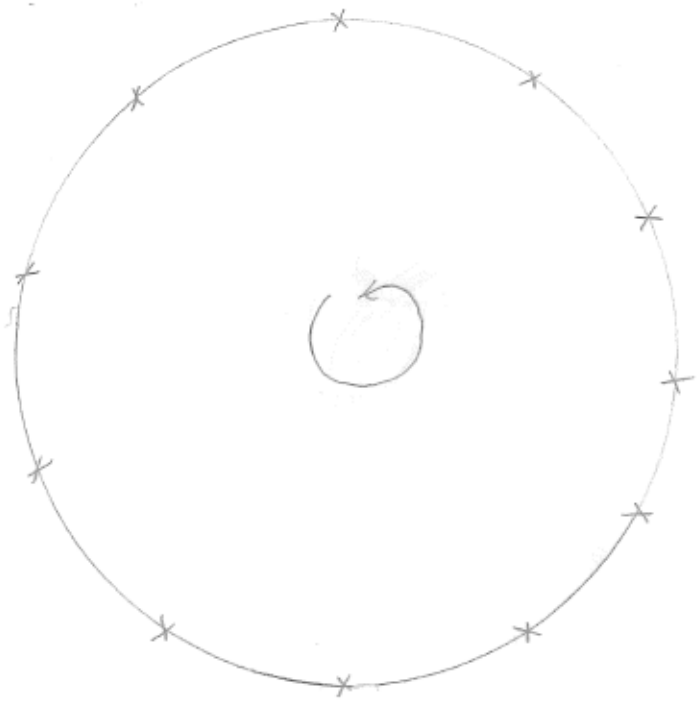




n.b. If tempo determines walking pace, potential collisions will have to be calculated!

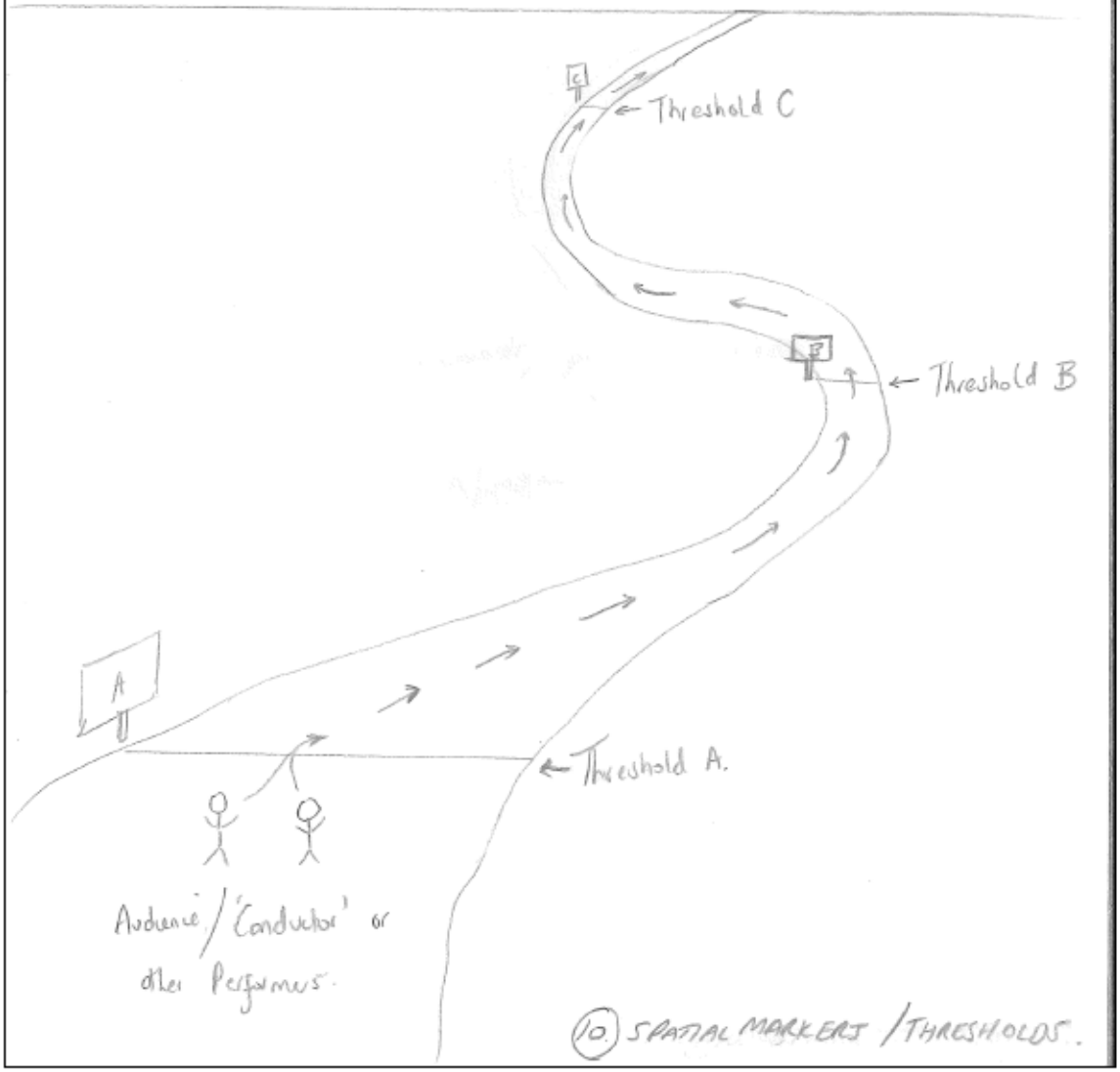
(8) TEMPO LINES

Sweeping cue for change ~ can be clockwise or anticlockwise, slow / fast & starting from any point & ending at any point. Could indicate change to any musical / action parameter. Could be conducted or communicated between players. Could work in other spatial configurations (semi-circles / lines)...



(9.) SPATIAL SWEEP CUE

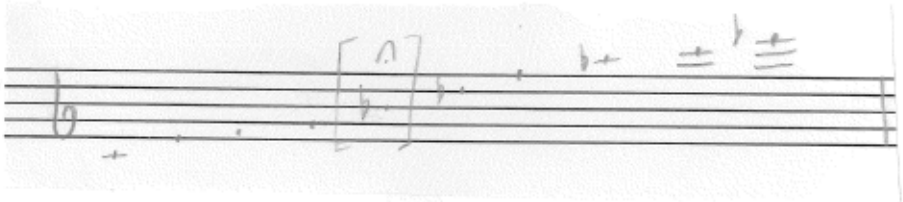
Spatial Markers or Thresholds to trigger change, or cue events to occur.



(10) SPATIAL MARKERS / THRESHOLDS.

· Phrase / Melody must have a recognisable shape or direction for this spatial relationship to be overt to the audience.

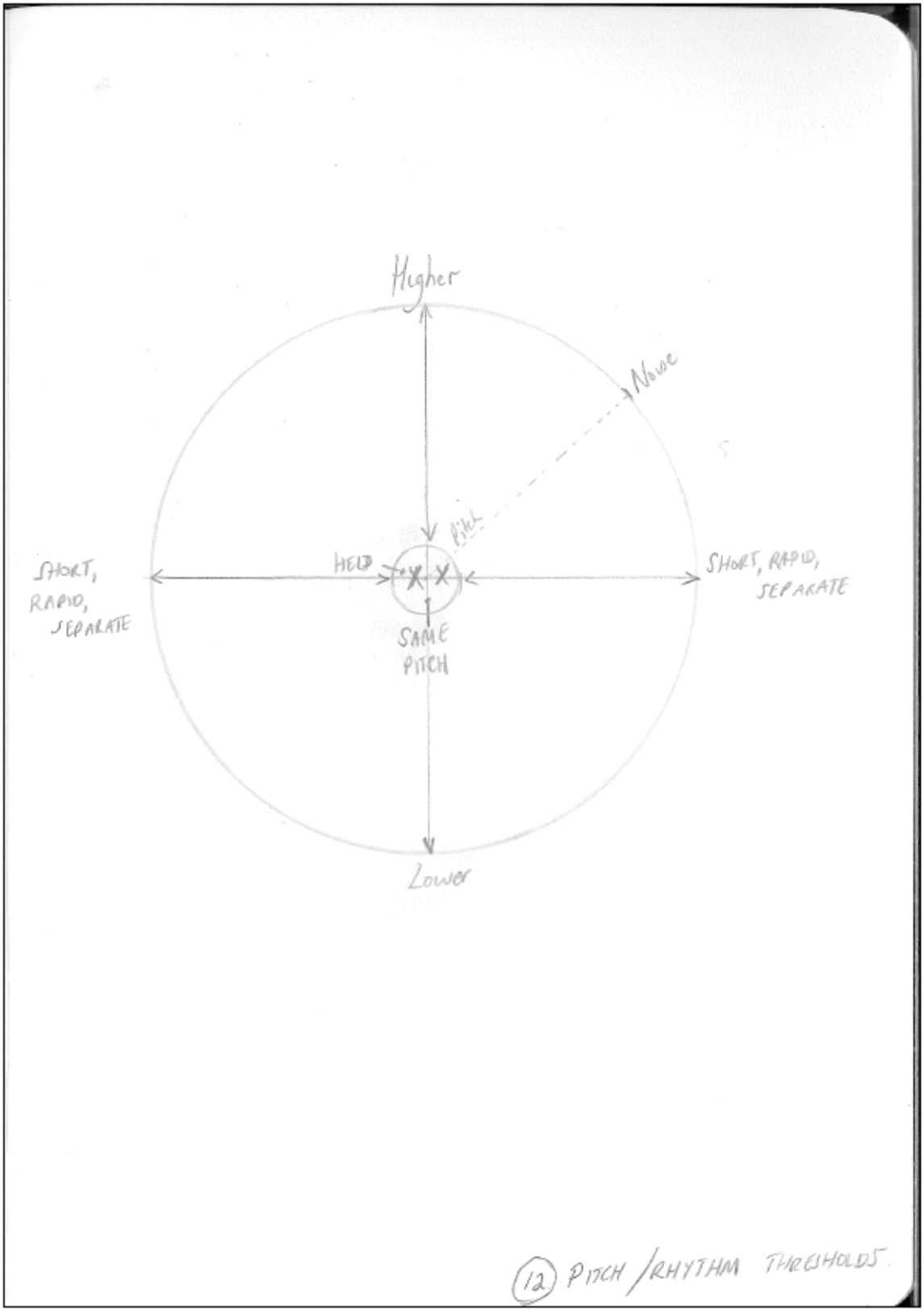
Move forwards, play forwards

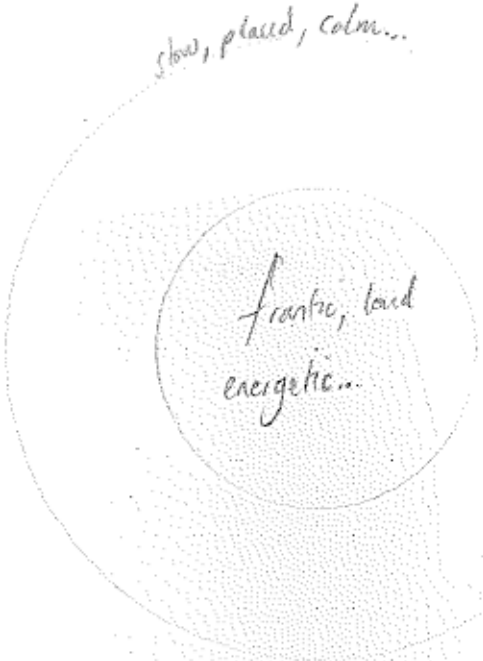


Move backwards, play 'retrograde'

[Stand still, hold / sustain current pitch]

(11) FORWARDS / RETROGRADE


Higher
Noise
Pitch
HELD
SHORT, RAPID, SEPARATE
SHORT, RAPID, SEPARATE
SAME PITCH
Lower
(12) PITCH / RHYTHM THRESHOLDS



(13) ACTIVITY LEVELS

Hollie Harding

Suite P

Three Miniatures for Solo Piano
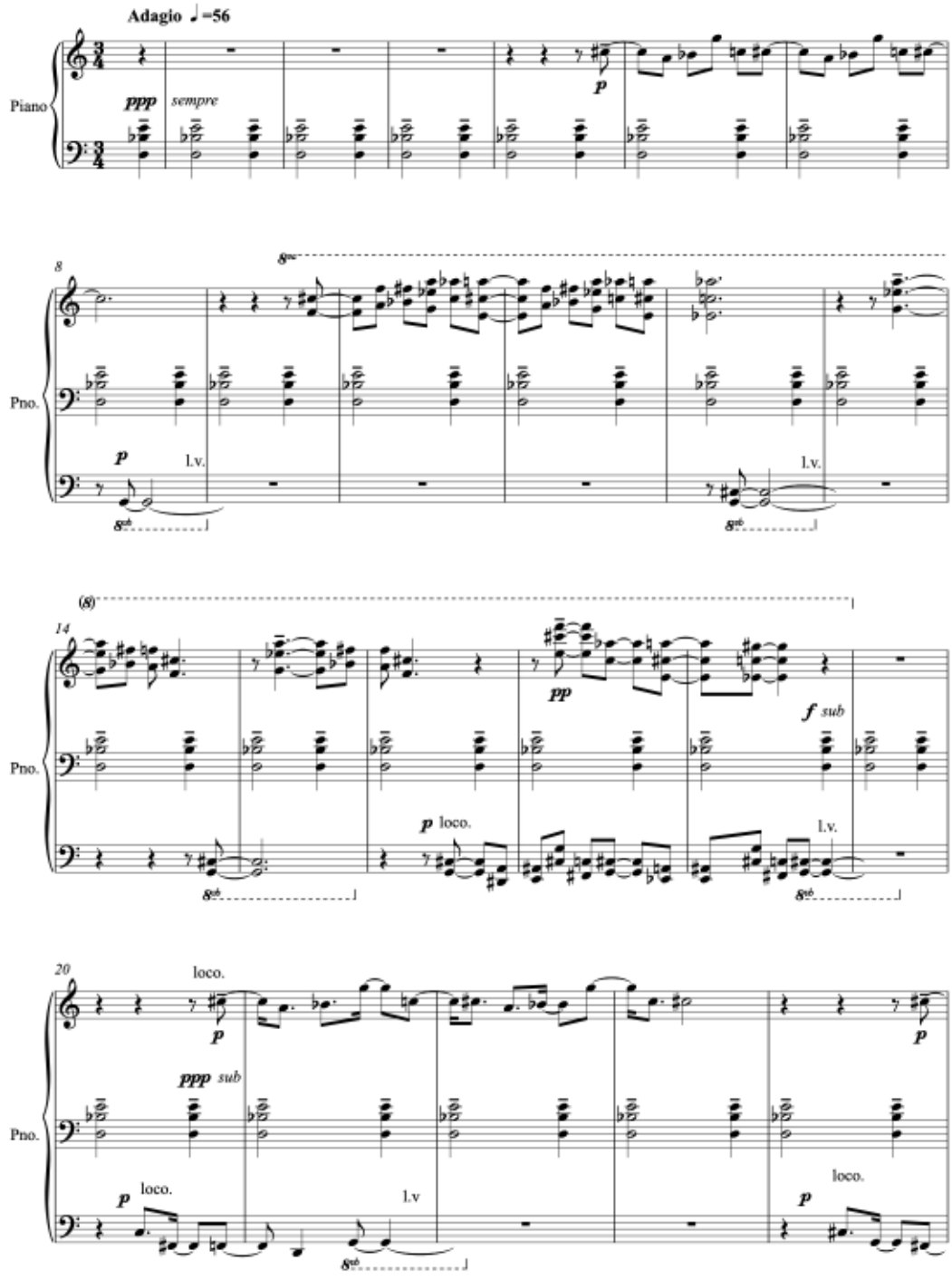
Duration Approx: 5'40

Suite P
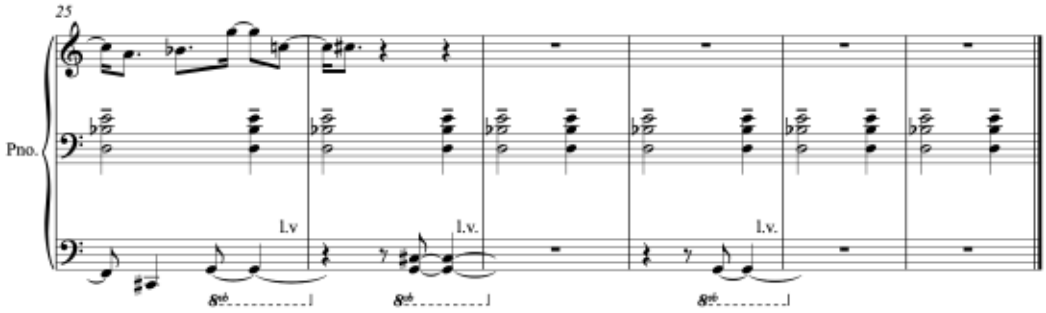
Three Miniatures for Solo Piano

This set of miniatures for solo piano explores three compositional ideas.
The first, 'Pedal', focuses on moving melodic lines around a fixed repeated chord or pedal point.
The second, 'Parallel', explores lines moving in opposing directions between the hands.
It features a scale with ever widening intervals that is also used to create growing distance between the two lines. The final miniature 'Pivot' explores contracting and expanding chords created by each of the pianists' hands rotating around a 'pivot note' D, spaced two octaves apart.
The use of grace notes in this movement serves to emphasize the idea of leaning or falling into the 'pivot note'.
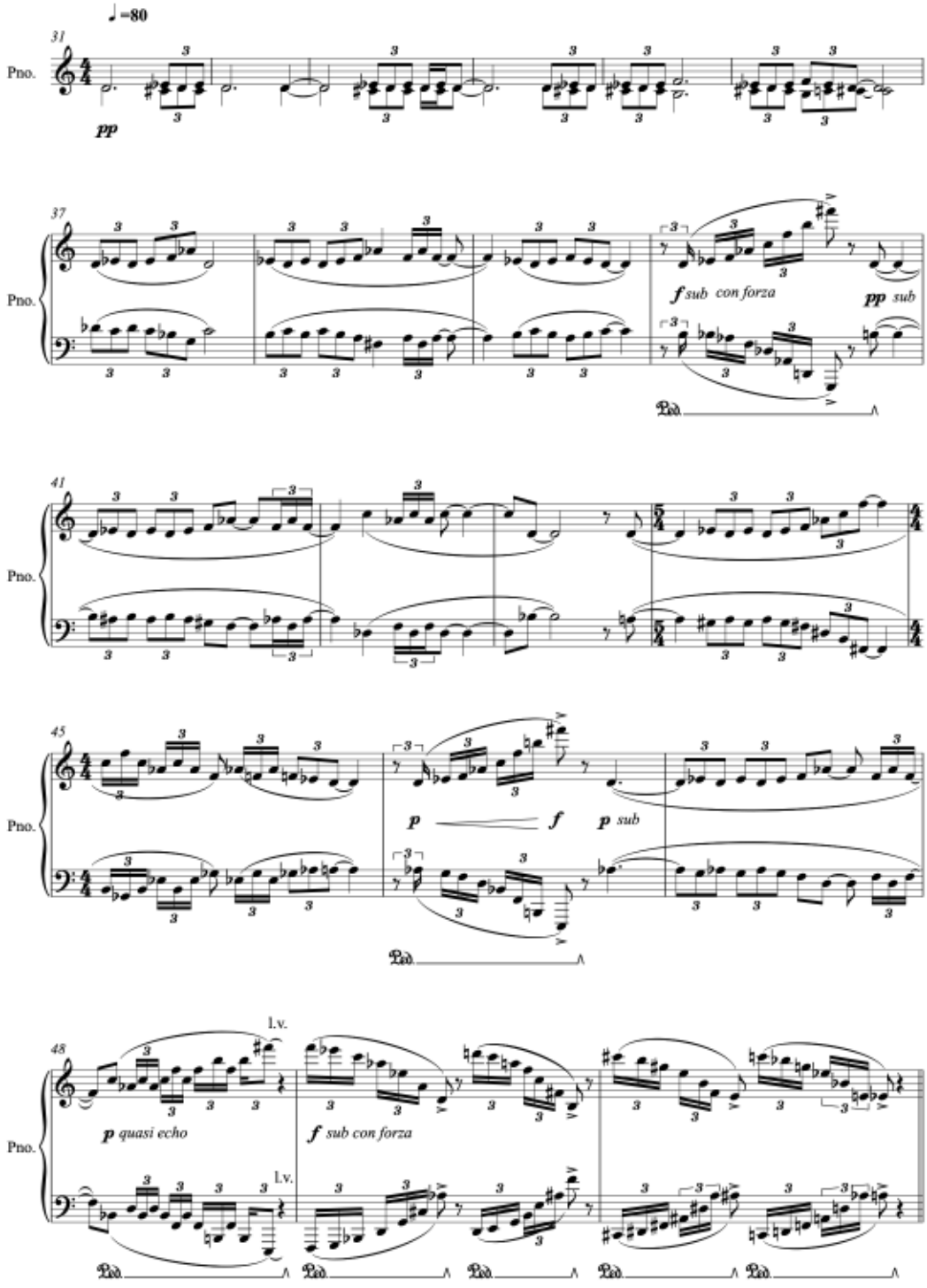
Pedal
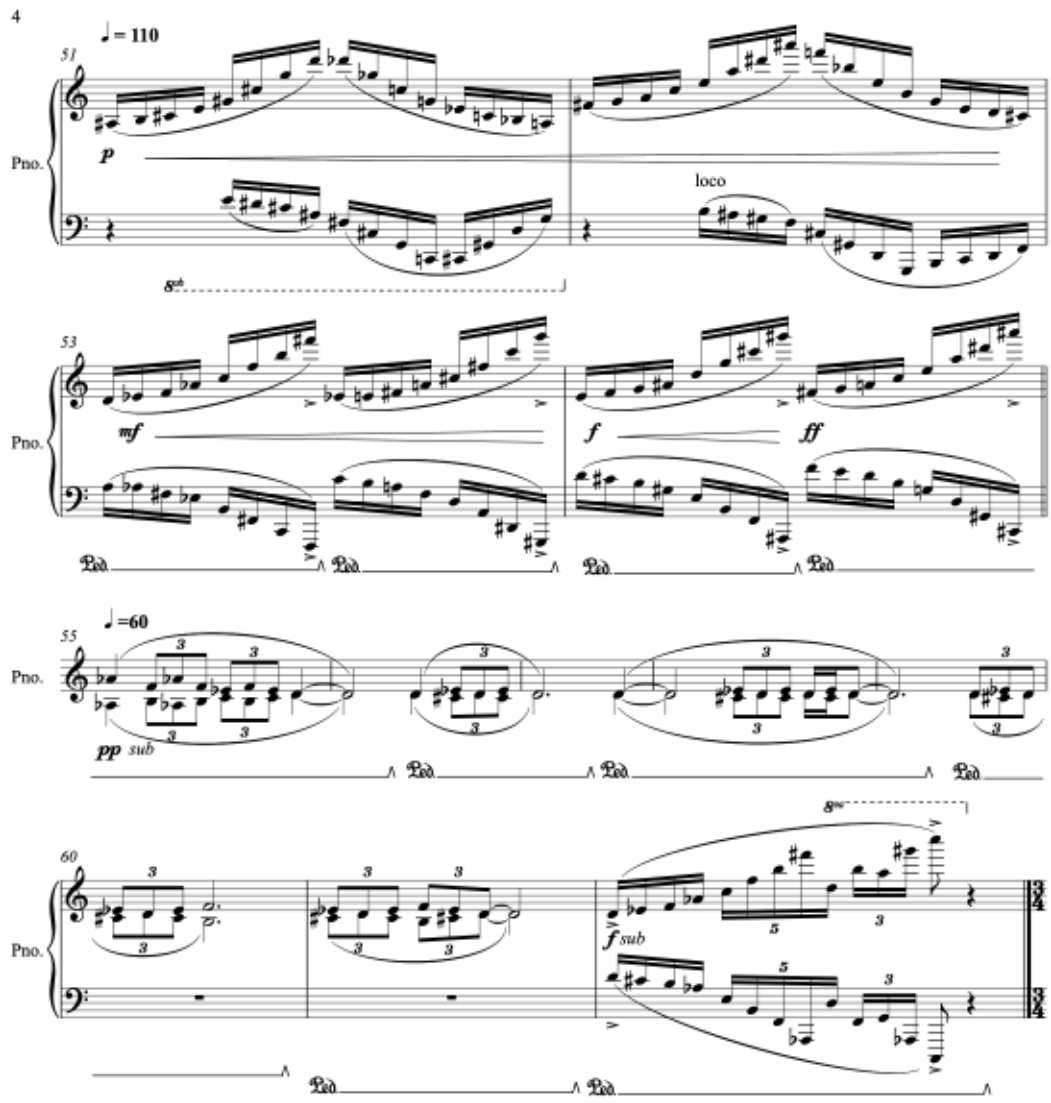

Adagio ♩=56
Piano
ppp
sempre
p
8
8va
Pno.
p
l.v.
8vb
l.v.
8vb
(8)
14
Pno.
pp
f sub
p loco.
l.v.
8vb
8vb
20
Pno.
loco.
p
ppp sub
p loco.
l.v
8vb
p
loco.
p

2
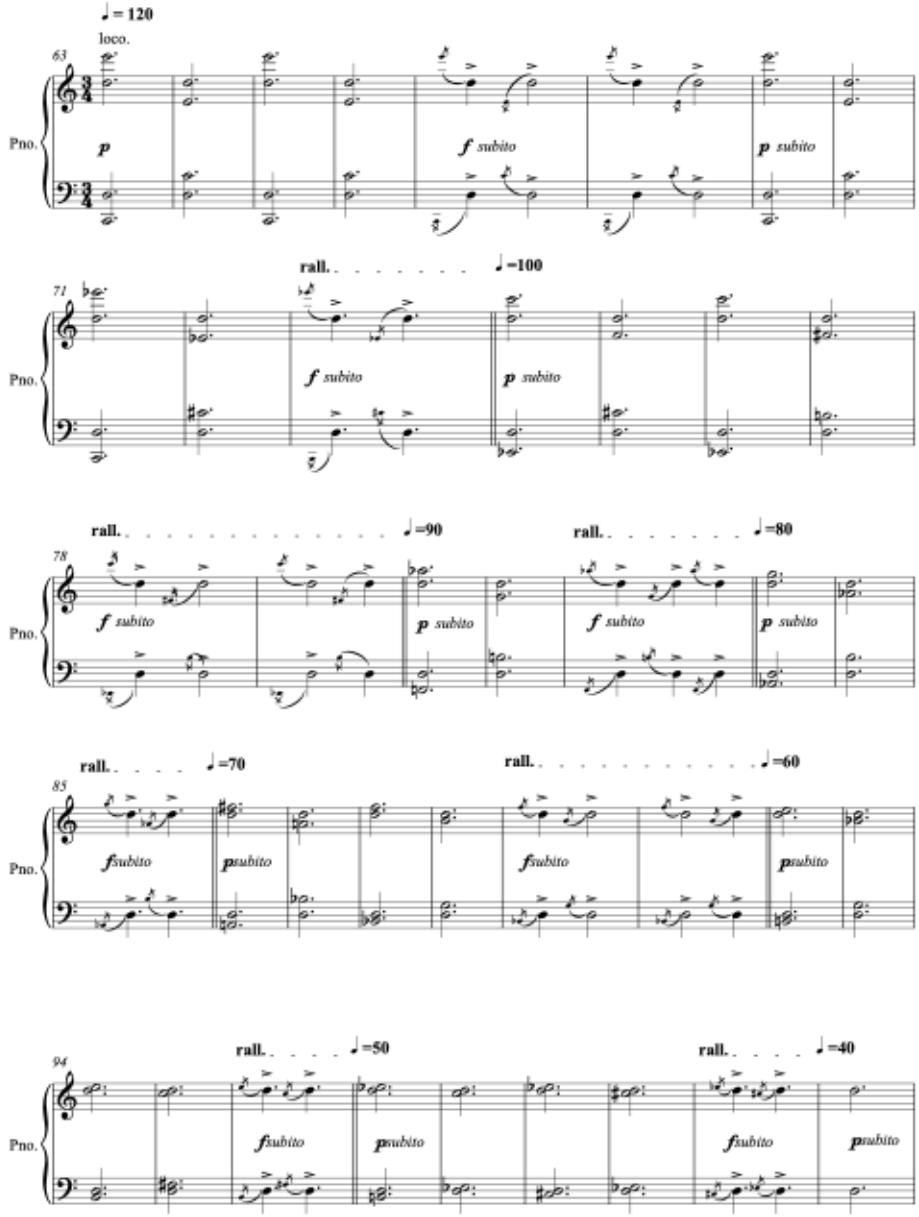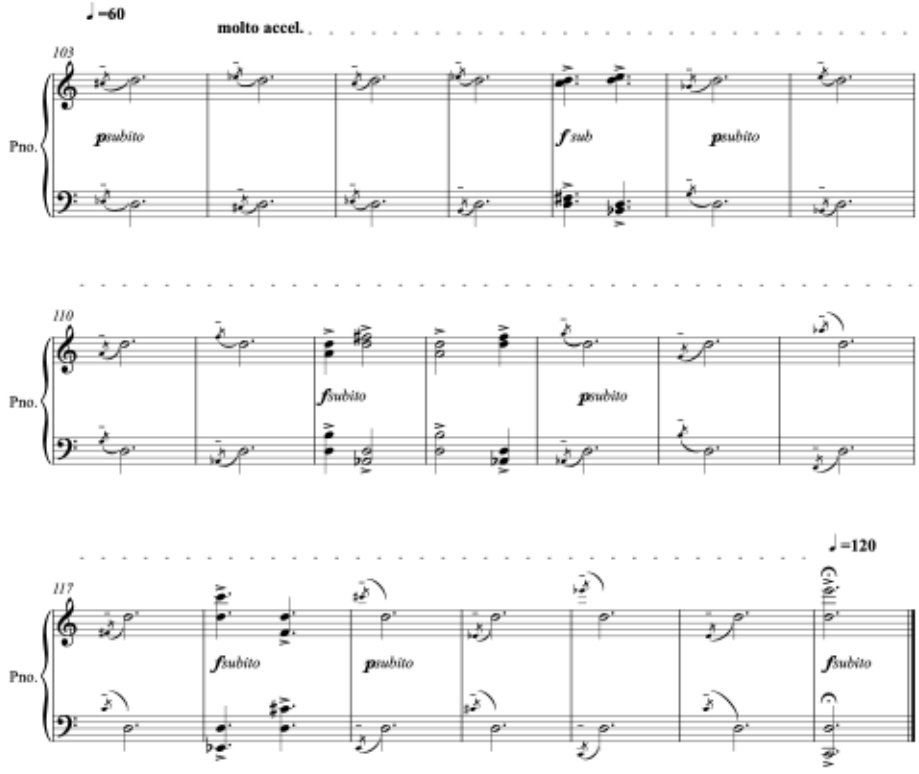


Parallel


♩=80
31
Pno.
pp
37
f sub con forza
pp sub
41
45
p
f
p sub
48
l.v.
p quasi echo
f sub con forza


4
♩ = 110
51
Pno.
p
loco
8va
53
mf
f
ff
Ped
♩ =60
55
pp sub
60
8va
f sub

Pivot


♩= 120
loco.
63
Pno.
p
f subito
p subito
rall. ♩=100
71
f subito
p subito
rall. ♩=90
rall. ♩=80
78
rall. ♩=70
rall. ♩=60
85
rall. ♩=50
rall. ♩=40
94
fsubito
psubito


♩=60
molto accel.
103
Pno.
psubito
fsub
psubito
110
Pno.
fsubito
psubito
♩=120
117
Pno.
fsubito
psubito
fsubito

Appendix 3: Interview with James Weeks on his use of Spatialisation in Performed Music

(Conducted in January 2019)

HH: How do you approach the practical aspects of musical structure such as cues for change and synchronisation, when working with performers who are spread out across space? Does this affect the sounds and complexity of musical material and the type of notation used?

JW: The decision to spatialise performers comes with the concept of the piece, it all gets worked out together, the material, the structure, the co-ordination or lack of, the poetic idea or 'conceit' behind it, the question of what the performers are 'being', their role within the piece...all these things influence and impact on each other, are part of each other and flow into each other and are basically not possible to disentangle retrospectively. But yes of course, the spatialisation has to be something that is right for the material; these pieces are *intended* to be spatialised, meaning they sound best like that and aren't intended *not* to be spatialised. Likewise notation and the way things are timed.

I think I would say that pretty much all my spatialised pieces, not only the ones you mention, start from the basis that individuals are working separately from each other, or are working within small groups that are themselves separate from each other. The image is always a variation of the idea of multiplicity: of bees in *Bee Haven* (each player is 'being' a bee), of human or animal couples in the *Ark* (*ærc*), of figures on a frieze (*Olympic Frieze*), of groups of labourers (*Radical Road*). The situation isn't quite so clear in *Venetian Sky*, though it is still pictorial, so you could view the participants (depending on what they are playing at that particular moment) as sunbeams, or onlookers, or wind or clouds. It's more that they are all contributing parts to a tableau. So in all these pieces the notation is read separately by each individual or separate group, and I tend to work in different material types which they can move between independently, ad lib., or choose their own fixed ordering.

In all these pieces there is never any strict synchronisation within the piece: often participants keep track of time with a stopwatch, and there are loose timings given for them to spend on each type of material, or a specific moment in the piece to begin doing something else. *Venetian*

Sky is the odd one out again as I decided I needed to control it more carefully, given the short duration of the piece and the need for things to be a bit more structured within it (this piece is not a steady-state *tableau vivant,* it's actually got a structure, albeit an incredibly simple one). Here I stood at the front with a blue flag and moved it gradually across a semicircle from lowered to raised to lowered; all the participants could see me and understand where they should be in the structure and what they should do...for the most part...

HH: *Bee Haven* (2017) creates a sonic environment reminiscent of the natural world, for the audience to move around within. Do you approach all of your spatialised pieces as 'sound environments' and does this change your compositional approach in comparison to your approach to writing for stage / concert hall?

JW: The idea is of fields, that is, that a piece is like a field and the performers (and therefore listeners) can move about in them, literally or figuratively. This crosses over from concert pieces to 'installations' of all types. A piece like *Walled Garden,* which is for 6 instruments and part of a larger concert work, creates the space of the page or pages of the music as fields in which each player independently roams about. Slightly differently, *mural* is a collection of 74 pieces for 4 singers, which constitute a kind of field of materials for the singers to put together in any order they want, probably in collaboration with one or more other vocal quartets. I think that sense of wandering around within a set of materials comes across in this piece even when it's not strictly spatialised (though if there were e.g. four quartets they could be spatialised around the room).

All the pieces I mentioned above are 'literal' fields in that the concept (the conceit) of the work involves the idea of real space: in *Bee Haven* it's a garden or maybe even a single bush with bees buzzing round it; in *ærc* it's the enclosed interior space of an ark or other place of safety, in *Radical Road* it's an 18th Century rural building site, in *Venetian Sky* it's the space of the Tiepolo painting. What's important in all of these is the idea of the sound coming as if from all around the audience - the image of multiplicity or abundance, that as the audience you are enclosed within the work, you are somehow embodied within it, and it in you. Structure and form become visceral experiences.

HH: Are the physical, visual, and mechanical aspects of music performance a source of interest / influence on your compositional processes, or do you focus predominantly on the audible effects of variations to spatial placement of performers?

At different times in different ways, yes, I am certainly involved with the visual and physical aspects of performance. I think these sorts of works (the spatial installations) are particularly physical, the bodily instantiation of the performers is a central part of the piece. This is most obvious in *Olympic Frieze*, which is about physical shapes and gestures made by the body as much as it is about sound, and I'm planning to do this again in a new piece I'm working on for Musarc. So there are obviously visual elements there; also in *Venetian Sky* the sense of shock-and-awe of the performers being ranged around the balconies of some huge space is part of the conception. This aspect isn't so important to pieces like *Bee Haven* and *aerc*, though. Quite how these things come into the mix depends on the idea I have, which is different each time.

Outside in

Hollie Harding

Duration: 6'30"

Instrumentation:

Outside, in

2 F Horns
2 Bb Trumpets
2 Tenor Trombones

Performance Note:

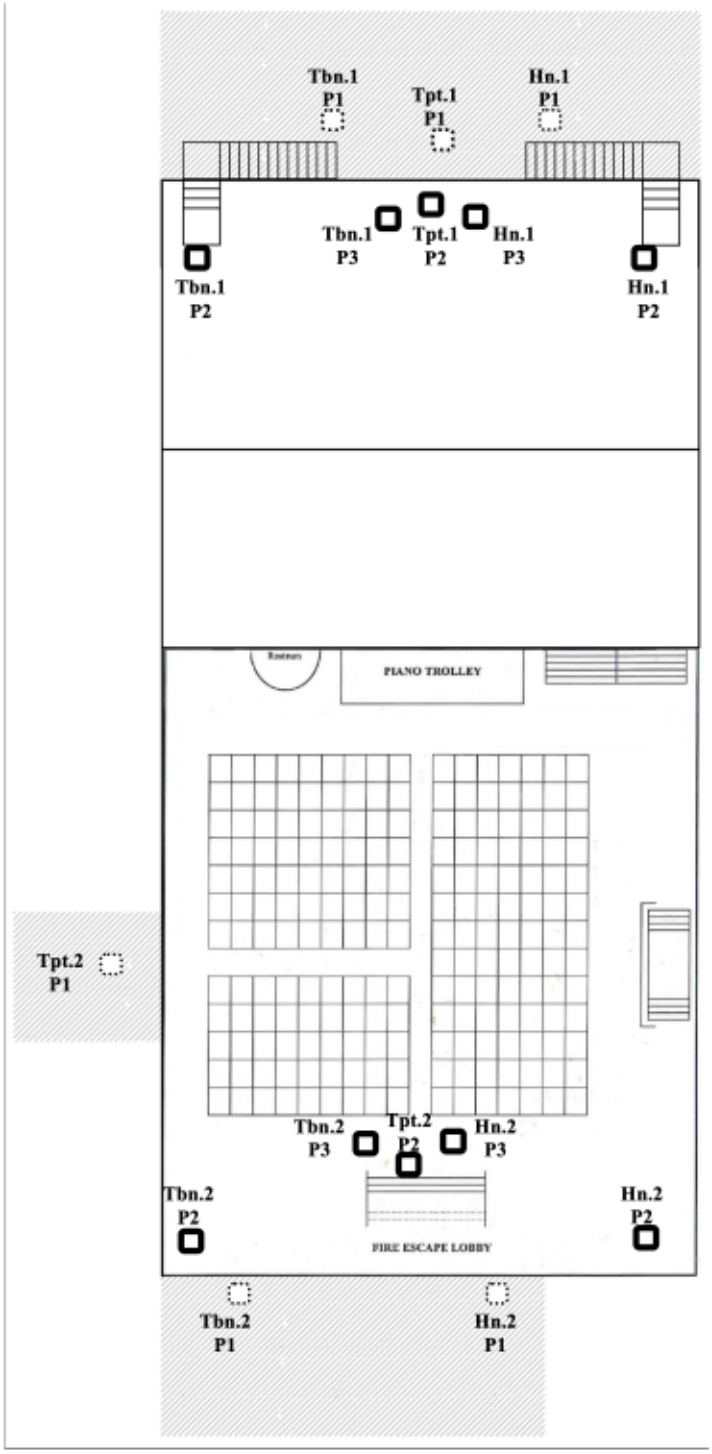
This spatial study explores the relationship between the acoustics of the concert hall and the surrounding offstage areas, celebrating the unique quality of distance, alongside investigating spatial possibilities within the hall itself.

In 'Outside, in' the Brass players are directed by a single uniform click track played to them through a wireless headphone system which easily allows them to move into their different positions (shown in the diagram overleaf) whilst still keeping in time. This means that the players have to perform with as much as mechanical rhythmic accuracy as possible, in order for all six lines to fit together properly.
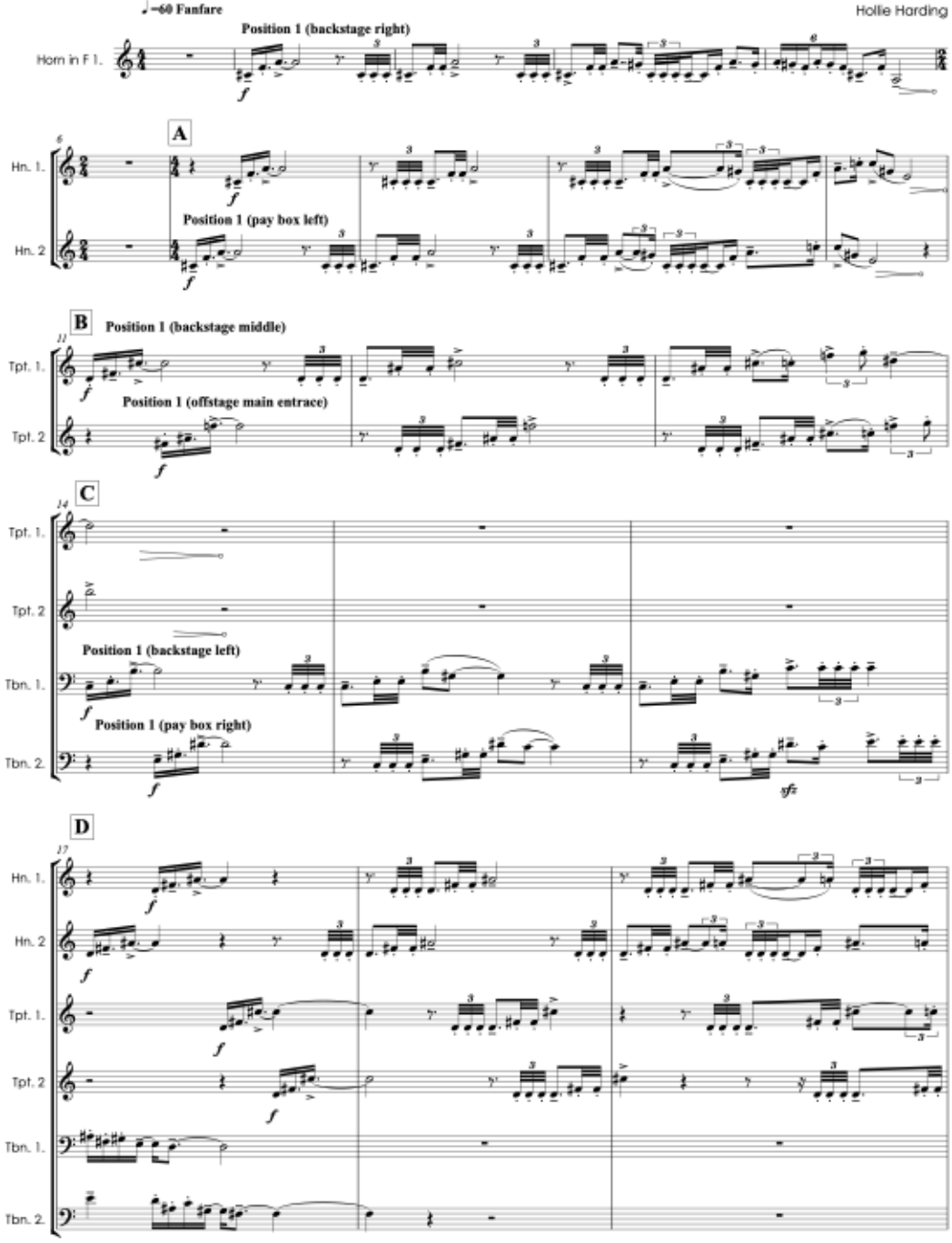
Technical Set up:
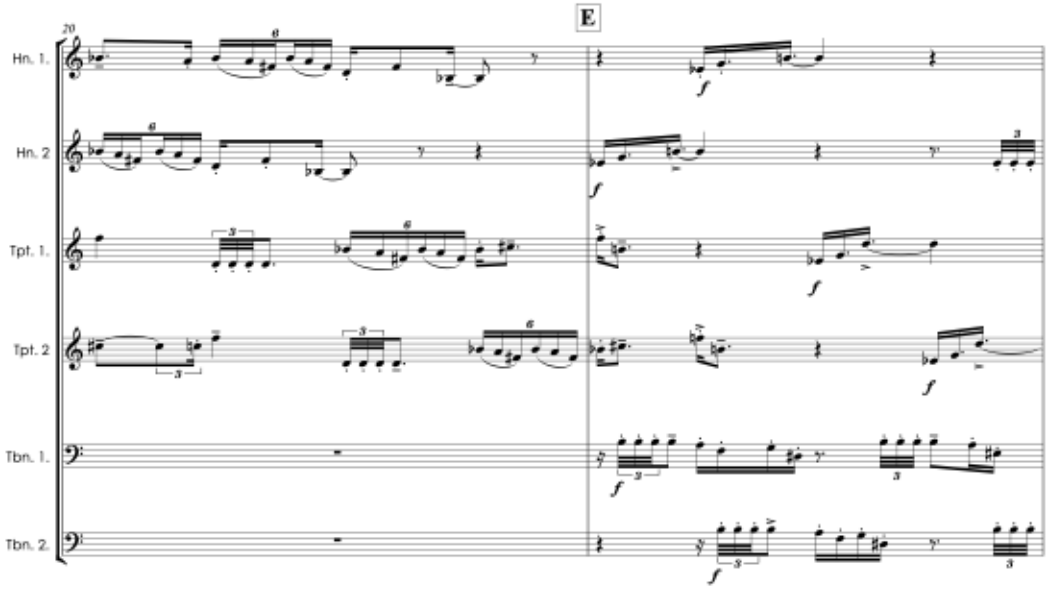
'Outside, in' requires a wireless headphone system to transmit a uniform click track to all of the Brass players in order to enable them to play together whilst in the various offstage and onstage positions. Cost-effective systems can be hired from 'Silent Disco London' and are more than suitable for performance in a moderate to large size venue. You will need 7 pairs of wireless headphones (one for each player and one spare for the director) that receive the audio signal from one transmitter connected to a laptop or mp3 player that plays back the click track.
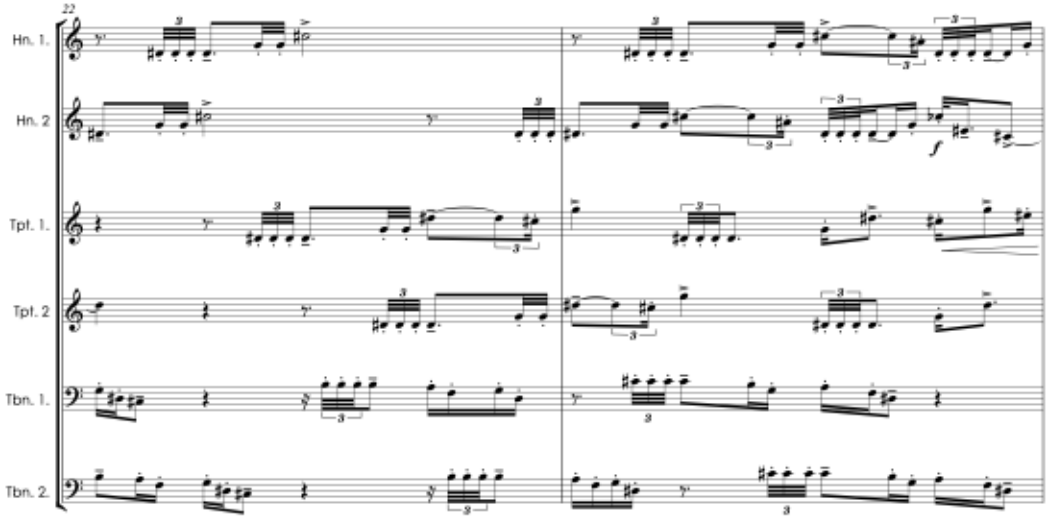
'Outside, in' Player Positions: Duke's Hall
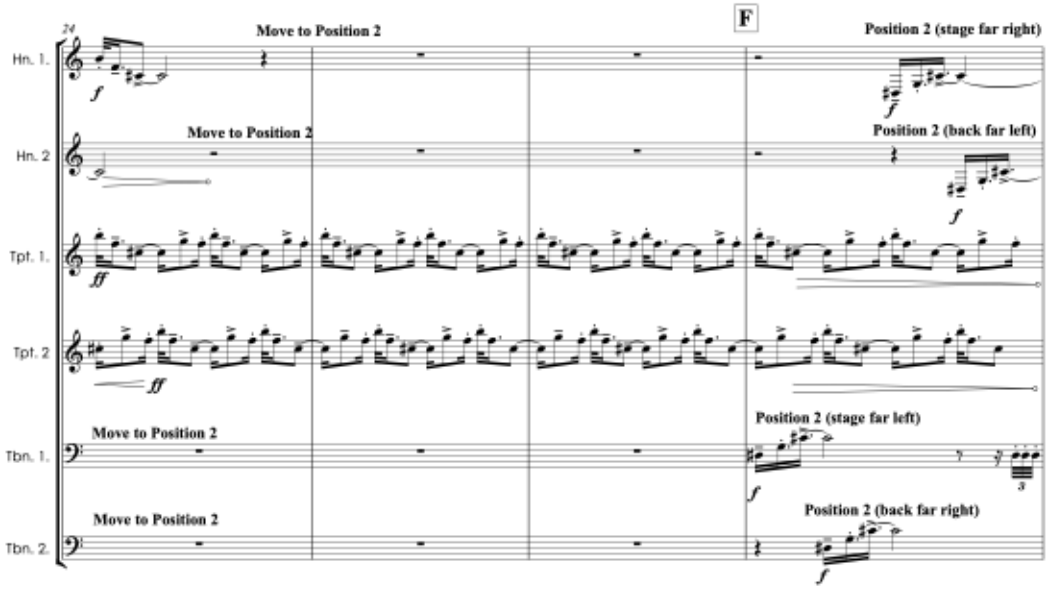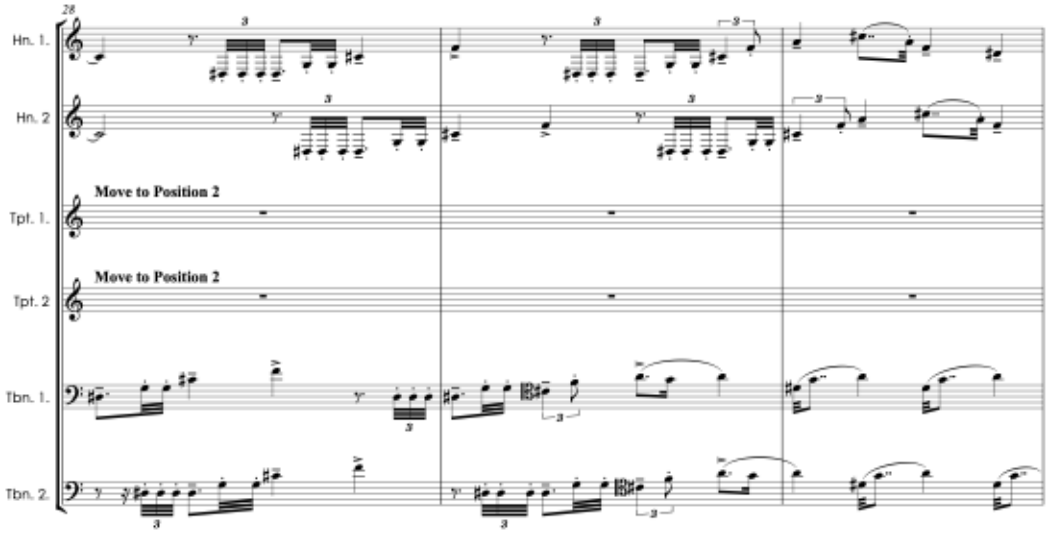


Outside, in
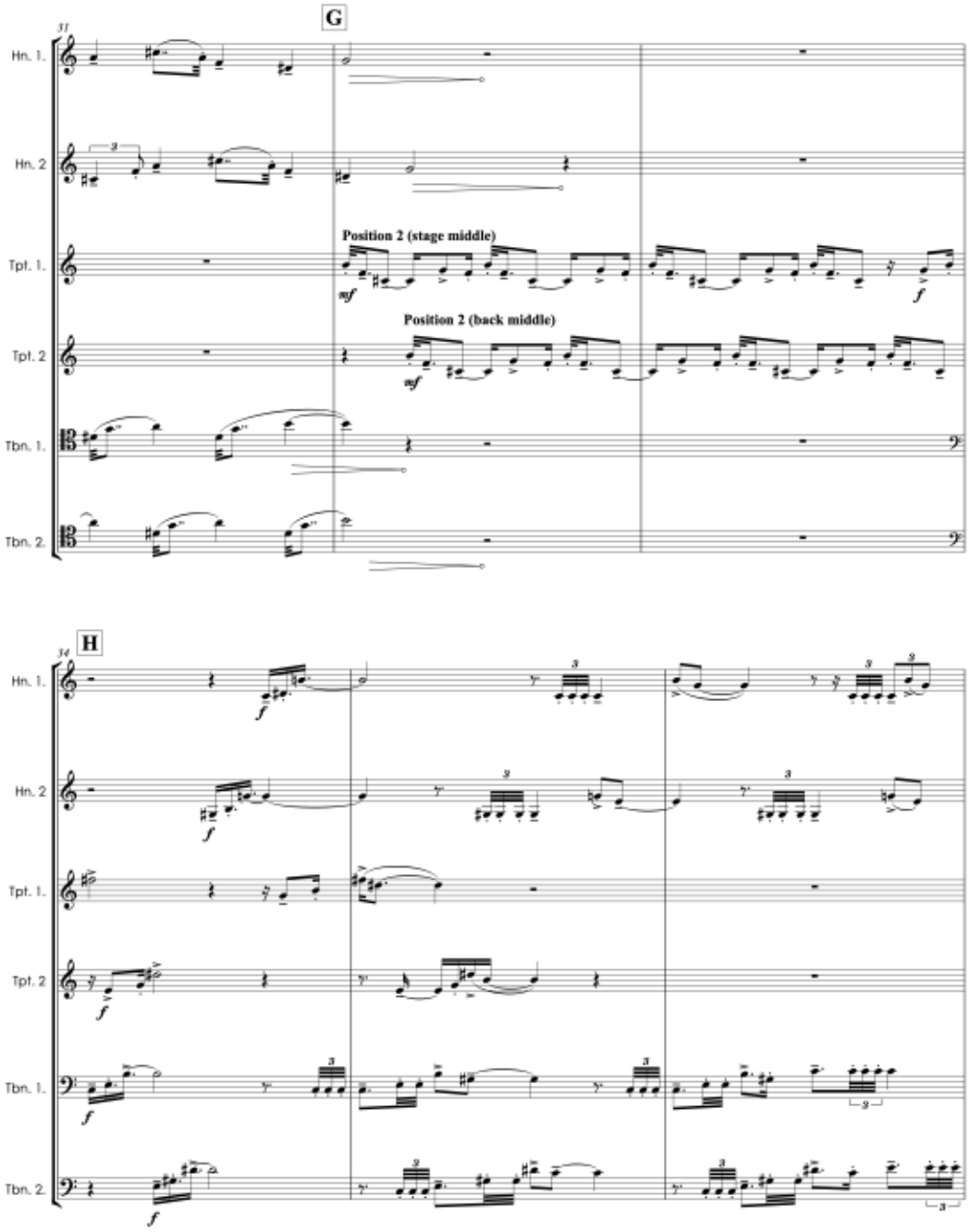

♩=60 Fanfare
Hollie Harding
Position 1 (backstage right)
Horn in F 1.
A
Hn. 1.
Hn. 2
Position 1 (pay box left)
B
Position 1 (backstage middle)
Tpt. 1.
Tpt. 2
Position 1 (offstage main entrace)
C
Position 1 (backstage left)
Tbn. 1.
Position 1 (pay box right)
Tbn. 2.
D
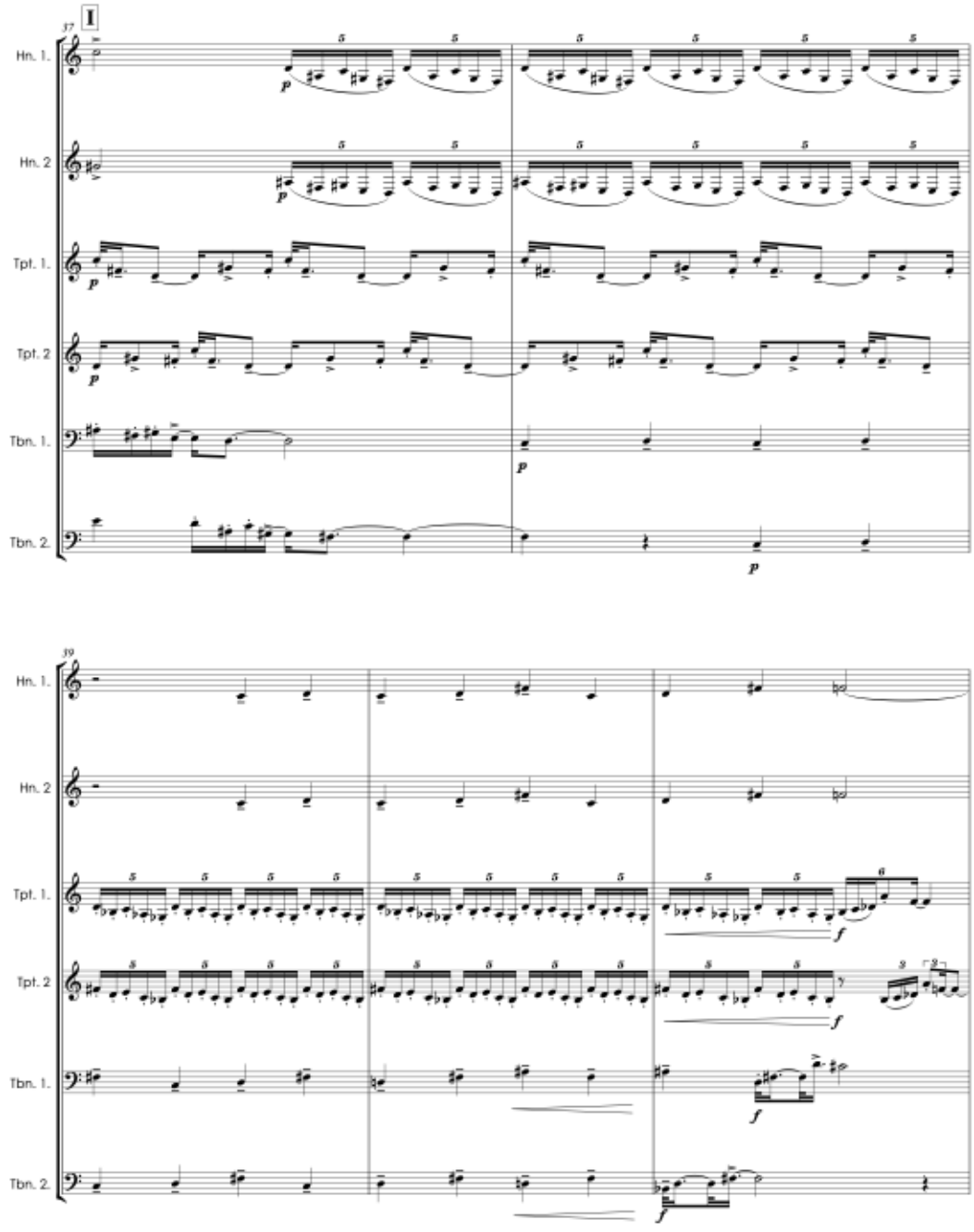

E
20
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
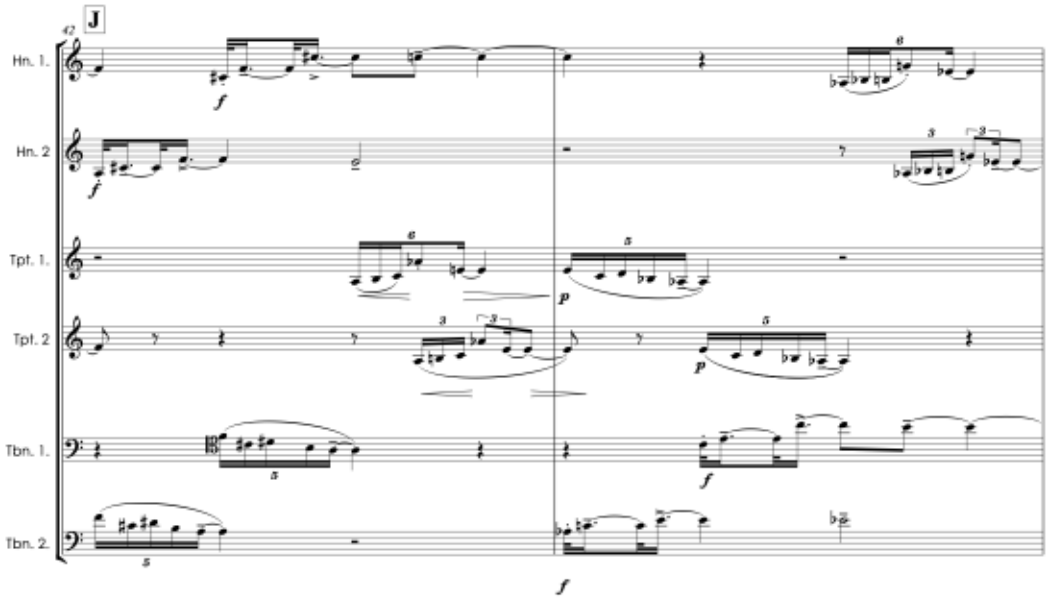

22
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
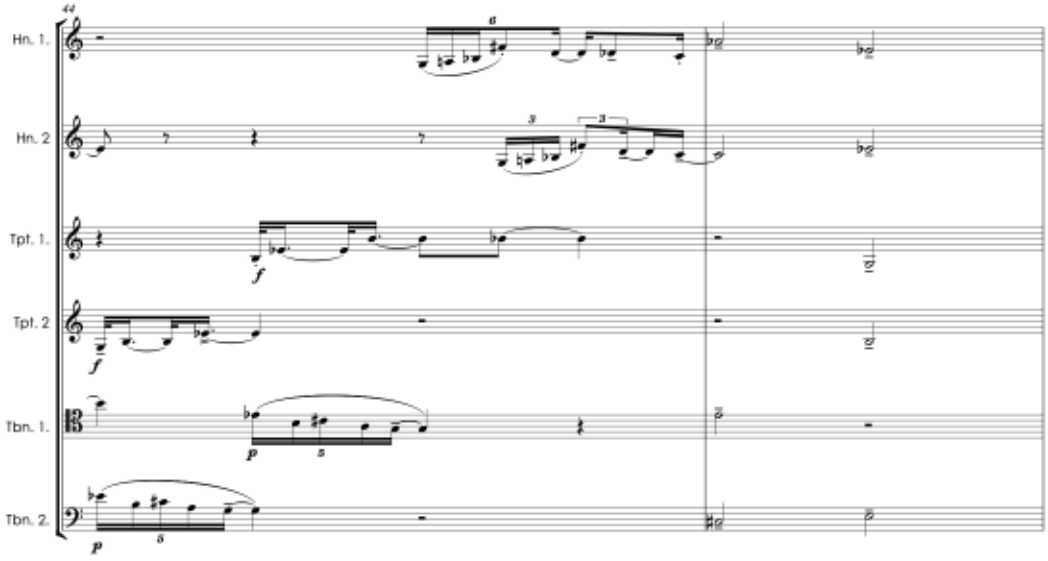

24
F
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
Move to Position 2
Move to Position 2
Move to Position 2
Move to Position 2
Position 2 (stage far right)
Position 2 (back far left)
Position 2 (stage far left)
Position 2 (back far right)
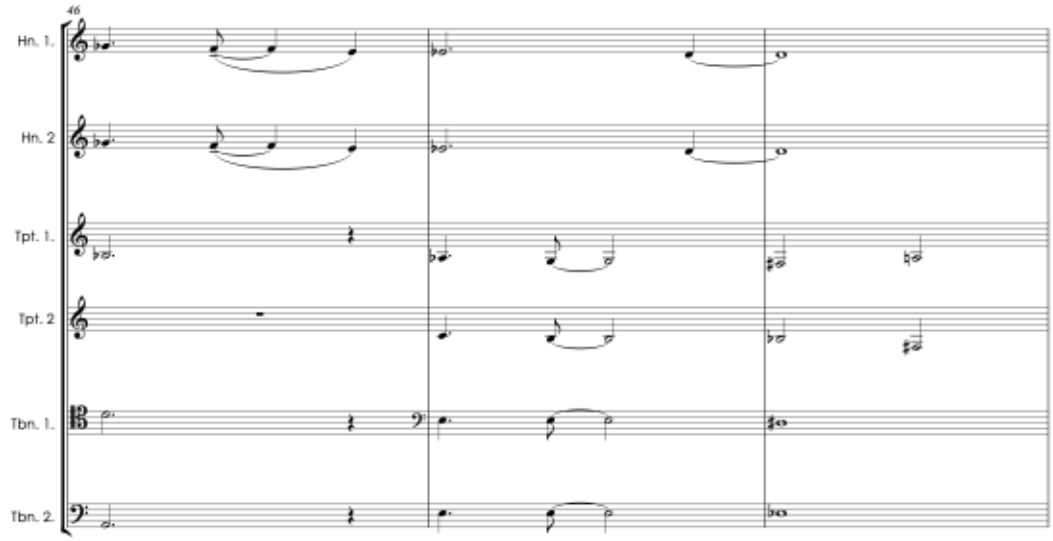

28
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
Move to Position 2
Move to Position 2
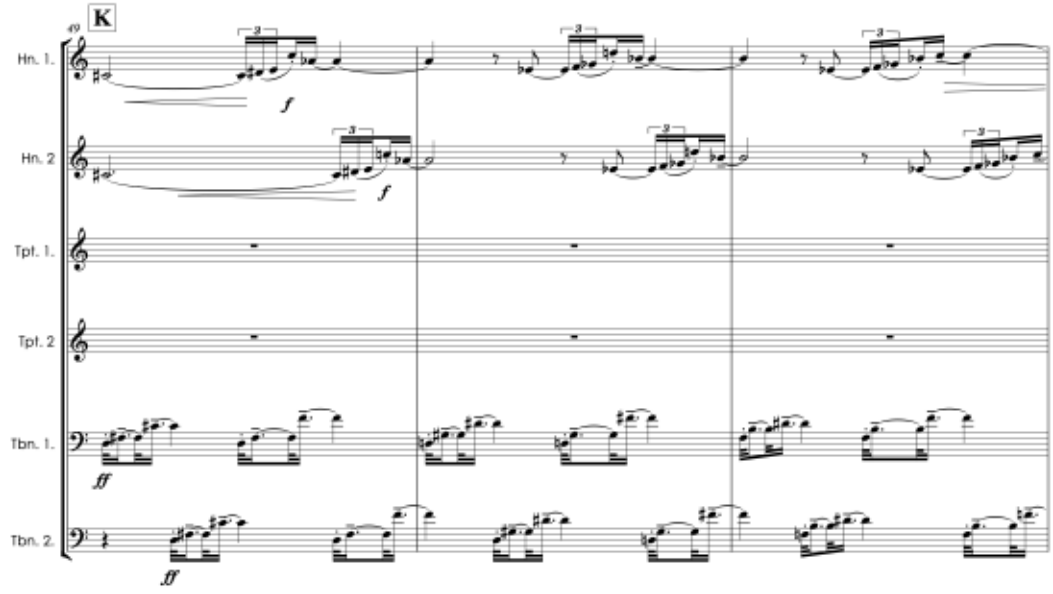

G
11
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
Position 2 (stage middle)
mf
f
Position 2 (back middle)
mf
H
14
f
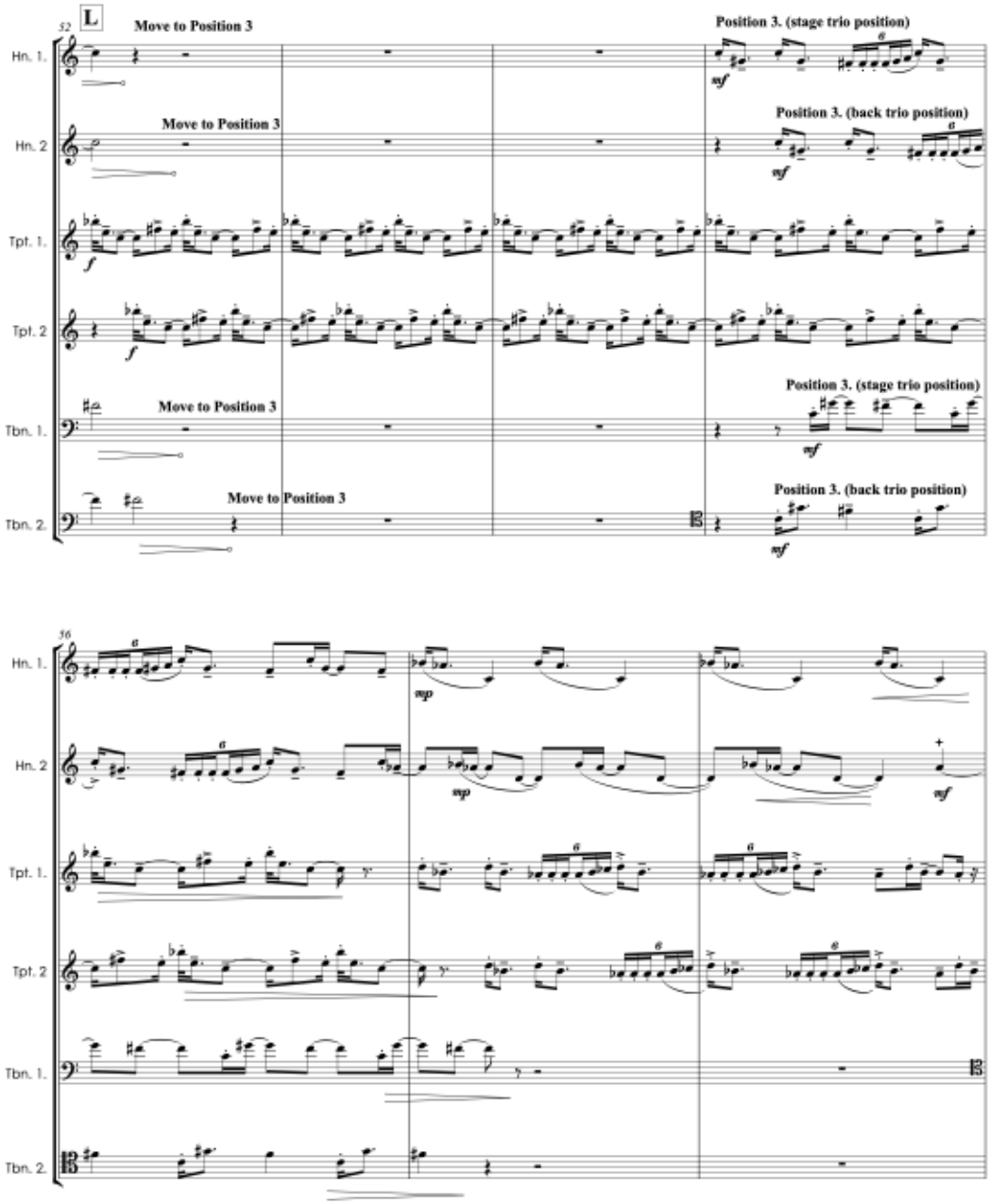

37
I
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
p
39
f
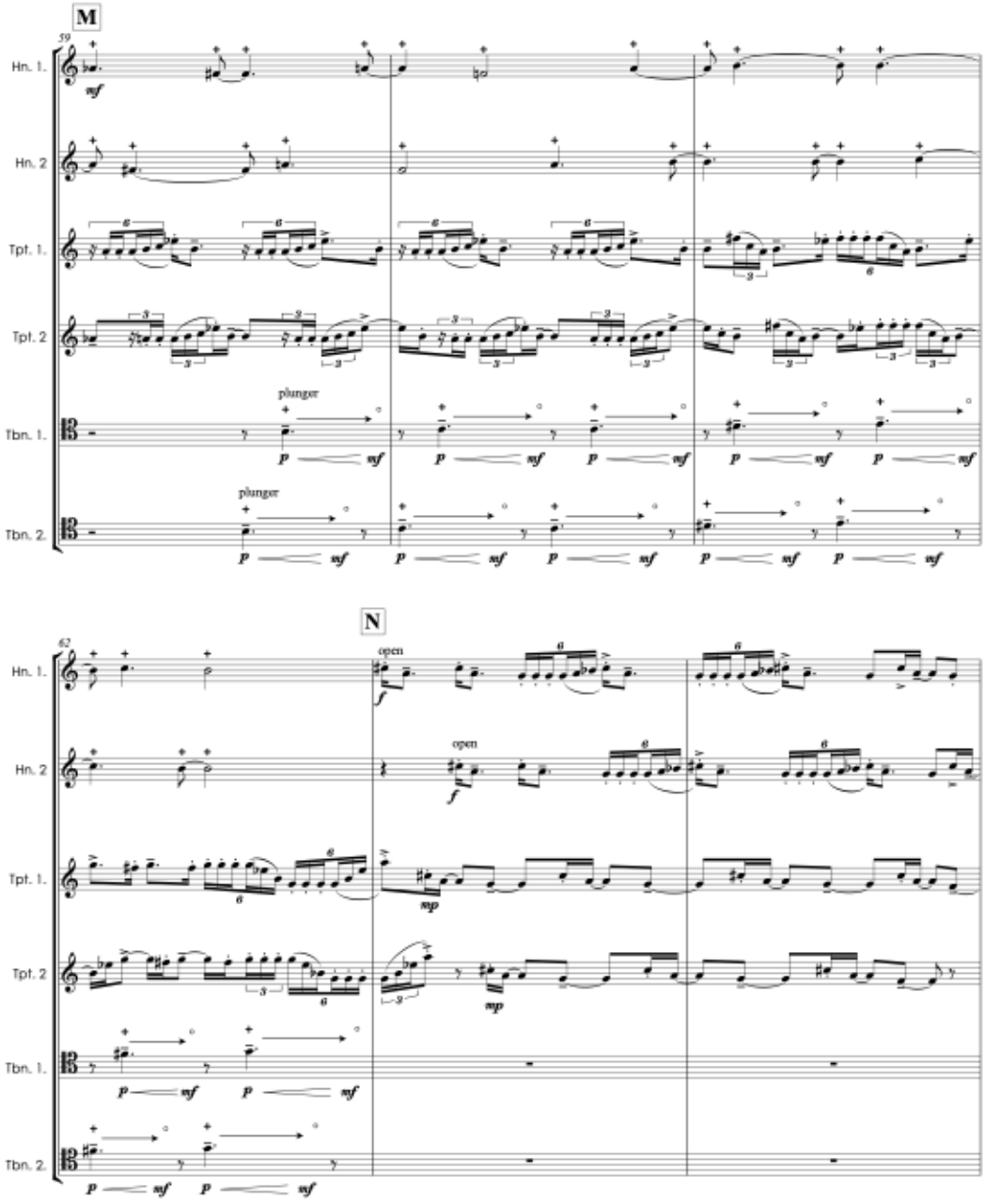

42
J
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
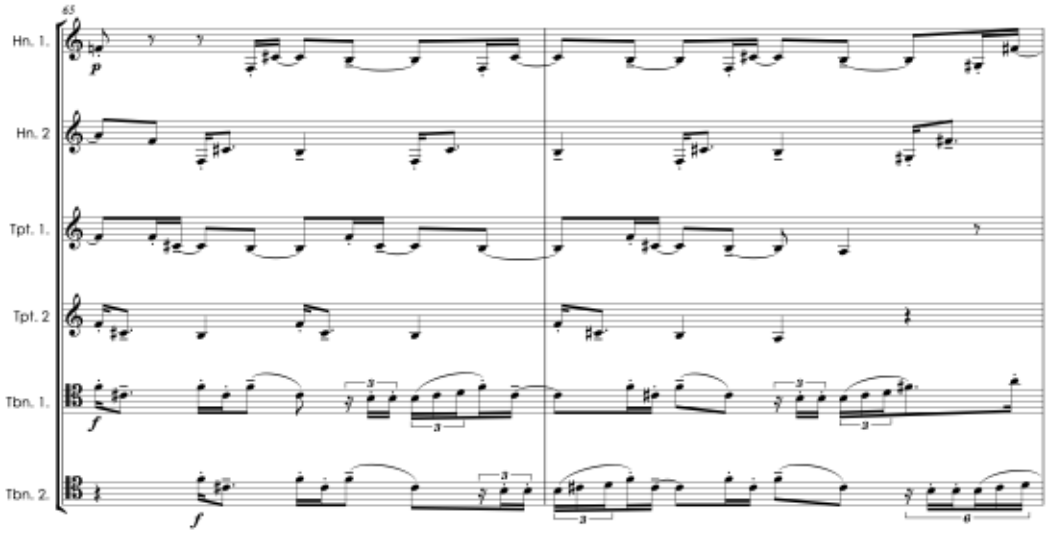

44
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
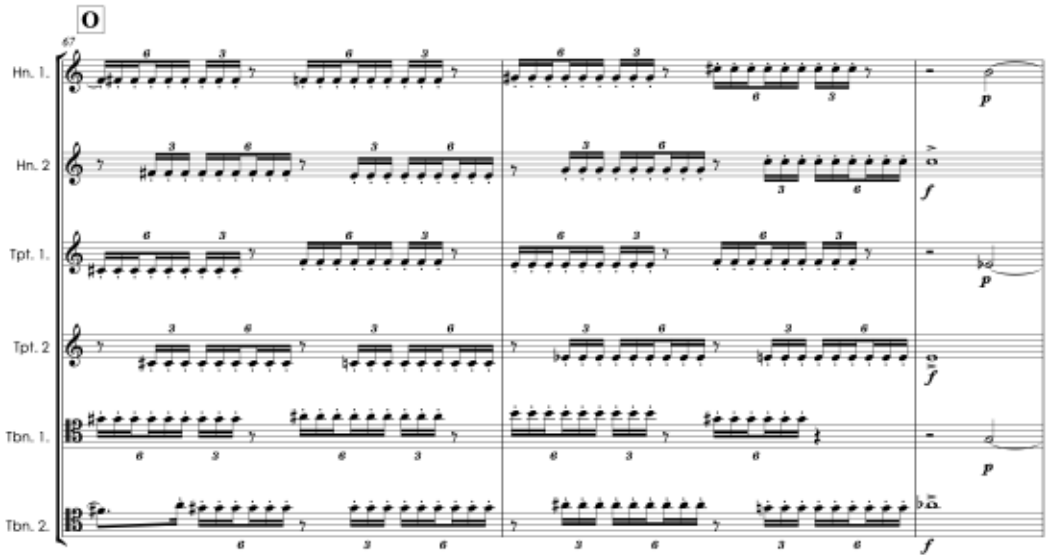

46
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
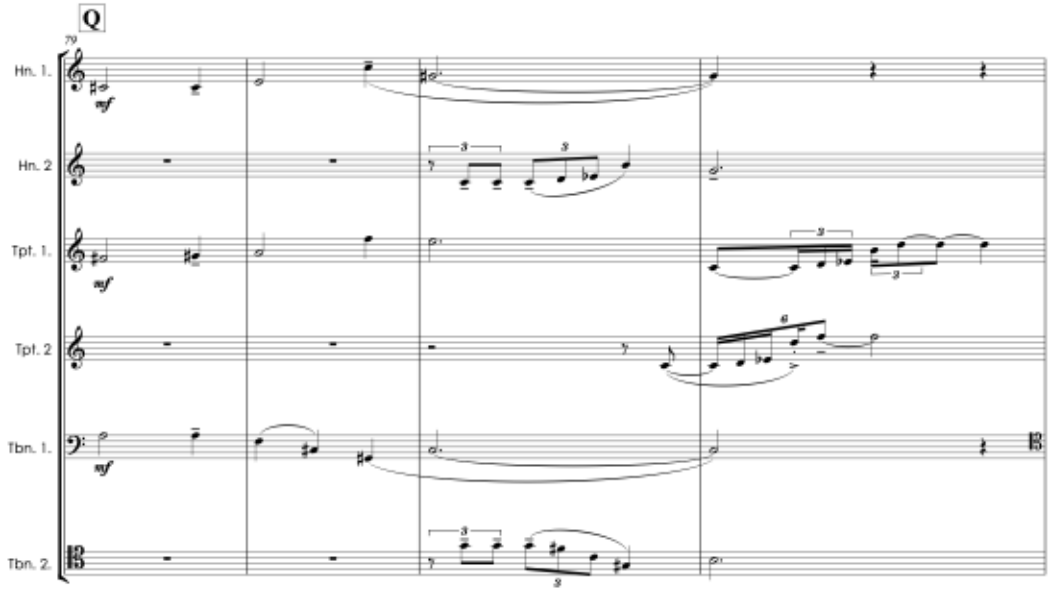

49
K
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
f
f
ff
ff
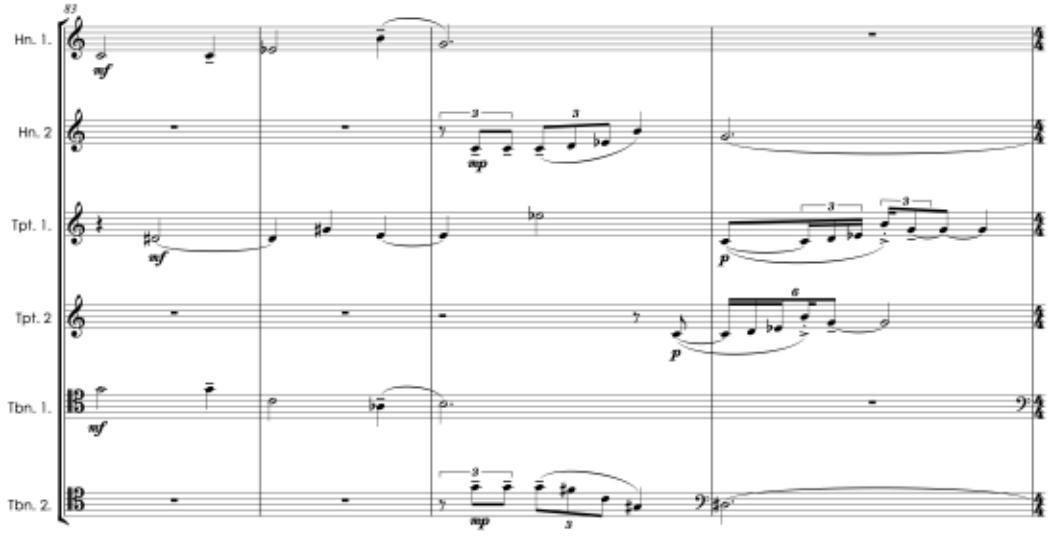

52
L
Move to Position 3
Position 3. (stage trio position)
Hn. 1.
Move to Position 3
Position 3. (back trio position)
Hn. 2
Tpt. 1.
Tpt. 2
Move to Position 3
Position 3. (stage trio position)
Tbn. 1.
Move to Position 3
Position 3. (back trio position)
Tbn. 2.
56
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
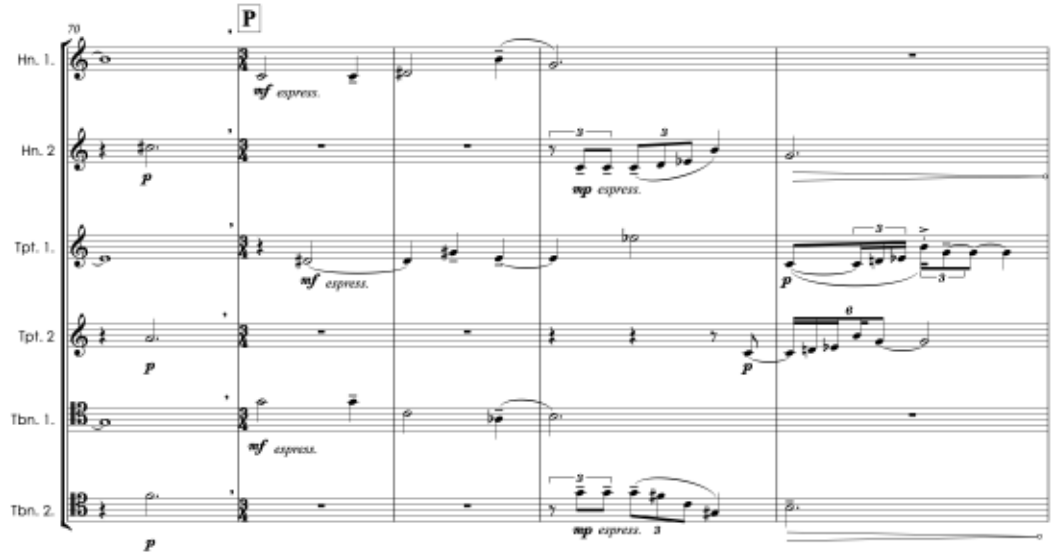

M
59
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
plunger
plunger
N
62
open
open
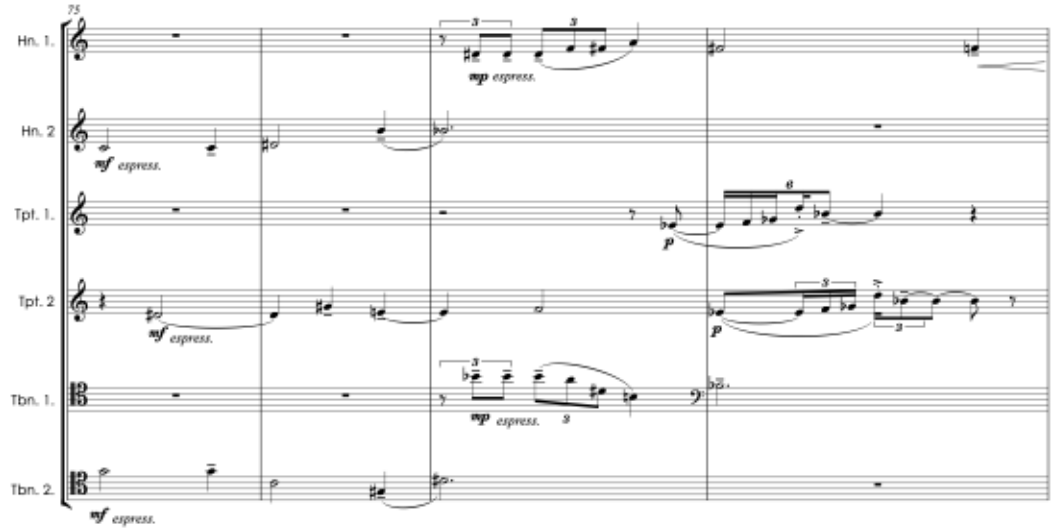

65
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
p
f
f
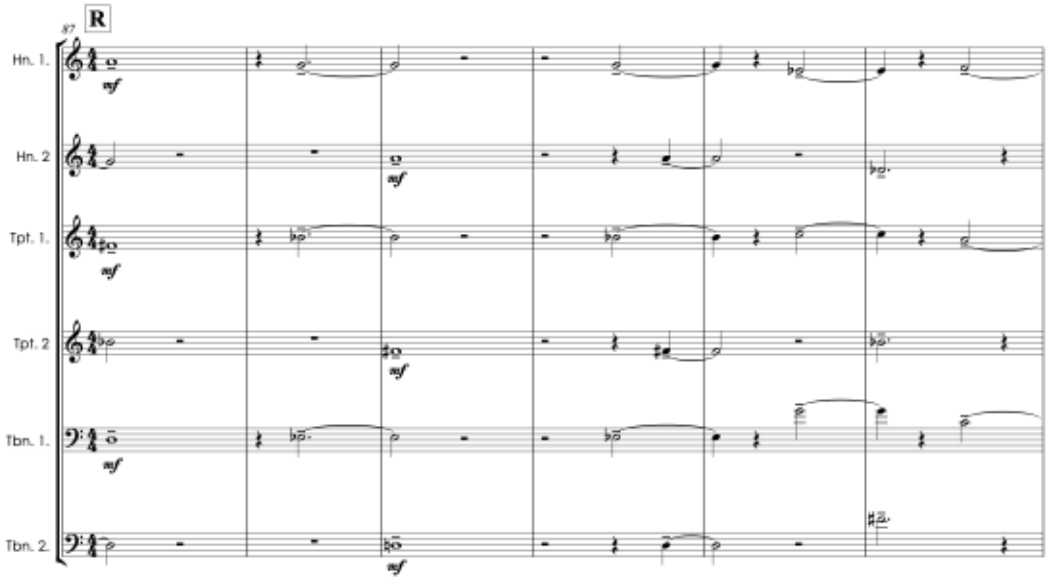

O
67
Hn. 1.
Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
p
f
p
f
p
f
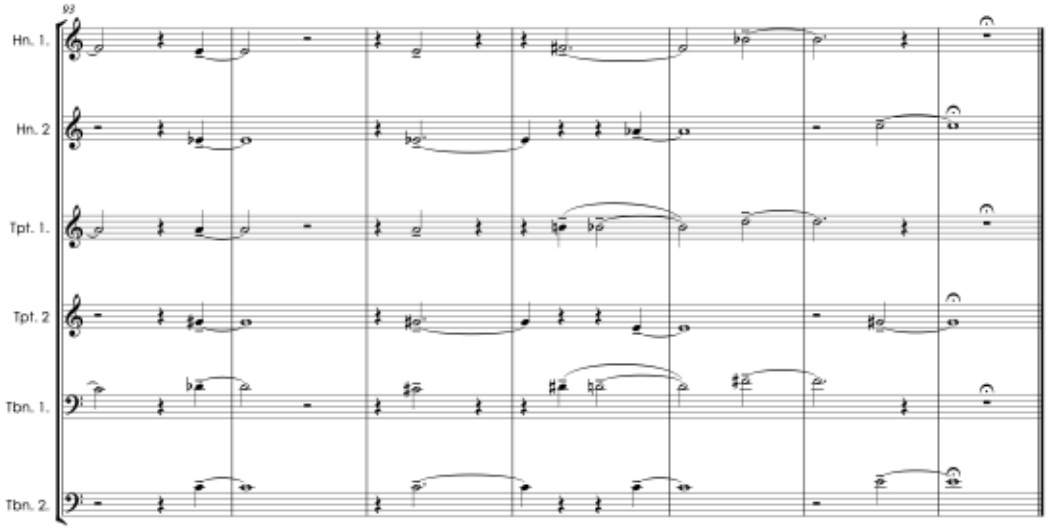

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79
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mf
mp
p


70
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mf express.
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75
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Tpt. 1.
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Tbn. 1.
Tbn. 2.
mf express.
p
mp express.


87
R
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Hn. 2
Tpt. 1.
Tpt. 2
Tbn. 1.
Tbn. 2.
mf


93
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Appendix 5: Programme Book - *Melting, Shifting, Liquid World* (2019)



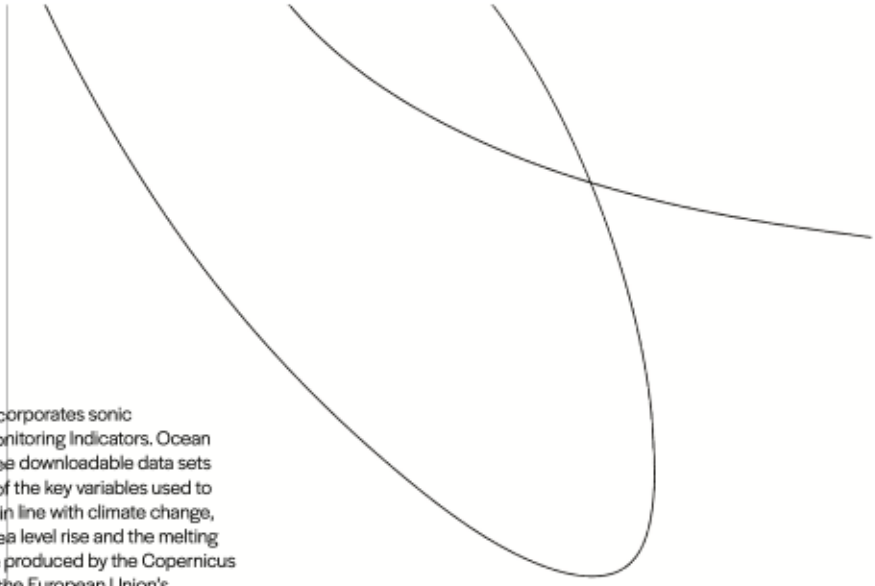
MELTING, SHIFTING, LIQUID WORLD

Melting, Shifting Liquid World is a new immersive, site-specific piece written by composer Hollie Harding for electric viola soloist Nic Pendlebury and the Trinity Laban String Ensemble, for performance on the iconic Great Map at the National Maritime Museum. The work explores themes of climate change and ocean pollution and includes a pre-recorded electroacoustic part that is delivered to the audience over bone-conduction, open-ear headphones.

The piece explores the idea of music as an environment that the audience is surrounded by and can move around and within. There are three layers of sound experienced within the piece, the first emerges from the live acoustic string ensemble who are spread-out across the Great Map, the second from the quadraphonic speaker system which amplifies the solo electric viola and audio effects, and the third from bone-conduction open-ear headsets worn by the audience. In this environment sound can therefore happen very close to, far from, and all around the listener. The piece explores the movement of sound around and across these different layers, and around the static or moving audience.

Melting, Shifting, Liquid World also draws upon three different sound worlds that move and shift between the three layers of sound. The first is pitchless sound which encompasses field recordings of Arctic Sea Ice (provided by renowned field recordist Chris Watson), white noise, water sounds, vocal sibilant and fricative consonant sounds and noise-based sounds from the live strings. This includes the performers generating white noise, scraping and snapping at their instruments, and playing with extended techniques that encourage overtones and distortion. This sound world is evocative of the volatile and changeable natural world, and draws upon sounds of, and from, the ocean.

Composer:
Hollie Harding
Performers:
Electric Viola Soloist / Director
Nic Pendlebury with Trinity Laban String Ensemble
Sound Design:
Hollie Harding and Ben Corrigan



The second sound world incorporates sonic interpretations of Ocean Monitoring Indicators. Ocean Monitoring Indicators are free downloadable data sets covering the past 25 years of the key variables used to monitor the oceanic trends in line with climate change, including ocean warming, sea level rise and the melting of sea ice. The data sets are produced by the Copernicus Marine Service as a part of the European Union's Copernicus Programme, the world's single largest Earth Observation Programme. The data set that I selected covers the rise in global ocean heat between 1993 and 2016, and includes the mean heat measurements along with the five different sets of measurements that this mean heat is derived from.

I interpreted this sonically, by scaling the heat measurements into audible frequencies (Hertz), using the data to determine the tuning and pitch inter-relationship of six sine waves, one for each set of measurements. As the measurements sit around similar points and all reflect a rise in temperature, I knew that the sonic outcome from this process would be one of sustained sine tones with interweaving changes of pitch and an overall upward pitch trajectory from the start to finish. I decided, through experimentation, to restrict the pitch range of the sonic interpretation to specific intervals. I found that the reduced scale of the pitch interpretation made the rising trajectory of the pitch of the sine tones much more gradual and less obvious to the listener, reflecting the nature of the slow cumulative changes to the temperature of the ocean over time. The reduced scale of interpretation also created smaller, microtonal differences between the sine tones that in turn generated beating patterns (vibrato) which oscillate at different rates over time, and through manipulation, between the left and right channels. When delivered over the headsets the beating manifests as an aural and a physical sensation for the listener, as the bone-conduction headsets function by delivering micro-vibrations through the cheek bones to the cochlear, bypassing the eardrum. This physical sensation of sound became a new tool that I could utilise within the piece, using it to allow the listener to experience and feel the localisation of sound to the headsets at certain points in the work, and at others working to obscure the origin of sounds for the audience between the different layers.

The final sound world in the piece is that of melody and harmony, which is primarily delivered by the acoustic strings and electric viola, but also emerges in the electroacoustic parts from pre-recorded processed fog-horns, and from in room machinery. The harmony of the piece tends to centre on changing fixed drones or pivot notes and the rate of harmonic change remains relatively slow. The staticity of harmony aims to lay into relief the volatile and evolving timbral and spatial textures, which change at a much faster pace. The electric viola has two main melodic solo 'refrain' sections at the start and end of the work, which lead into cadenza like passages for the soloist, involving rapid string crossings and bow motion, in combination with fragile left hand harmonics - generating volatile timbres with overtones and distortion. These two sections bookend a more turbulent, heavy and gestural middle section to the piece that builds into an expansive electracoustic solo. The concluding electric viola 'cadenza' passage features a new harmonic and melodic accompaniment from the ensemble, which slows into a looped chorale that is eventually obliterated by white noise as the headsets transmit a reading of 'Still Life with Sea Pinks and High Tide' (The Silvering, Bloodaxe Books, 2016), spoken into the ears of the audience by the poet herself, Maura Dooley.

This event is part of the Trinity Laban Parallax Series which showcases new research work by Trinity Laban students and staff.



Hollie Harding
Composer

Hollie is a composer, researcher and curator of contemporary music events in the UK and overseas. She is currently working towards a fully funded PhD in Composition at Trinity Laban, as the first recipient of the Trinity Laban RDP Scholarship. **Melting, Shifting, Liquid World** is the concluding work of her of PhD thesis exploring the arena, ensemble and action spaces of music, through composition.

Hollie has a longstanding connection with Norway and is grateful to have twice received funding from the Norwegian Arts Council to work with Alwynne Pritchard and Sjøforsvarets Musikkorps (Norwegian Navy Band). Other ensembles she has worked with include the London Philharmonic Orchestra, CHROMA ensemble, Castallian String Quartet, Ensemble Via Nova (Weimar) and DeciBells (Basel). She was 2017 Composer in Residence with CoMA and subsequently led workshops on their Summer School in Orkney, and at their 2018 Festival of Contemporary Music for All. She was also one of four selected composers on the Cohan Collective 2018 residency working with choreographers, dancers and members of Bournemouth Symphony Orchestra at Pavilion Dance South West. She is Artistic Advisor and Trustee for Borough New Music and has been Director of Production for the London Ear Festival since it began in 2013.

hollieharding.com



Nic Pendlebury
Director / Electric Viola

Nic is a versatile musician who throughout his career has remained at the forefront of contemporary performance and musical education. He is probably best known as the founder and violist of the Smith Quartet. Now in their thirtieth year they are regarded as one of the world's leading exponents of contemporary music and have had over 250 works written for them by many of the world's leading composers. Nic's aspiration to create new work has most recently been witnessed in his commissioning of new work for electric viola, an instrument he believes has tremendous artistic and compositional potential, the creative scope of which has perhaps not yet been fully explored. A relatively new direction, Nic has already collaborated with and commissioned pieces from Steve Reich, Colin Riley, Dominic Murcott, Stephen Montague, John Ashton Thomas, John Marc Gowans and Hollie Harding whose work **Melting, Shifting, Liquid World** for electric viola, string ensemble and pre-recorded material you will hear this evening. His first installation Spem in Alium a realisation of Tallis' masterpiece arranged for 40 electric violas and diffused through a circle of 40 loudspeakers, was premiered at last year's Sound Festival in Aberdeen.

Nic is also Head of the String Department at Trinity Laban Conservatoire of Music and Dance in London and leads one of the most vibrant string departments in Europe. As well as his administrative, educational and managerial responsibilities he conducts several of the college orchestras including the Trinity Laban String Ensemble, with whom he has toured throughout Europe collaborating with many international soloists. In recognition of his creative work, research in the field of new music and as a leading educationalist Nic was conferred with the title of Professor in 2018.

Costume and Set Design:
Rosie Whiting, Florence Meredith, Estera Parker and Sophie Donaldson
Costume and Set Realisation:
Rosie Whiting, Florence Meredith and Estera Parker



There are five massive concentrations of plastic debris in the oceans around the world. These huge collections of plastic cover large swathes of the ocean - they are commonly called 'Garbage Patches'. The 'Great Pacific Garbage Patch' is located in the North Pacific Gyre (system of circulating ocean currents) off the coast of California, and is the largest ocean garbage patch in the world. This floating mass of plastic is twice the size of Texas, with plastic pieces outnumbering sea life six to one.

The costume and set design for **Melting, Shifting, Liquid World** has been created through collaboration between Rosie Whiting, Florence Meredith, Estera Parker and Sophie Donaldson.

Researching the dramatic effects of human plastic consumption on the ocean and its inhabitants, we explored the following concepts:

- **the majestic beauty of the ocean and how plastic affects this**
- **the rising of temperatures, sea levels and growth of garbage patches**
- **how much of our effect on the natural world is hidden and seen**
- **human emotion surrounding climate change**
- **human innovation in tackling climate change**

Our main focus was to realise our design without further contributing to climate change. To achieve this we have worked with reused and recycled materials. We have used:

- **30 second hand boilersuits**
- **114 used plastic bags**
- **3 used fishing nets**
- **6 mattress covers**
- **4 sacks of ripped plastic garment bags**
- **50 bottle caps**
- **1 roll of cellophane**
- **28 fruit nets**
- **various plastic bottles, fabric scraps and plastic packaging**

Through collaborative workshops we explored different processes through which to transform and create new textiles and forms with these materials. We hope that the audience are given a sense of both the beauty and the loss of the changing natural world, and are inspired to reflect on their own relationship with the ocean.

We would like to give thanks to Chris Carey's Collections and Stig Williams for their textile recycling services, Hannah Pegram, Kate Page at Mountview, Uncle Ned's Beds for donations of clear plastic and special thanks to fisherman David Dunn for his donations.

@rosie_whiting
@florencemeredithdesign
@sophieruthdonaldson





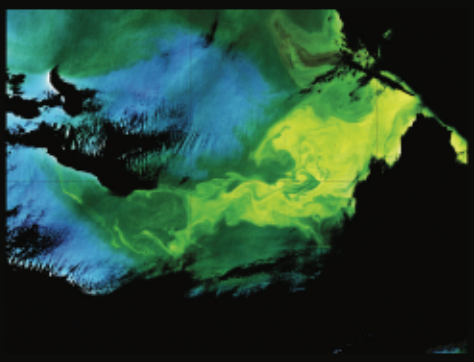


SCIENCE, SATELLITES, SOUND, AND THE SEA.

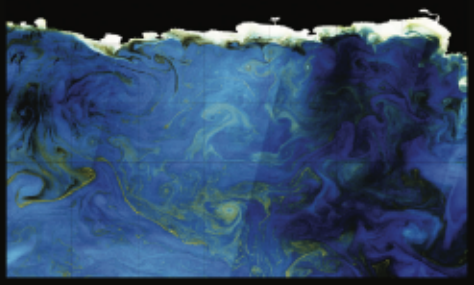
Dr Hayley Evers-King,
Plymouth Marine Laboratory

The Earth is an immensely complex system. It is dynamic; constantly changing in space and time on scales from microns to miles, and seconds to the entirety of geological time. Changes on Earth occur naturally, but also through the impacts that we, as a society, can have on the planet. Like the Earth itself, climate change is a complex topic to understand. Key to this understanding, is the collection of data that can accurately capture the complexity of the Earth system. However, even with all the scientists in the world, it would be impossible to measure and monitor, in person, all the parts of the Earth system that play a role in climate; the oceans, the land, the ice, the mountains, the atmosphere, even life itself. To get the full picture, one tool in the scientist's toolbox is the satellite. From space, data can be collected much more rapidly, in much more diverse forms, and in far greater quantities.

Observing the ocean is particularly important in terms of understanding climate change and its impacts. The ocean covers the majority of the Earth's surface, and is a vast storage reservoir for heat and greenhouse gases. It is home to the microscopic organisms that produce half of the oxygen in the air we breathe – the phytoplankton. Oceans provide a significant food source for over 3 billion people and livelihoods for 8% of the global population. Over 800 million people could be at risk from the effects of climate change induced sea level rise in the coming decades. Plastic has been found ubiquitously throughout the oceans and in nearly all types of marine life that have been surveyed. These are big challenges, which require big approaches to understand and address them.
The European Commission Copernicus programme is the largest provider of satellite based Earth Observation data, providing over 20 terabytes of data every single day (that's the equivalent of watching the entire of F.R.I.E.N.D.S 720 times, every day). The data is freely available to all – scientists, businesses, and every citizen of the world. The programme consists of 7 Sentinel satellites (so far, there are many more planned) – they orbit overhead at over 27000 km/hour. This allows them to collect data regularly covering the surface of the Earth, collecting different measurements of all parts of the Earth System. The global oceans are sampled by Sentinel-3, a satellite with 3 sets of sensors to measure the colour of the ocean, its temperature, and its height.



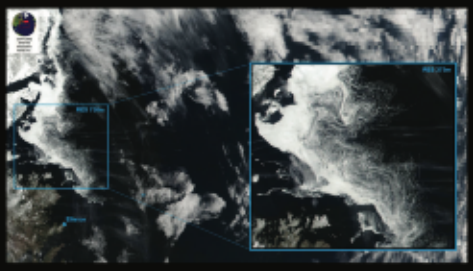
Enhanced true colour pseudo-nitzschia phytoplankton bloom, South California coast *(Copernicus, EUMETSAT, and PML)*



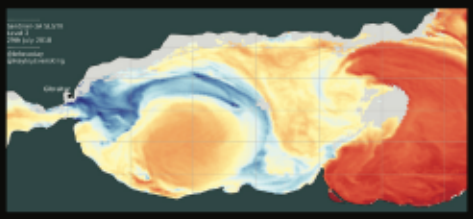
Enhanced true colour Noctiluca scintillans "sea sparkle" bloom in the north Arabian Sea *(Copernicus, EUMETSAT, and PML)*

Images produced from the satellite data are indeed beautiful, but a static image cannot convey the scale and complexity that these datasets capture in time and space. Nor can it capture the feelings of awe, fear, and inspiration that come from being able to understand something that is so much vaster than yourself. Communicating this is something that is still a challenge for those of us who work with the data, and are more used to statistical analyses and graphs, but it is something that music can really help with. Ocean processes have patterns that can find analogy in the patterns in music. Some have a cyclic element, – the annual changes in seasons that show in the growth of phytoplankton and the greenness of the sea, the interannual oscillations from climate phenomena like El Nino that show in the temperature and height of the sea surface. These are the baselines of the ocean. Then there are dramatic events that rise and fall rapidly – the formation of a harmful algal bloom, the collapse of an ice sheet, or the sudden impact of a storm surge. Like the crash of symbols, or a change in tempo, these events are dramatic. Then there are trends that build more gradually over time, like the warming of the ocean that features in the composition Hollie has created. For me, the soundscape Hollie has produced evokes the sheer scale of both the ocean and the problems it faces. It reminds me of time spent diving, when you can feel like you're totally enveloped in something, but you still get a feeling of great size of the space you're in. The slow, almost imperceptible rise of the music associated with the temperature brings to mind the feeling of knowing the likely future associated with climate change, but feeling powerless to stop it. The other aspect of Hollie's piece, brought in by the string ensemble, is reminiscent of the volatile and dynamic nature of the oceans on much shorter timescales. In this way, a musical composition is able to communicate the complexity of ocean processes that can be observed in the wealth of satellite data we now gather.

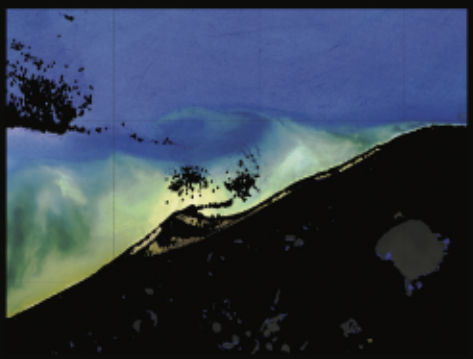
Working with Hollie has encouraged me to think about my own work in new ways, and I hope what she has created will encourage all those who attend this event, to gain a new perspective on our oceans, both from space, and through sound.



Detaching ice patterns thinning and disappearing in the open ocean, off the coast of Newfoundland, Canada *(NOAA/NASA/DoD/EUMETSAT)*



Alboran Gyre circulation observed from sea surface temperature, Mediterranean Sea (*Copernicus, EUMETSAT, and PML*)



Enhanced true colour Fibrocapsa japonica blooms in the inshore bays of the Florida, Atlantic coast (Copernicus, EUMETSAT, and PML)

Violin 1
Anja Jamsek
Ben Richardson
Stefan Calleja
Amelie Von Wurttemberg
Iryna Glyebova
Hajnal Miklossy

Violin 2
Olivia Holland
Ana Stahlmann
Faye Cullen
Wilmien van Rensburg
Natasha Kenealy

Viola
Javier Morillas Arques
Peter Fenech
Harry Mak
Louise Tsui

Cello
Thibault Blanchard
Jenny Sturt
Clare Durgan
Eliane Soedirman

Double Bass
Jess Price
Enzo dell'Oglio

Solo Electic Viola and Director
Nic Pendlebury

Trinity Laban String Ensemble

Trinity Laban String Ensemble is the String Department's flagship group. Formed from senior students it has given many performances not only in prestigious London venues such as the Royal Festival Hall, Queen Elizabeth Hall and St. John's Smith Square, but also on the international circuit, including performances at Slovenia's Ljubljana Festival, Italy's Emilia Romagna Festival and at the Dartington International Summer School. The group have performed with many international artists including oboist Nick Daniel, clarinettists Dimitri Ashkenazy and Darko Brlek, pianists Deniz Gelenbe and William Howard, violist Rivka Golani, organist David Titterington, saxophonist Gerard McChrystal, actor Edward Fox and jazz musician Julian Arguelles, with whom they recorded the critically acclaimed album 'As Above So Below'.

The group has an eclectic range of repertoire from standards of the genre such as the Tchaikovsky and Dvořák Serenades to the works of living composers such as John Adams, Steve Reich and Eleanor Kats Chernin. They have also given world premieres by prominent composers such as Paval Novak, Graham Fitkin, Benjamin Ellin and David Mathews and in 2008 released on the Nonclassical label the highly acclaimed premiere recording of Cortical Songs by Nick Ryan and Radiohead's violinist John Matthias. In Autumn 2013, the group premiered a new harp concerto by Joseph Phibbs together with harpist David Watkins.

The ensemble has also collaborated with cross-genre artists including Barry Adamson and Nick Cave, John Cale (Velvet Underground) and jazz pianist Uri Caine in a performance of Brahms' Handel Variations. Experienced with working in contemporary dance, the ensemble has collaborated with various choreographers including Sonia Rafferty and Henri Oguike and Lizzie Kew Ross.

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Jennifer Hamilton Voice;
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Sound Technicians
Kit Venables
Ieva Vaiti

Marketing
Fiona Moorhead
Sophie Harvey
Martha Orgles

THRIFT GROWS TENACIOUS
AT THE TIDE'S REACH.
WHAT IS THAT REACH WHEN
THE WATER IS RISING,
RISING?

OUR MELTING, SHIFTING,
LIQUID WORLD WON'T WAIT
FOR MANIFESTO OR
MANDATE, EACH
WARNING A RECKONING.

ICE IN OUR GIN OR VODKA
CHIRRUPS AND SQUEAKS
DISSOLVING IN THE HOT,
STILL AIR OF TALKING,
TALKING.

Still Life with Sea Pinks and High Tide by Maura Dooley

(The Silvering, Bloodaxe Books, 2016)

Acknowledgements

I would like to give a huge and heartfelt thanks to those who have supported this project, and to everyone who has generously given their time, resources and expertise in order to make it happen. There are a few people who I feel must be thanked specifically for their contributions they are, in no particular order:

Electric Viola Soloist Nic Pendlebury and all of the performers from Trinity Laban String Ensemble, who have been a delight to work with.

Aftershokz headphone company, who generously provided 100 brand new pairs of headsets for the project.

Maura Dooley, for kindly allowing the use of her poem Still Life with Sea Pinks and High Tide (The Silvering, Bloodaxe Books, 2016), and for her wonderful reading of the text which concludes the piece.

Chris Watson, for his contribution of three brilliant field recordings of Arctic Sea Ice.

Dr. Hayley Evers-King, for her wonderful words for the programme book, and for the illuminating discussions about turning data into sound.

Sound Designer Ben Corrigan, for sharing his expertise in the making and mastering of the electroacoustic parts.

The costume design team: Florence Meredith, Rosie Whiting, Estera Parker and Sophie Donaldson for their creativity, hard work, beautiful and thoughtful design.

Trinity Laban Performance Department, in particular Marianne Chapman, Sonali Banerjee and Alex Regan - it couldn't have happened without you!

Special thanks to Hans Biørn-Lian at the National Maritime museum for his guidance, patience and support from the very beginning, and to all other staff at the National Maritime Museum for their contributions.

Fiona Moorhead and Simon Wall for the beautiful video trailer.

David McCormick and his team for capturing visual documentation of the performance and to Chris Tanton for audio recording.

Louis Buck for the wonderful design work for the programme book and leaflet.

Sound Technicians Ieva Vaiti and Mikey Parsons.

Trinity Laban and Royal Museums Greenwich marketing teams.

Trinity Laban Research Department for supporting me through my studies - I couldn't imagine a better institution in which to do a PhD.

Dr. Dominic Murcott, Professor Sam Hayden and Alwynne Pritchard for their invaluable advice and guidance.

Finally thanks to my friends and family for their interest and support in this project - in particular to my partner and best friend Phil Stewart for his patience, encouragement and understanding.

Hollie Harding is supported by PRS Foundation's Women Make Music

This project is generously supported by:

Supported using public funding by ARTS COUNCIL ENGLAND

Women Make Music PRS Foundation

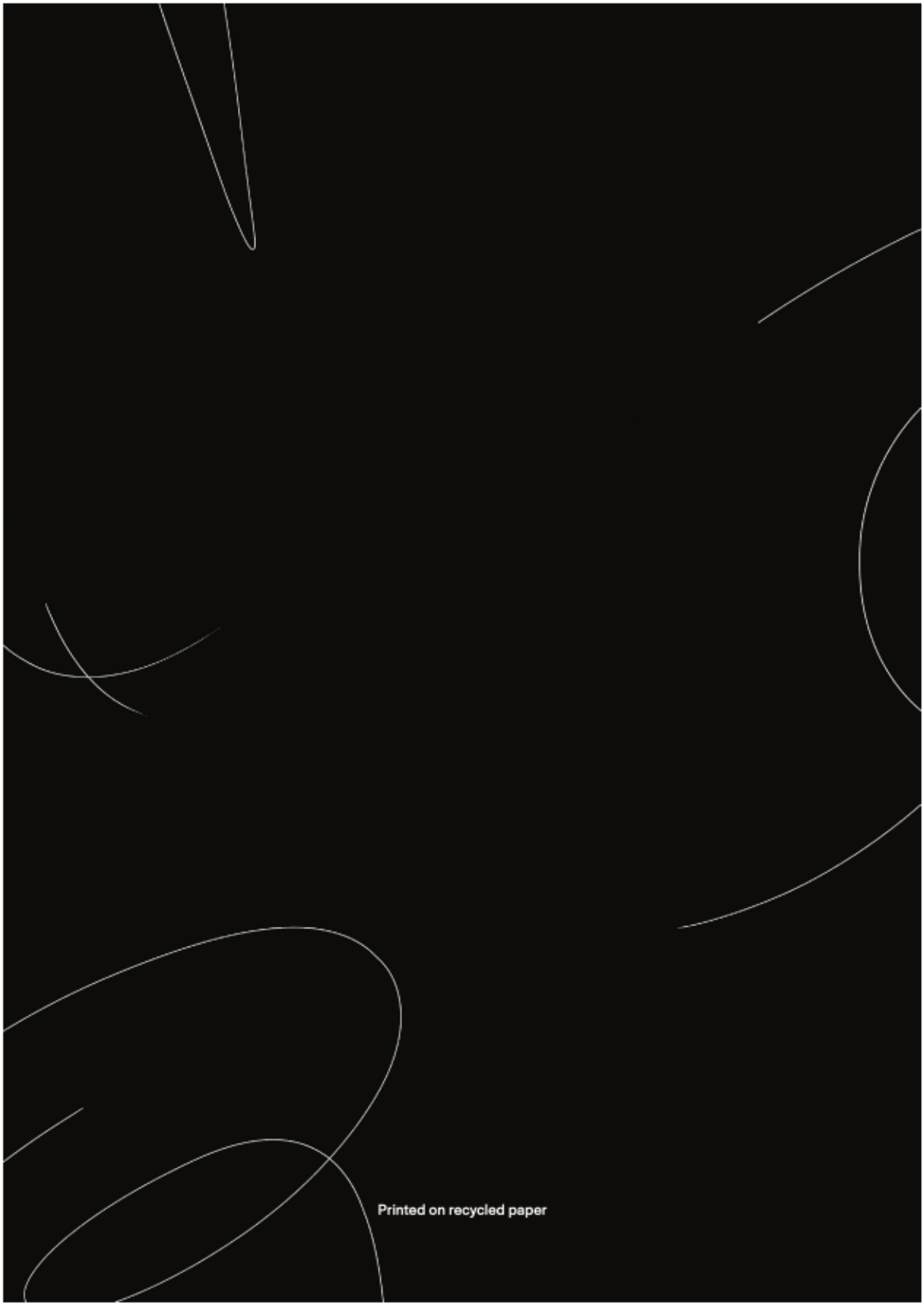
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TRINITY LABAN CONSERVATOIRE OF MUSIC & DANCE

HINRICHSEN FOUNDATION

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