

Guidelines for Composing Locative Soundtracks

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Abstract

This thesis investigates the composition of original adaptive musical soundtracks for locative walking activities such as cultural visiting, mobile games and urban, and nature walks; those semi-formal orchestrated walking experiences. This investigation views the ‘soundtrack’ – similarly to those typically found in ‘display’ media experiences such as films and computer games – as an accompaniment rather than the principal feature of the experience. Thus its role is to support and enhance the walking ‘narrative’. In order to best achieve this the soundtrack needs to be heard as congruent and embedded into the activity.

This thesis is oriented towards the field of Human Computer Interaction (HCI) and also at composers of such soundtracks; reflecting the thesis’s intention to develop guidelines for locative soundtrack composition that draws upon detailed mappings between musical structure and spatial structure that drives the creation and experience of both.

An initial study explored how a group of participants interpreted and responded to different musical features which adapted to their walking routes. This study revealed that participants formed a set of connections between the physical space and the musical structures. These findings were then used to motivate an in-the-field design, composition and deployment of a large-scale adaptive soundtrack for a public cultural visiting experience, which was subsequently experienced by a group of visitors. This study revealed that the soundtrack was considered congruent with the activity and was deeply engaging, quite distinct from a typical visit to this site. These research activities are reflected upon and discussed to distil a framework of guidelines for composing locative soundtracks that is generalizable to other settings and activities.

Published Works

The following is list of peer-reviewed publications, which have drawn directly from this thesis work. Section 1.5, *Thesis structure* outlines how these publications relate to different elements of this thesis.

Hazzard, A., Benford, S. and Burnett G. "Walk This Way: Musically Guided Walking Experiences." In *Proceedings of the 32nd Annual ACM Conference on Human Factors in Computing Systems*, 605–14. ACM, 2014. (Presented at CHI 2014, Toronto, Canada)

Hazzard, A., Benford, S. and Burnett G. "You'll Never Walk Alone: Designing a Location-Based Soundtrack." In *Proceedings of the 2014 Conference on New Interfaces for Musical Expression*, 4, 2014. (Short paper with poster presentation at NIME 2014, London, United Kingdom)

Hazzard, A., Benford, S. and Burnett G. "Sculpting a Mobile Musical Soundtrack." In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. ACM, 2015. (Presented at CHI 2015, Seoul, republic of Korea)

Hazzard, A., Benford, S., Chamberlain, A. and Greenhalgh, C. "Considering Musical Form in Location-Based Soundtracks" In *Proceedings of the 2015 Conference on New Interfaces for Musical Expression*, 2015. (Short paper with poster presentation at NIME 2015, Baton Rouge, Louisiana, USA)

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A PhD is generally considered an individual pursuit, a personal challenge that one undertakes and battles with alone. I am delighted to say that this was the opposite of my experience. I had the good fortune to be exquisitely supported by a number of people to whom I now owe a lifetime's worth of gratitude.

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Chapter 1 - Introduction

1.1 Overview

Musical soundtracks are important features of many of our everyday formal and informal experiences and we have historically engaged with them on many different levels: as entertainment, as accompaniment, as a driver of activity and regulator of mood, and as a signifier of identity, culture and faith. The rapid development of digital technologies over the past 20 years – in particular with mobile devices, networks, sensors and positioning systems – has subsequently seen music ‘seeping’ out of our homes, cars, workplaces, cinemas, concert halls and nightclubs into those places in-between, those mobile and locative settings. Music now accompanies us everywhere as we walk, travel, wait, shop and explore – it is all-pervasive. It has been noted that the prevalent function of music is no longer a ‘commodity’, but a ‘resource’ (Hargreaves and North 1999). Furthermore, artists and designers alike have seized upon mobile and ubiquitous computing to explore new opportunities, motivations and settings to create and present musical art and experiences where location serves as both a palette for creation and a stage for presentation (Tanaka 2008). This endeavour, often termed *Locative Media*, has seen a broad range of practice and technical solutions to deliver sound and music experiences that are either mobile, or location-based.

This thesis engages with the field of locative media as it is concerned with methods of composing adaptive locative musical experiences. The research engagements charted here focus on the composition and evaluation of adaptive soundtracks to accompany walking experiences, and as such much of this thesis is presented from the perspective of the composer, who is also the author. The author comes from a background as a musician and composer, who subsequently became interested in location-based media practice and consequently pursued the opportunity to undertake an extensive period of work that combined the process of musical composition within Human Computer Interaction (HCI).

This thesis was supported by the Horizon Centre for Doctoral Training, who has a mandate to engage with new practices and investigations into the digital economy in the broadest terms, i.e., how ubiquitous computing can shape and integrate into all facets of our everyday lives. In light of this mandate an interdisciplinary approach is necessitated to best understand the full implications of a ubiquitous technologies in the hands of a user.

The field of Human Computer Interaction (HCI) traditionally had a focus on ‘engineering usability’ – a scope that has broadened in tandem with the development and deployment of new technologies – and is often engaged with interdisciplinary investigation. The HCI community is largely made up of researchers and academics from a wide range of disciplines such as computer science, engineering, psychology and the arts, and therefore research is often approached via theories and methodologies drawn from these respective fields (Kaptelinin 1996). Consequently, HCI research adopts a disparate range of methods and approaches. In the case of this thesis, the author who is placed within a computer science department has incorporated a number of disciplines into the following investigation, which is primarily rooted in HCI; they are music theory, psychology and sociology. Psychology and sociology are commonly trodden paths with HCI, but the integration of music theory is less so. While this thesis from, an academic perspective, is firmly aimed at the HCI audience, from a practical perspective it also speaks to experienced composers of music. Thus the author is aware that the language surrounding music composition and music theory presented in this work may not be familiar to all within HCI, nonetheless, an attempt has been made to explain this language in straightforward terms. To support this, footnotes are utilized to add further detail and explanation, but also the scope of this thesis cannot seek to cover all contingencies, thus it is anticipated that the reader may need to self-seek further clarification.

1.2 Motivation

The motivation for this thesis came as a direct response to the current state of research within mobile and locative musical experiences. In surveying the literature (see Chapter 2) the author made some key observations. First, a significant portion of the prior research has placed a focus on the development and study of novel, bespoke technical solutions that exploit a range of mobile, networked, sensor technologies as a creative musical tool. While the work is interesting and important in understating how new technologies can be appropriated in creative settings, often little emphasis was placed on the sound or music itself or the resultant user experience. Furthermore, looking back at this body of academic research over the past 15-20 years, there appears to be little in terms of technology transfer, where these unique tools have received any mainstream, commercial deployment, i.e., usage beyond their initial development. Arguably, an exception to this is found in HP Labs Mediascape (HP Labs 2015; Reid, Cater, et al. 2005), which although it is no longer in production, the development team have gone on to create *AppFurnace*, a similar

mobile experience authoring platform (Calvium 2014), which is the tool used in this thesis.

A second observation of prior work concluded that the majority of locative music research has positioned the music - or sound - as the principal modality of the experience. While many propose that their locative musical experiences are accompaniments for re-connecting listeners with spatial environments the majority of this work is nonetheless targeted towards the auditory channel and the notion of locative sound art. The author noted that many of our everyday musical experiences are soundtracks accompaniments, such as those found in theatrical performances, formal ceremonies, films, television programmes and computer games. In most of these settings, the role of the soundtrack is to accompany the activity or narrative, where the music is used to shape, drive, inform but ultimately support these experiences. There are some examples of audio guides for formal location-based activities that use adaptive musical accompaniments, but typically these are in combination with other sound sources such as narration and non-musical sound design. There are very few examples that just use music. There is also a body of work that engages with music as a means to drive facets of human behaviour in mobile and locative settings, for instance mobile 'apps' to accompany exercise routines such as running, jogging or cycling. Typically, they focus on contextual information as a method for music recommendation and retrieval (e.g. the 'smart' playlist), and the majority use existing playlists of commercial music. Non-speech audio (e.g., music) has been widely explored as an alternative to speech based spatial navigation systems and their musical approaches can be divided into two categories: those which use auditory spatialization techniques to mirror spatial movement; and those which develop a vocabulary of musical sounds to communicate instructions or to represent places, or objects. However, these are working with a limited musical palette at a relatively low level of detail (e.g., spatializing sound).

The author was also interested in the mechanics of composition but identified little prior work with an emphasis on the application of music in its traditional western traditional form (i.e., melody, harmony, rhythm, dynamic, metre, timbre). The phrase 'application of music' has two meanings here. The first relates to the musical style many of these locative experiences use. Typically, locative music research activities have tended to veer towards electro-acoustic music, via a focus on generative systems, sonification and the live processing of ambient sound. Some of this stylistic slant was as a direct result of the technical

infrastructure used to capture, generate or control the music. Referring again to our everyday musical experiences (in the western world), they are typically saturated by styles that use functional harmony (tonal music) as found in our popular music and soundtrack music. The author noted this as a gap in the research and wanted to explore the composition of tonal music in locative settings. Following on from this previous point – the second connotation of ‘application of music’ – noted an absence of prior research that explored and utilized the core features of traditional western tonal music’s (i.e., melody, harmony, rhythm, dynamic, metre, timbre) as parameters that could be mapped to spatial experiences.

The observations listed above - when coupled together - motivated the line of enquiry described throughout this thesis: a focus on the relationship between *musical structure* and *spatial experience*. By *musical structure* the author refers to the component features of western tonal music, such as melody, harmony, rhythm, timbre and dynamics. *Spatial experience* refers to orchestrated walking experiences with an exploratory purpose that includes engagement or interaction with points of interest along the way, which might benefit from an adaptive musical accompaniment in a similar manner to a computer game soundtrack. These experiences could be a visit to cultural heritage site, an urban tour or a mobile game. This thesis is not concerned with the development of new technologies to create or present musical soundtracks, but evidently it does engage with technical solutions for authoring media and the control of mobile media functionality. While these do not represent principal research areas, their function and integration into the workflow of producing and delivering locative soundtracks are still important features and thus are factored into this research.

1.3 Research questions

Leading on from the motivation for this thesis work, one overarching principal research question was defined, along with three sub-research questions. These are now presented and discussed.

Principal research question:

Can a relationship between musical structure and spatial experience be formed, which informs and guides the composition of effective soundtracks that respond to and drive the spatial experience?

By ‘musical structure’ the author refers to the established components of music as referenced through the western tonal tradition, i.e., melody, harmony, rhythm, texture, dynamics and timbre. By ‘spatial experience’ the author takes to a holistic view of the notion of experience. According to Wright et al. (2008) *“Etymologically, ‘experience’ stands for an orientation toward life as lived and felt in all its particulars”*. The concept of experience within HCI has been a developing notion. Traditionally, HCI research primarily focused on systems design and ‘usability’ was the term of choice, utilized to describe the effectiveness of system (Norman 2013; McCarthy and Wright 2004; Hassenzahl, Law, and Hvannberg 2006; Law et al. 2009). As technological developments transformed the way that humans engage and interact with computers the notion of the ‘user experience’ and ‘experience-centred design’ have come to the fore (Wright, Blythe, and McCarthy 2006; Law et al. 2009; Law et al. 2008). According to Law et al. (2008) although the term ‘user experience’ was adopted swiftly and widely accepted, and the notion of a ‘good user experience’ was viewed as advantageous within HCI design, there was a lack of clarity as to what it actually meant. This resulted in a call for an overarching definition (Hassenzahl, Law, and Hvannberg 2006; Law et al. 2008; Law et al. 2009). Benford et al., states that ‘user experience’ embraces a range of facets above and beyond usability, which include *“affect, sensation, pleasure, aesthetics and fun”* (2009, 1). Whereas Wright and McCarthy’s extensive work on the nature of the ‘user experience’ proposes that experience, or ‘felt experience’ can be understood as a continuous ‘unity’ of four threads (McCarthy and Wright 2004; Wright, Blythe, and McCarthy 2006; Wright, Wallace, and McCarthy 2008):

- The Sensual Thread: concerns the physicality of the experience, how a user’s sensory interaction shapes the experience.
- The Emotional Thread: describes a sense making process based on the user’s principles, objectives and aspirations.
- The Compositional Thread: describes how the individual fragments of the experience are related and interconnected.
- The Spatio-Temporal Thread: how the current experience is associates or relates to past and future experiences.

Collectively, these threads describe an experience as an all-encompassing event, one that cannot be detached from any attribute of life. It is evident to see how these four threads can be attuned to describe both the process of listening to music and the exploration of physical space (e.g., walking). In order to create effective soundtracks for locative experiences, an understanding of the user

experience is fundamental to the investigation. Therefore, a holistic perspective of ‘experience’ underlines the methodological approach of this thesis.

Subsidiary research questions:

1. *What are the implications for a framework of guidelines for composing locative soundtracks as mediated through the chosen technology?*

The compositional guidelines charted in Chapter 8 (Conclusion) of this thesis resulted from a series of practical research engagements, which used a commercial authoring platform and accompanying mobile application, *AppFurnace*¹ by Calvium. The adaptive functionality of this authoring platform uses GPS positioning technology, which in turn presents a set of unique challenges and limitations. The integration of technological systems into a user experience sometimes results in what have been referred to ‘seams’ in the experience, where constituent parts of the system ‘rub up against each other’, and these need to be accounted for (Weiser 1994; Chalmers and MacColl 2003; Chalmers and Galani 2004; Chalmers et al. 2005). Consequently, the resultant compositional guidelines have been shaped – to some degree – by the inherent functionality of this technical infrastructure. Thus this research question seeks to chart and rationalise for this influence.

2. *What are the implications of the physical environment on the development of guidelines for composing locative soundtrack experiences?*

Any research activity that is either mobile based or site specific (location-based) needs to consider the impactions of the physical environment. As stated by locative experience artist Teri Rueb, “*I draw upon landscape as a first framework for understanding mobile experience*” (Rueb 2014b) and this is certainly the case with the work detailed here. As set out, the aim was to understand methods of driving the composition of adaptive musical accompaniments for physical environments; evidently, the attributes of the physical environment will feature prominently. To this end it is important to understand the context of the locative experiences. Schmidt et al. (1999) note that context is vital in understanding peoples interactions with computers, and when these interactions are placed within mobile or locative settings a wider understanding of context is necessitated. The

¹ <http://appfurnace.com>

² <http://www.steinberg.net/en/products/cubase/start.html>

³ <https://www.steinberg.net/en/company/technologies/>

⁴ MP3 – a digital audio format - Motion Picture Export Group-1 Audio Layer 3

model proposes the *physical environment* and *human factors* as the core facets that characterise mobile context. The *physical environment* encompasses the factors of *location, infrastructure* and *conditions*. Whereas, *human factors*, considers the *task, user* and the *social environment*. This thesis draws on Schmidt et al.'s (1999) model for context-aware mobile systems to sensitise this research question.

3. *What would be the experiential bearing on the user experience of such soundtracks that adapt and respond to their exploration of a physical space?*

Defining guidelines for intelligent, adaptive soundtracks for locative experiences does not intrinsically address the issue of their value. Their value is not to be assessed by the composer, but rather the listener, the person who experiences the soundtrack in its intended setting. Thus, the promotion of compositional guidelines for composers also requires an accompanying understanding of how they may shape the user experience, for a number of rationale: first, to feedback into the mechanisms of the compositional guidelines; second, a composer working in locative experiences is also functioning as a designer of such experiences, and thus needs to consider more than just matters of music in the absolute sense; third, to contribute to the existing body of knowledge as to how music can mediate human experience.

1.4 Methodology

Having set out the intentions of this thesis, we now turn to consider the methods employed for their realisation.

1.4.1 Overview

This thesis uses a mixed methods approach, combining a quasi-experiential study, practice led research and real-world naturalistic observation. The combination of these methods has enabled the author to navigate the complex task of understanding the 'musical soundtrack' from both the composer's and user / listeners perspectives. This endeavour is made complex, in part, as the author is also the composer, thus they study their own compositional practice. Thus subjectivity and subsequent reflexivity is a notable characteristic of this thesis's methodology, which offers significant insight to both the high-level approach, and the finer detail of granularity. The combination of methods reflects both the interdisciplinary nature of this thesis and the development of compositional guidelines whose advancement began with a tightly constrained focused observation through to a real-world visitor engagement.

1.4.2 Approaches

The approaches used in this thesis concern the charting of the user experience, a common HCI enterprise and ‘research through design’. The earlier discussion on the principal research question noted the development and importance of charting the ‘user experience’ in HCI research (McCarthy and Wright 2004; Benford et al. 2009; Law et al. 2008; Hassenzahl, Law, and Hvannberg 2006). ‘Research through design’ (RtD) concerns the artist or practitioner generating and revealing research through the design process, an approach that has grown out of the field of art and design (Frayling 1993). Frayling notes three types of RtD, *materials research*, *development work* and *action research*. The latter type – *action research* – is relevant here, “where a research diaries tells, in a step by step way, of a practical experiment in the studios and the resulting report aims to contextualise it” (Frayling 1993, 5). Frayling notes that the design object itself is not enough to communicate the research, as it is too ‘ephemeral’, rather some form of structured dissemination is necessitated (1993). ‘Research through design’ is often criticised for being a retrospective process, that design often begins without the intention for a research engagement, and consequently there is a need for an established methodological process and subsequent examples and theories that can be drawn on to drive forward best practice (Zimmerman, Stolterman, and Forlizzi 2010). Nonetheless they can stimulate ‘theory for design’ such as guidelines and frameworks, although Rosner (Rosner 2015) is critical of these, suggesting that they are often too attached to the work itself, thus difficult to generalise for other settings. ‘Research through Design’ has been embraced by HCI, leading to a number of theoretical approaches such as ‘design from within’ investigative design methodology (Taylor et al. 2011). This concerns the practitioner engaging in an extended process of self-reflection, audience interaction and iterative revision as both artist and researcher (Taylor et al. 2011). This approach emphasizes gaining a detailed understanding of a creative process, and one that is ecologically valid by being situated in the production of a real-world artistic experience. Similarly, Benford et al. (2013) with ‘performance-led research in the wild’ propose that the ‘staging’ of public artworks and experiences that are artist-led, and researched from an HCI perspective in-the-wild, characterise a distinct methodological framework. They argue for the non-linear interplay between three constituent factors: *theory*, *(artistic) practice* and *study*, which subsequently creates opportunities to capture real-world user experience data; drive the iterative development of the artwork; where theories can contribute and steer artistic practice; and practice can contribute to theory. The work charted in Chapter’s 4-8 draw upon RtD methods as outlined above.

Jacobs et al. (2013) notes the importance of clarifying whose voice is active when communicating 'Design from Within', where the practitioner is also the researcher. Thus, each chapter will illuminate the active voice – researcher or composer – to enable transparency of communication and understanding.

1.4.3 Study methods and data capture

A number of methods and data capture techniques are used within this thesis.

Study 1 (Chapter 3): a quasi-experimental study used a combination of quantitative and qualitative methods. Participants walking pace, durations and distances were calculated and compared using statistical methods to reveal any notable trends; the author took field notes using a Dictaphone to capture a rolling objective observation of participants behaviours; participants completed questionnaires that contained rating scales; and semi-structured interviews were conducted post task. Interviews were subsequently transcribed and a thematic analysis undertaken to reveal pertinent and common themes, a method promoted by Braun and Clark (2006) for its flexibility.

Study 2 (Chapter 4): a research through design engagement, which saw the design of a large-scale soundtrack for a real world setting, a sculpture park. Here a regular transference of perspective was necessitated (Benford et al. 2013), moving between that of the composer (creating the soundtrack) and the author (charting the process). The types of data captured from this research engagement included the composed music (recorded and sometimes scored), semantic detail housed within the digital audio workstation used to compose and produce the music, notes, photographs and videos from the setting. This process also engaged with some pilot-participants, where field notes and semi-structured interviews were captured onto a Dictaphone. The author should note that the composition guidelines developed throughout this thesis are not indented just for deployment at cultural visiting sites, but rather a range of exploratory walking activities that might benefit from a musical accompaniment. This setting – Yorkshire Sculpture Park – was chosen as it presented a suitable activity (i.e., walking around the park exploring and interaction with a range of artefacts), in open grounds appropriate for GPS driven mobile application, and as a public site it would offer opportunities for the recruitment of visitors for a user study.

Study 3 (Chapter 5): charts a user study of the soundtrack developed in the preceding chapter. This was naturalistic study that similarly to study one captured the objective viewpoint of the author (field notes and video) and the

participant (questionnaire with rating scale questions and post-task semi-structured interview). In-the-field observation of participants requires the investigator (i.e., author) to balance the needs of the research (e.g., to capture the user experience) against disturbing the participant experience a factor noted by Preece et al. (2015).

The work charted in this thesis contains a mixture of HCI design (i.e., the design of a locative experiences, which are supported by digital tools, positioning technologies and mobile computing devices) and the composition of music, which is illustrated via the language of music theory. The author recognises that this is unusual combination for a thesis, particularly one produced from a computer science department, where the author is situated. As detailed earlier this arises as a direct result of the interdisciplinary approach of the Horizon Centre for Doctoral Training that has supported this research, the background of the author and the method necessitated to address the research questions postulated here.

This combination of qualitative HCI approaches such as user observation, semi-structured interviews and questionnaires in conjunction with a practice-led, in-the-field, design engagement (i.e., RtD) has enabled the author to chart the nature of adaptive, locative soundtracks from the perspectives of the two primary stakeholders, i.e., the composers of such experiences and the people who experience them.

1.5 Thesis structure

This thesis contains 8 chapters that detail the research journey charted here. The content and structure of these chapters are as follows:

Following this introductory chapter, *Chapter 2* presents a survey of related literature, which in turn sensitizes and guides the direction of this thesis. This research straddles two core fields of research, music theory and human computer interaction (HCI), although other related areas are featured alongside. Here the author begins with an exploration of the function of music and the listening experience, which delves into the fields of music sociology, psychomusicology, HCI and music therapy. Second, concerns some passing detail on music theory and music perception, which outlines the compositional approach taken here in addition to some motivation drawn from embodied cognition. Following this a specific focus is placed on the functions, mechanisms and conventions in

(display) media soundtracks. Finally, a survey of the locative media, specifically locative musical experiences is presented which outlines the current state of practice and focus for this work.

Chapter 3: Follow the music: charts the first research activity, which represents the first volley in investigating the nature of adaptive music in a locative setting. It was principally driven by concepts of embodied cognition as discussed in Chapter 2. This quasi-experimental study saw a group of 22 participants explore an empty field whilst listening to four adaptive music selections composed specifically for the activity. Each of the four extracts placed a focus on adapting a different musical feature. The findings showed a tendency for participants to form virtual mappings between these musical events and the physical location, notionally termed as *attachments*. This activity also exposed a number of other factors, such as the implication of the chosen technologies and the nature of the participant experience. This study was effectively a sensitising study to steer the direction and methods subsequently used in the following research engagements. This chapter begins the exploration of the principal research question in addition to sub-questions 1 & 2. The material contained in *Chapter 3: Follow the music* formed the basis of a conference paper presented at ACM SICH 2014: *Walk this Way: Musically Guided Walking Experiences*.

Chapter 4: Sculpting a real world soundtrack, builds on the findings detailed in *Chapter 3* and charts the design, composition and mobile ‘app’ authoring of an expansive location based soundtrack for a real-world cultural visiting experience – a sculpture park. Further theoretical guidance and motivation was drawn from practices in display media soundtracks and prior music psychology research into audio / visual perception. This was an in-the-field research through design engagement, where the author who was also the composer describes, from both perspectives, an iterative processes of composition, testing and refinement of a large-scale adaptive soundtrack. This activity further explores the principal research question and sub-question 2 (Section 1.3). The work detailed in this chapter is also charted in two publications: *You’ll Never Walk Alone: Designing a Location-Based Soundtrack* (NIME 2014) and *Sculpting a Mobile Musical Soundtrack* (ACM SIGCHI 2015).

Chapter 5: A walk in the park. This chapter describes a naturalistic visitor study to evaluate the locative soundtrack designed in the previous chapter. A group of 22 visitors explored the cultural visiting site – a sculpture park – accompanied by the adaptive musical soundtrack and they were interviewed afterwards. A

thematic analysis of the interview transcripts, alongside GPS tracking data reveal that the soundtrack provided an effective underscore for a visit to this site, and contributed to a cohesive and unique experience. The user study detailed in this chapter has also been partly described in *Sculpting a Mobile Musical Soundtrack* (CHI 2015).

Chapter 6: Composing the Soundtrack: this chapter presents a reflective musical analysis (from the perspective of the composer) and discussion on the composition of the adaptive soundtrack charted in Chapter 4, to distil and reveal key compositional approaches. This type of discussion is unusual for the field of HCI, as it is largely conducted from a music theory perspective. Elements from this chapter are included in the following publications *Sculpting a Mobile Musical Soundtrack* (CHI 2015), *Considering Musical Form in Location-Based Soundtracks* (NIME 2015) and *You'll Never Walk Alone: Designing a Location-Based Soundtrack* (NIME 2014).

Chapter 7: The user experience. This discussion chapter covers the user study detailed in *Chapter 5: a walk in the park*, so as to distil and understand how the approaches used in the composition of the sculpture park soundtrack affected how it was experienced by users. This chapter takes an HCI approach to the study findings, focusing on the experiential factors that arose from the study in addition to the implications of the technical infrastructure. This chapter addresses all three of the sub-research questions. This chapter includes content published in *Walk this Way: Musically Guided Walking Experiences* (CHI 2014) and *Sculpting a Mobile Musical Soundtrack* (CHI 2015).

Chapter 8: Conclusions. This final chapter synthesises the pertinent themes exposed from Chapters 6 and 7 to first answer this thesis's research questions and then to distil a framework of guidelines for composing locative soundtracks. Through the presentation of this framework the author argues for series of tangible connections between musical structure and the physical structure of the environment that a locative soundtrack is situated in, alongside a number of experiential factors that arise from musically accompanied locative experiences, which can influence the design of such experiences. In doing so, the author also acknowledges the scope of this work and the need for further action to supplement and solidify the guidelines it outlines. Chapter 8 will draw partly on the composing recommendations presented in the discussion sections in the ACM SIGCHI 2014 and 2015 publications, *Walk this Way: Composing a Location*

Based Soundtrack and Sculpting a Mobile Musical Soundtrack and Considering Musical Form in Location-Based Soundtracks (NIME 2015).

1.5.1 Technical apparatus

The following contains a brief outline of the technical apparatus used through this thesis work. All the composition work discussed in this thesis was undertaken using *Steinberg Cubase 5* digital audio workstation² (DAW). Sound source creation was managed via a set of *Virtual Studio Technologies* (VST's) plugins. Completed compositions were exported in an mp3 audio file format encoded at 44.1khz sampling frequency and 128kbps bit depth. To enable the dynamic control of individual musical elements within the soundtracks the audio files were exported as either *cells* or *stems* (Phillips 2014). *Cells*: segments of music that contain one or multiple instruments parts or sound sources that can either be looped or be triggered sequentially. *Stems*: discrete layers of sound that can be assembled vertically. Stems may contain a single instrument or sound source, or may consist of a sub-mix of several sound sources (e.g. drums and percussion on 1st, guitars and keyboards on the 2nd and vocals on the 3rd). Stems therefore allow for the dynamic rearrangement of the actual instrumentals / sound sources, these potentially allow for more complex and varied musical arrangements, as stems can be initiated or silenced at different points in arrangement, and combined with other stems to form new orchestrations of music (Phillips 2014).

Calvium AppFurnace, a commercially available mobile app authoring platform, was used to author the locative soundtracks and the associated *AppFurnace Player* to deliver it to an iPhone 4s for user playback. *Calvium App Furnace* is typical of contemporary mobile app authoring tools. Here the author can draw geo-referenced lines, points or polygon shapes (zones) onto a chosen map visualisation, which then act as trigger points for playback of cells or stems of music when a user enters or exits a geo-tagged zone. Zones can be paced adjacent to each other or overlapped, or multiple zones can be nested. *AppFurnace* provides basic audio functionality such as cross fades between audio files.

² <http://www.steinberg.net/en/products/cubase/start.html>

³ <https://www.steinberg.net/en/company/technologies/>

Chapter 2 – Related work

2.1 Introduction

“There is probably no other human cultural activity which is so all-pervasive and which reaches into, shapes and often controls so much of human behaviour” (Merriam 1964, 218).

Merriam (1964) was, of course, referring to music, which may well be the most ubiquitous of media – it is integrated and embedded into the majority of our everyday activities and experiences such as our media soundtracks, it accompanies our journeys and populates our work environments, it drives our exercise routines and shapes our shopping and dining experiences, and it frames our individual, social, cultural and religious identities. This chapter aims to provide a view on ‘music’ from a number of perspectives, so as to (1) reveal the focus of the research contained in this thesis and (2) to set out the perspectives that this research will draw on to support and qualify it. Figure 1 details the position of this thesis’s research.

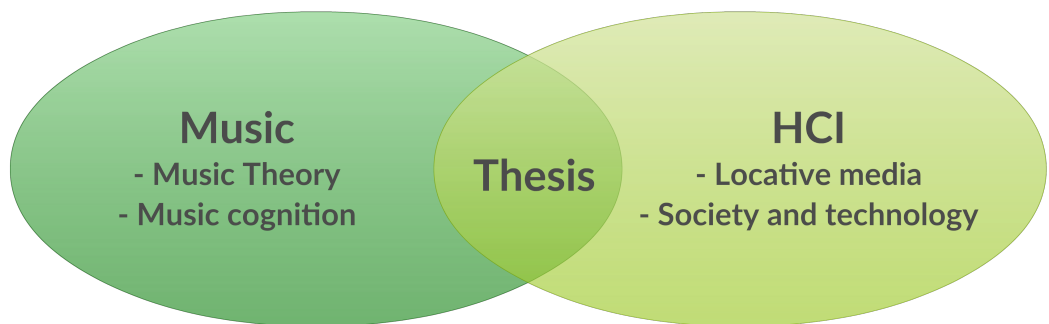


Figure 1: Position of thesis

This thesis is primarily concerned with ‘guidelines for composing locative soundtracks’. There are three key attributes in this phrase: ‘guidelines’ (process), ‘composing’ (action) and ‘locative’ (setting). The ‘setting’ of this work (locative) steers it in to the realm of Human Computer Interaction (HCI), which has an established history of investigating the opportunities and challenges that surround the presentation of musical experiences in mobile and locative contexts. This overarching field is constituted by a number of discrete areas of enquiry, which are: (1) locative media experiences and (2) music sociology, with a focus of how technology (in this instance the (mobile) music player) shapes humans interaction in the world. The ‘action’ of the work in this thesis – composing – brings it into the realm of music theory. As will be described, this work is firmly

situated in the western tonal tradition of music composition, thus the established theory of diatonic music is embraced as the tool kit here. Furthermore, music theory – as a field of research – also engages with music cognition and psychomusicology; a body of knowledge that seeks to understand how humans perceive and respond to music. Literature from these areas is also drawn upon throughout this thesis. Finally, the ‘process’ concerns other motivating factors, which are drawn from both the areas of HCI and music theory.

The structure of the following survey first considers the experience and function of music from a listener’s perspective, which draws primarily on the field of psychomusicology and also HCI. This is followed by the exploration of some key elements of music theory and how they relate to our perception of music from an embodied cognition perspective. Then we turn to media soundtracks and human’s interpretation of combined audio-visual media. Finally, the author contemplates the field of locative media, with a focus on locative audio / music media experiences. This section draws on prior work from the field of HCI.

2.2 The experience and function of music

Music is sensed in general ways that are universal, such as its shape, motion, form, and inferring of mood. In listening to music our personal experiences correspond with the general, but contain unique associations formed by the individual’s perspective (Ratner 1983). Music can be perceived from a number of perspectives, such as its contours (gestures); associations between the music and imagery, objects, actions or words; it is often said that music’s ability to conjure emotions is its key function; and music is also design, the interweaving of these gestures, associations and feelings into a musical work (Ratner, 1983). Merriam’s (1964) landmark text, *The Anthropology of Music*, attributed ten functions to music: (1) *Emotional expression*, (2) *aesthetic enjoyment*, (3) *entertainment*, (4) *communication*, (5) *symbolic representation*, (6) *physical response*, (7) *Enforcing conformity to social norms*, (8) *validation of social institutions and religious rituals*, (9) *contribution to the continuity and stability of culture*, (10) *Contribution to the integration of society* – without doubt a weighty mandate. Sloboda et al. (2001) remarked how these ten functions have a social bias, and that they reference the act of communal music making as well as listening. The work in this thesis concerns solitary musical experiences in locative settings, thus it undoubtedly engages with the first six of these functions.

2.2.1 The function of music

What do people actually do with music? Why do they listen to it, where and with whom? Numerous investigations have asked these questions (e.g., Merriam 1964; DeNora 1986; Sloboda, O'Neill, and Ivaldi 2001; Hargreaves and North 1999; North, Hargreaves, and Hargreaves 2004; Heye and Lamont 2010; M. Bull 2004; Michael Bull 2006). Schäfer et al. (2013) observed the diversity of opinion throughout this body of research, suggesting this was as a result of the differing methodologies applied. Thus, Schäfer et al. (2013) compiled the findings from the significant investigations (i.e., the functions attributed to music), which included 22 theoretical positions and 30 empirical studies. After removing duplicates 129 unique 'functions for music' remained, which were then used to structure a questionnaire completed by 834 respondents. A principal component analysis of the responses revealed three high-level dimensions, which were that humans listen to music to "*regulate arousal and mood, to achieve self-awareness, and as an expression of social relatedness*" (Schäfer et al. 2013). The first two were more prevalent than the latter.

Hargreaves and North (1999) similarly use *cognitive, emotional* and *social* domains as a means to describe the function of music in everyday life, noting that people uses music in a variety of settings, the music is carefully chosen to suit the setting or activity, which was also observed in DeNora's (DeNora 1999) in depth interviews with 50 women. Solboda's study used an experience sampling method (ESM) to capture a group's 'everyday' music listening habits, which revealed that they predominately listened to music whilst doing housework or travelling (Sloboda, O'Neill, and Ivaldi 2001). The introduction of the Sony Walkman in 1980 signalled a shift in humans listening habits (Hosokawa 1984). The "*Walkman listener, who is found in the world of listening to music alone. This listener seems to cut the auditory contact with the outer world where he really lives: seeking the perfection of his 'individual' zone of listening*" (1984, 167). The MP3[•] player and the iPod (released to market in 1991 (Gunn and Hall 2008)) replaced the Walkman, and more recently smart phones have become our multi-media devices of choice. In parallel to this technological development there has been an increasing trend for listening to music on the move and in location based settings. Listening to music via headphones, as is typically the case with mp3 players and smart phones, is a solitary experience compared to many other listening situations which are often

[•] MP3 – a digital audio format - Motion Picture Export Group-1 Audio Layer 3

social (North, Hargreaves, and Hargreaves 2004; Schäfer et al. 2013). Michel Bull has studied iPod users in urban environments and note that they create an ‘auditory bubble’ within which they reframe their spatial experience (Michael Bull 2006; Michael Bull 2005; M. Bull 2001). Although a ‘bubble’ appears to represent a boundary or dissociation from the real-world environment within which they traverse, interestingly their self-curated musical accompaniments also draw attention to their surroundings. Similar observations have been noted by (Heye and Lamont 2010; Herbert 2012; Herbert 2013; Beer 2007). Herbert (2013) states that mobile music listening does not function as a background feature – as “*musical wallpaper*” – but rather the music mediated the listener’s world. In her words Herbert stated that:

Mobile sound technologies were frequently used by participants to configure environment, demarcating public and private spaces by filtering out some aspects of experience whilst emphasizing others, so promoting dislocation from surroundings and freedom from social interaction. At other times, listening to music on the move served to alter perception of surroundings, not simply by enhancing awareness of particular features”

It appears that mobile music listening delivers a particular type of listening experience, where the physical space is re-configured around the listener’s choice of music.

2.2.2 Listening

Before exploring the experience of music further we consider what is meant by ‘listening’, how do we listen and what bearing does the context or setting within which we listen have on our perception of music? Here the author delves into the literature from the fields of music sociology and psychomusicology.

Gaver (1993) talks about everyday listening as being aware of the noises in the real-world around us. He suggests that the difference between ‘everyday listening’ and ‘musical listening’ is one of ‘experiences’ and although different, they do overlap and neither describe a fixed process. For instance, humans are able to focus on sound / music in terms of its ‘attributes’ or just as readily on the object making the sound (Gaver 1993). Discussion around music listening typically acknowledge Chion’s (1994), three modes of listening, which are ‘casual’, ‘semantic’ and ‘reduced’. ‘Casual’ listening is the most common and “*consists of listening to a sound in order to gather information about its cause (or source)*” (p.25). ‘Semantic’ listening concerns the extraction of meaning, or

interpretation of the sound, rather than an understanding of its cause or quality; pertinent examples would be speech and Morse code. ‘Reduced’ listening refers to a focus on the quality of sound rather than listening to its source or meaning, such as the timbral quality of a violin, the sound of the bow scraping against the strings in combination with the resonance of wood and the colouring of the player’s vibrato. There are several other theory’s on modes of listening (Sonnenschein 2001; Schäfer et al. 2013) and Langkjær’s (2013) adds *intertextual listening* (e.g., hearing, or recognising the similarities between other music and the musical work currently listened to); *structural listening* (e.g., as sometimes conducted by trained musicians, who analyse the musical components within a work); *free listening* (e.g., whatever comes to mind); *contextual listening* (e.g., hearing associations between music and other extra-musical attributes); *hearing emotions*; *prospective listening* (e.g., anticipating upcoming events, musical expectation); and *Hearing things in music in a specific multimedia context*. This inspection of the literature will look at *contextual, hearing emotions, prospective* and *hearing things in a multimedia context* in the forthcoming.

2.2.3 Contextual listening and associationism

Contextual listening (Langkjær 2013), referential listening (Sonnenschein 2001), associationism (Cohen 1993), referentialism (Meyer 1956; Scott D. Lipscomb and Tolchinsky 2005) all describe the same cognitive process, namely how humans connect, and associate music to other extra-musical concepts, objects, places, times and people.

According to Cohen’s (1993), ‘associationism’ is formed around *sensationalistic, mechanistic, reductionistic* and *connectionistic* features. As Cohen states “*a basic tenet of associationism is that one idea commonly accompanied by another can independently evoke the other in its absence*”, which accounts for the recall of nostalgic memories when listening to music that was previously listened to at that time. A common example, as quoted by Davis is the “*“Darling, they are playing our tune’ phenomenon*” (cited in Liljeström, Juslin, and Västfjäll 2013, 242). Meyer (1956) and Langkjær (2013) both observe that music does not symbolise emotions, actions or events as it is a ‘non-referential’ art form, thus in itself it does not contain any comprehensible meaning. But rather it is the listeners who assign and attach meaning to musical works in response to associations formed from the settings and contexts within which their listening takes place. Clarke (2005), draws parallels between Gibson’s ecological perception theory and music perception, suggesting that people understand various musical facets such as

style and genre and collect meanings for music which may be cultural, geographical, historical or emotional.

Associationism does not just concern those connections which music listeners make for themselves, they are also orchestrated, of which a notable example is the use of the leitmotif⁵ in film soundtracks; a musical motif or theme that represents a character or concept (e.g., love or loss). Once a leitmotif is heard in alignment with its narrative attribute (e.g., character) on screen, just the sounding of the leitmotif on its own is enough to conjure up the character without their visual presence required on screen. An often quoted example is contained throughout the film *Jaws*, where the alternating semi-tone 'shark' motif is used to indicate the shark's presence (Wingstedt, Brändström, and Berg 2010). Soundtrack music specifically is investigated in more depth in section 2.3.5.

2.2.4 Music and emotions

Sloboda, according to Cohen (2001, 266) proposed that emotion is the primary characteristic of music. Music and emotions have a long history and a significant body of research has grappled with making sense of this phenomenon. There are two general, but contrasting, theories as to the connection between music and emotion, namely the cognitivists and emotivists positions (Scherer and Zentner 2001; Juslin and Västfjäll 2008; Juslin 2011; Juslin and Sloboda 2001; Gabrielsson 2002). The cognitivists argue that music can only signify emotional states for the listener, the listener merely acknowledges the emotional content inherent in the music, but does not experience the emotions themselves. Whereas the emotivists argue that music does elicit the emotional reactions in the listener (Scherer and Zentner 2001; Juslin 2011; Gabrielsson 2002). Nevertheless, humans regularly attach moods and emotions to music and it is a link that is firmly established. The type and frequency of emotional responses to music depend on the music's style, the context it is heard in, whether the music is self chosen, whether it is a social or solitary setting and the listener's personality traits (Zentner, Grandjean, and Scherer 2008; Liljeström, Juslin, and Västfjäll 2013; Juslin 2013). Juslin's extensive work on music and emotion (e.g., Juslin and Västfjäll 2008; Juslin 2011; Juslin and Sloboda 2001; Juslin 2013) has seen the development of a set of eight mechanisms for describing how music evokes emotions in the listener, they are: *brain stem reflex* (e.g., a musical event that stimulates a physiology response such a sudden

⁵ First use of the leitmotif is generally attributed to the 19th Century German composer, Richard Wagner, who regularly utilized the leitmotif as a narrative device in his operas.

loud accent); *rhythmic entrainment* (the physiological response as a result of a listeners entrainment to a powerful rhythmic pattern, for instance a emotional 'lift' when dancing to techno music); *evaluative conditioning* (e.g., formed through repeated pairings between a particular musical work and another stimuli such as a place, person or action, where over time the music assimilates the emotion intrinsic to the stimuli, i.e., associationism (Cohen 1993)); *contagion* (e.g., where an emotion is recognised in the music and the listener simulates, or entrains the response); *visual imagery* (e.g., the music prompting a visual image that in turn stimulates a visual response); *episodic memory* (e.g., the triggering of a recalled memory associated with the music, i.e., contextual or referential listening (Langkjær 2013; Sonnenschein 2001)); *musical expectancy* (e.g., an emotional response to a listener's expectancy of musical continuation that is either confirmed, delayed or disrupted, i.e., a sudden unprepared key change has been shown to produce thrills (Juslin 2011; Liljeström, Juslin, and Västfjäll 2013); and *aesthetic judgment*, e.g., an emotional response triggered by an aesthetic response, but this also accounts for mixed or contrasting emotional responses, such as 'pleasurable sadness', how humans can often enjoy negative emotions in relation to musical experiences (Liljeström, Juslin, and Västfjäll 2013; Juslin 2011).

One of the principals factors that music plays such as key role in media soundtracks is its ability to portray, steer and carry the emotional narrative (Cohen 2001; Cohen 1990; M. Boltz, Schulkind, and Kantra 1991; M. G. Boltz 2004; Scott D. Lipscomb and Tolchinsky 2005; Meyer 1956; Collins 2013; Wingstedt, Brändström, and Berg 2010; Cooke 2008; Cook 2000). To 'emote' is one of Wingstedt et al.'s (2010) six 'narrative functions' of media music. Cohen (2001, 267) observes that "[r]eal life entails multiple emotions, simultaneously and in succession. Miraculously, yet systematically, these complex relations – this 'emotional polyphony' – can be represented by the musical medium". The argument for this phenomenon finds Cook (cited in Cohen 2001, 2) arguing that in multimedia soundtracks, music "*readily finds an object*", meaning that music forcefully characterises emotions, but only in an abstract way, and media images forcefully depicts objects, and thus connections are easily made between the two. Meyer (1956) goes on to describe how musical-cultural associations have saturated film soundtracks, and these musical conventions are widely expected (i.e., associationism).

2.2.5 Music expectation

Drawing on one of Juslin's music-emotion mechanisms – *musical expectancy* – further outlines the notion of *associationism*. The field of music cognition has studied listener expectation at length (e.g., Meyer 1956; Huron 2006; Pearce 2014; Tillmann 2008; Larson 2012; A. Boltz 1989; Chion, Gorbman, and Murch 1994). With western tonal music listeners learn to anticipate and expect common melodic, rhythmic and dynamic actions in response to the set of probabilities which structure most musical works (Tillmann 2008; Meyer 1956; Chion, Gorbman, and Murch 1994). These expectations are learned, not through the study of music or performance, but rather just through exposure, by repeated listening to a range of tonal styles. This phenomenon can occur because of the hierarchy of relationships within the diatonic system creates a significant degree of repetition in musical structures (Tillmann 2008). Various studies have revealed that listeners have expectations for a range of musical features such as harmonic progressions and cadences (Schmuckler 2006; Chion, Gorbman, and Murch 1994), melodic content (Pearce 2014; Schmuckler 2006) and time (A. Boltz 1989; M. R. Jones and Boltz 1989).

2.2.6 Music and physiology

The investigation moves on here from humans' cognitive perception of music to their physiological responses.

2.2.6.1 Sports and exercise

A body of research has sought to comprehend the effect of music on humans' physiology and physicality. We can observe humans synchronising physical movements to the tempo or pulse of music in a wide range of activities such as marches and processions, aerobic exercise classes that are driven by the pulse of high energy music, in dancing and even audiences applauding in time with concert music (Styns et al. 2007). Dancing is a key example of human's innate ability to synchronise physical motions with rhythmical pulse. Noorden and Moelants (van Noorden and Moelants 1999) surveyed the tempi of dance music using a sample set of 12148 tracks and they noted that the majority of tempi were within the spectrum of 115bpm – 127bpm (472.4ms - 521.7ms) (van Noorden and Moelants 1999). The rationale for this, so argues Moelants (2002b) is that humans have a innate preference for synchronising physical movements to tempo range of 480 – 500 milliseconds (i.e., 116 – 125bpm). Moelants (2002b) points to three other types of study that focused on different physical activities, which all similarly revealed a trend for this preferred pulse. They were average waking

pace (i.e., 513ms = 117bpm) (Murray, Drought, and Kory 1964), preferred tapping rate studies, where a participant is asked to tap at pulse comfortable for them (Collyer, Broadbent, and Church 1994; Kay et al. 1987; Moelants 2002a; Fraisse 1982) which all noted a range from 450ms – 500ms and audience applause (Néda et al. 2000). In this latter example they observed that impulsive fast applause averaged at 493ms and slow applause at approximately half that rate – 253ms.

The study of sports sciences has revealed that music accompaniments within sports and exercise routines can have a noticeable effect on performance such as regulating pace, task duration, or setting an appropriate mood prior to, or during, a training session (e.g., Karageorghis, Terry, and Lane 1999; Karageorghis and Terry 2008; Copeland and Franks 1991). A number of theories have sought to explain the affective nature of the music in these settings, which include tempo synchronisation (Szabo, Small, and Leigh 1999; Abernethy and Batman 1994); music as a diverter of attention, thus reducing the impact of fatigue (Nethery 2002); and the regulation of emotions (Terry et al. 2012; C. I. Karageorghis and Priest 2012; C. Karageorghis and Priest 2008).

A range of mobile device systems have sought to take advantage of the above work to offer context-aware training ‘apps’, such as *TripleBeat* (De Oliveira and Oliver 2008), *JoMP* (Liu and Kung 2009), *DJogger* (Moens, van Noorden, and Leman 2010) and *Personal Soundtrack* (Elliott and Tomlinson 2006). All of these represent systems that utilize playlists with tempo metadata, which is then used to either regulate or adapt to user exercise behaviour. These examples date from the mid-late 2000’s, some high profile variants of this approach have recently been commercially released such as Nike+Sportsband⁶ and Spotify Running⁷, which uses a playlist of specially selected songs that are presented in response to the joggers pace, determined by the accelerometer on a smart phone.

2.2.6.2 Cognitive processing and therapeutic function

Other work has considered the affect of music on listeners cognitive processing, specifically its effect on attention. Bull (2006), DeNora (1999) and Herbert (2012) have all noted that music masks both external and internal distractions. Furthermore, people chose specific music that was sympathetic to a setting or activity, an example being instrumental music for working or studying (DeNora

⁶ https://secure-nikeplus.nike.com/plus/products/sport_band/

⁷ <https://www.spotify.com/uk/running/>

1999). Some studies have demonstrated that listening to background music can increase work performance (Shih, Huang, and Chiang 2009; Berland as cited in Burleson, Center, and Reeves 1989) while others note a dependency of effectiveness to musical style (Uhrbrock 1961; Hallam, Price, and Katsarou 2002; Morton, Kershner, and Siegel 1990).

Music has a long history of being used in therapeutic contexts, from the treatment of emotional stress and anxiety to post-operative pain relief (Siedlecki 2005; Koenig et al. 2013; McCaffrey and Locsin 2002; J. A. Finlay et al. 2014; Hekmat and Hertel 1993; Cepeda et al. 2006; Dahlquist et al. 2007; Maslar 1986; MacDonald et al. 2003; Mitchell, MacDonald, and Brodie 2006). Similarly to the body of work from sports science, there are a number of proposed rationale for music's therapeutic functions, which include the regulation of mood (Maslar 1986), stimulating the release endorphins for pain relief (McCaffrey and Locsin 2002) and as a distractor from pain or stress (J. A. Finlay et al. 2014).

2.2.7 Summary of the listening experience

Music is a rich and vivid art form that permeates all aspects of our everyday lives. We choose our accompaniments carefully to suit the context and to regulate our desired mood and emotions. We form detailed and powerful associations between music and extra-musical forms, where the music can act as a prompt, or a 'rewind' button to navigate our past memories. Furthermore, music can mediate how we interact with, and perceive, physical space. This body of literature will be returned to in *Chapter 8: YSP user experience*, to assist in understanding the visitors' experience of a large-scale locative soundtrack.

A composer needs to be aware of and consider how their music may be interpreted and experienced. Particularly, if the composer is working within setting where the music is not absolute, but rather its function is to accompany, or mediate another activity (Herbert 2013). Having delved into the function of music, we now turn our attention to the composer's perspective by focusing on music theory and music perception.

2.3 Music theory and perception

Here the author draws attention to a number of key elements of music theory that are central to the work of this thesis. The first of these outline the core musical features used in the composition work in this thesis, which is then followed by an exposition of musical form. The third section moves this

discussion of music perception, which explores the notions of musical time, space and embodied cognition.

2.3.1 Musical features

Music, and in this case western tonal music can be characterised by a set of features that constitute a musical structure. Although the terms that describe these features are, for the most part, commonplace a number of different terms and levels of abstraction are used liberally throughout music theory. For instance, Owen (2000) proposes four overarching musical themes, they are *pitch* (all matters melodic, e.g., melody and harmony), *timbre, intensity* (i.e., dynamics) and *duration* (all matters rhythmic, e.g., note values, metre, tempo), each of which contain some sub-features. Conversely, White (White 1984) separates these features out into *melody, harmony, rhythm, tone colour* (i.e., timbre), *form, tempo* and *dynamics*. Whereas, Spencer and Temko (1994) further divide harmony into *cadence* and *tonality* and also add *density* and *texture*. Throughout this work the author's cores set of feature terms are the same as White (1984), but occasions that penetrate into more detail additional features are referred to such as *cadence, density and texture*. The author assumes that the reader will have a basic understanding of music, thus no further detailing of them is contained here.

2.3.2 Musical form

"Without organisation music would be an amorphous mass, as unintelligible as an essay without punctuation, or as disconnected as conversation which leaps purposelessly from one subject to another [...] The presentation, development an interconnection of ideas must be based on relationship [...] musical blocks (phrases, motives, etc) will provide the material for building larger units of various kinds, according to the requirements of the structure. Thus the demands of logic, coherence and comprehensibility can be fulfilled, in relation to the need for contrast, variety and fluency of presentation" (Schoenberg, Strang, and Stein 1967).

Schoenberg et al. (1967) describe the composition of large scale musical form as constructed from the meaningful and logical relationships of small units, a perspective that is equally applied to the post-composition analysis of form (Spencer and Temko 1994). So 'form' refers to the particular structure of a certain music composition (Levy and Sandler 2008). Historically, the analysis of music has led to the establishment of 'set' formal structures (i.e., 'forms') by which other

compositions are judged, termed 'class concepts' by Meyer (1956), and these define a set of expectations as to how the organisation of a composition should unfold. These established 'forms' come in two principal types, sectional forms and developmental forms (Stein 1979). Sectional 'forms' refer to musical works that are structured around a particular organisation of inter-related blocks, or sections, each made up of contrasting thematic material (e.g., ternary form, rondo, verse-chorus). Developmental forms may also be crafted around a sequence of sections, but these sections are organically formed from the variation and development of motifs that permeate the whole composition (Stein 1979).

Toch (1958) recoils at the discussion of established 'forms' stating that "*whatever FORM might be, let us not confuse it with forms*" (1958, 153), going on to propose that 'forms' are an inheritance from the classical period's misguided attempts to understand the compositional process, noting that the use of the term is typically prefaced by the term 'analysis'. According to Toch, musical form is about moments of contrast and the "*balance between tension and release*" that musical form unfolds over time (1958, 157). This vision is also reflected by others such as Berry, who suggests it is "*the punctuating shaping of time and 'space' into lines of growth, decline and stasis hierarchically ordered*" (Berry 1976, 5). Moreover, Ratner takes a similar view, proposing that musical form is understood by moments of arrival along a temporal path (Ratner 1983); arrival defined by cadence, contrast, tension and release. The similarity between temporal musical contours and journeys through physical space has, understandably, been observed and noted (Ratner 1983). Regardless of one's position on what constitutes music form (i.e., established musical 'forms' or form in music free from conventions), they both describe the need for contours 'punctuated' by contrasts and tension and release. Schoenberg et al. (Schoenberg, Strang, and Stein 1967) note that moments of contrast are realised by a number of means most notably via harmonic changes and the thematic variation of motifs. Furthermore, certain 'forms' are characterised by the use of different metres (i.e., dance 'forms' such as *minuet*, *trio*, *chaconne*) or the relationship of key centres (i.e., large-scale musical forms such as sonata or symphony) (Stein 1979; Schoenberg, Strang, and Stein 1967). Although many of these traditional 'forms' date from the classical period and thus refer to the music of that period (Toch 1958, 153; Schoenberg, Strang, and Stein 1967; Spencer and Temko 1994; Stein 1979; Meyer 1956), they are still common currency in the discussion, analysis, and tutoring of music composition. Furthermore, others have been subsequently added that reflect more contemporary styles (e.g., jazz, popular music rock, world music) (Covach 2005; Levy and Sandler 2008; Adorno 1941; Lena and Peterson 2008). The utility of

established 'forms' for the composer divides opinion: unnecessary and irrelevant (Toch 1958) or essential for the emerging composer to understand how to craft musical relationships, which leads to good practice, upon which the composer can then start to push against and expanded upon convention (Schoenberg, Strang, and Stein 1967). From the authors perspective, established musical 'forms' can be constructive in offering guidance to how some musical relationships can be 'played out', particularly when in need of inspiration.

2.3.3 Musical space and time

Stravinsky described music as consisting of sounds placed in the organization of time (Morgan 1980), with Schopenhauer adding "*to the complete exclusion of space*" (Norman, Judith, Alistair Welchman, and Christopher Janaway, eds. Schopenhauer 2010). However, in contrast, Berry (1976) included the notion of 'space' into musical form. 'Musical space' is also discussed by Morgan (1980) who observes that music performs in a space of its own, one that is fashioned around simultaneous events as characterised by melodic lines, counter-melodies, motifs and rhythms. These discrete events inhabit their own space at any given point in time, and are thus cohabiting, complementary objects that create musical textures - a "*space of relationships*" (Morgan 1980). Musical textures are characterised by Dubnov et al., (1997) as a 'superparameter', constructed from a combination of single parameters and as such it reflects Gestalt theory of individual items melding into a single entity of focus - a texture is thus considered an audio object. These objects (textures) occupy a space that is both vertical (i.e., concurrent or overlapping musical voices) and a horizontal space, which is governed by the temporal unfolding of these musical events.

Music can be measured by seconds, minutes and hours, but this would tell us little about the nature of it. 'Musical time', it would seem, is measured by factors such as pulse, tempo, metre and the internal structure of motifs, phrases and sections. Thus, musical time occupies a different temporal domain than that of time in the real world (e.g., clock time, or the cycles of night and day). Musical time is internal - that is - until it is integrated into the realm of other temporal activities or media, e.g., a religious ceremony, an accompaniment for a ballet, or a film or computer game soundtrack. When music becomes an accompaniment, then musical time becomes subservient to other temporal domains. In these instances the form of the music - its moments of contrast, arrival and tension and release - is then governed by the structure of the primary modality.

2.3.4 Music and embodied cognition

Given that music has spatial and temporal qualities the parallels between movement through physical space and music have evidently been observed (Ratner 1983; Schiller 2009; Toch 1958). The use of metaphors in humans understanding of music is often infused with physicality. Harris (2007) notes the parallels that exist between maps and the musical score and the 20th Century French composer, Edgar Varèse's stated future vision where musical colour and timbre "*would become an agent for delineation like the different colours on a map separating different areas, an integral part of form*" (Varèse 2005, 12). Furthermore, the discussion above on musical form stressed the importance of relationships between musical events and features, which is also noted in the physical world: "*In Nature we never see anything isolated, but everything in connection with something else which is before it, beside it, under it, and over it*" stated Goethe. This quote resonates equally well when the word *nature* is replaced with the word *music*. It seems unsurprising then that Goethe also stated that "*music is liquid architecture; architecture is frozen music*" and this analogy has been used to inspire the work of composers and architects alike (Young, Bancroft, and Sanderson 1993).

Turning to the field of philosophers and linguists can assist in revealing why humans' have historically used physical concepts to perceive and communicate the nature of music. According to Margolis (1987) as cited in (Brower 2000), humans form meaning by 'pattern matching', that all conceptual thinking results in the aligning of corresponding patterns to those previously experienced and stored in the memory. Whereas in Mark Johnson's *The Body in the Mind* (M. Johnson 1987), Johnson sought to find "*a constructive theory of imagination and understanding that empathizes our embodiment as the key to dealing adequately with meaning and reason*", a theory that addresses human cognition, as an antithesis to the objectivist theory of meaning. His theory of embodied meaning also explores 'pattern matching' as related to human's bodily interactions; the notion that human's embody a physical form that is situated in a physical / spatial world, thus the way in which they then understand and describe non-physical concepts – such as maths (Lakoff and Núñez 2000), art, music (Brower 2000) and emotions – is best achieved via metaphors of a physical description, which then brings these concepts into the real-world of our innate understanding (M. Johnson 1987). Central to this theory are the "*metaphorical projections*" between images schemas and conceptual metaphors, i.e., cross-domain mappings (M. Johnson 1987; Zbikowski 1997; Zohar Eitan and Granot 2006; Zohar Eitan and Granot 2009; Saslaw 1996; Wilkie, Holland, and Mulholland 2010; M. L. Johnson and

Larson 2003; Brower 2000; Lakoff and Núñez 2000; Lakoff and Johnson 2008; Lakoff 1993; Rohrer 1997). ‘Image schemas’ (or ‘embodied schemas’) are rooted in human’s perceptions of space, interactions and forces with other objects in an environment. There are too many image schemas to list and explore here, but some, for instance, are the container; path focus to end point focus; following a trajectory; enablement; and attraction (M. Johnson 1987). The image schemas represents the source domain, which is then mapped (i.e., pattern matched) to the target domain, termed the *conceptual metaphor* (M. Johnson 1987; Lakoff and Johnson 2008; Wilkie, Holland, and Mulholland 2010; Brower 2000). Conceptual metaphors that embody physicality are used pervasively in the description of music, for instance, ‘the cellos accented a **low** D, before **ascending** an octave **higher**’ or ‘she played the largo movement with the **softest** of touch at a unusually **slow** tempo, before **accelerating** through the **extended** coda’.

A body of prior research has investigated image schemas and conceptual metaphors as related to music in depth (Brower 2000; Wilkie, Holland, and Mulholland 2010; M. L. Johnson and Larson 2003; Budd 2003; Larson 2012; Zbikowski 1997; Zbikowski 2002; Zbikowski 2008). Brower (2000) in particular has sought to comprehend the role they play. She states that there are three type of ‘pattern matching’ processes in our perception of music: intra-opus patterns – which relate to the patterns contained within the musical work itself; musical schemes – that relate to patterns drawn from musical conventions; and finally image schemas (IS) – mapped to embodied cognition (Brower 2000). Brower (2000) goes on to outline a set of image schemas most pertinent to music, which are the *container*, *cycle*, *verticality*, *balance*, *center-periphery*, and *source-path-goal*. Her reasoning being “that these schemas reflect basic features of bodily experience of “space, time, force and motion” (p. 327), which in turn leads to the development of the notions of musical space, musical time, musical force and musical motion (Brower 2000). The *container*, in Brower’s work (2000), is not expanded upon in direct musical terms, but rather its typically acts as a vessel within which other image schemas (IS) function. *Containers* can be nested, in motion (transition from one to another) and can be both stable and plastic (Brower 2000). Simple metaphors for a musical container would appear to be found in descriptions such as “the music is **in** the key of Bb”, or “this composition is played on the piano”. The latter example references the instrument, the timbre as the container from which the music emanates. Running through the other IS proposed by Brower (2000): *verticality*, readily illustrates metaphors such as ‘ascending pitch is up and descending pitch is down’; *balance* effectively describes the pull of the tonic note or chord tonal harmony, resulting in the cadence; *source-path-goal*, the force of

melodic or harmonic motion (also related to the *balance* IS), a common metaphor being *melody is movement along a path* (e.g., the melody **starts** on a **low** 'Bb', before **reaching** a climax at **high** 'Bb', where it makes its way to a 'F' at the **end**).

Johnson and Larson (2003) discuss the metaphor of the *musical landscape* to describe how human's journey through music is similar to journeys through a physical landscape; they describe how musical events passed are thus behind and the placement of events to come at specific points in the landscape (i.e., "the vocal's enter here"). This metaphor neatly contains Brower's 'musical space' (i.e., the container being traversed), 'musical time' (the timings of events such as the start, end and points of interest in located in-between), 'musical force' (i.e., the goal – to journey through the space and get to the end) and 'musical motion' (i.e., the act of moving through the music space over time). Other physical concepts pervade the description of musical relationships, such as 'musical magnetism' as used by Larson (2012), which describes the need for an unstable tone to resolve to the nearest stable tone. This relates to diatonic music, where there is an established tonal hierarchy of consonance and dissonance. Musical magnetism relates directly to the image schema of *force* (Lakoff and Johnson 2008; M. Johnson 1987; Zbikowski 2008; Wilkie, Holland, and Mulholland 2010) which maps into metaphors of resolution and closure.

So far, this discussion concerns one direction of flow – *physical* (source) to *musical* (target) – the pattern matching of characteristics of the physical domain to that of the musical domain. A few examples have sought to explore the reverse of this flow – *musical* (source) to *physical* (target) – whether cross-domain mappings of motion can flow from music to a physical representation. This exploration requests more than the temporal synchronisation of physical movements to rhythms in music, such as is observed with dancing, marching, or exercising, but rather it invites an investigation as to whether human's map musically embodied schemas into spatial manifestations? One of these pieces of research, a study by Eitan and Granot (2004), who engaged with 77 college students (37 of these had some form of musical training) and asked them to imagine an animated character and to track the moments of these characters in reply to various musical extracts heard. The types of movement the participants were asked to imagine included vertical and horizontal movement, distance, speed, force, movement type (e.g., walking, running, sliding) and energy levels. The musical stimuli consisted of dynamic contours (i.e., crescendo or decrescendo), pitch direction (e.g., ascending or descending), pitch intervals (increasing or decreasing) and timing (accelerando or de-accelerando) (Zohar Eitan and Granot 2004). Their results were palpable in

that they showed that the music did indeed promote spatial mappings. However, their results demonstrated this to be a more complex and nuanced area than predicted, as the expected symmetry with mappings was not universally observed (Zohar Eitan and Granot 2004). For instance, intensifying and abating motions were symmetrically perceived and a number of one to many mappings, such as crescendo representing distance and velocity. Pitch revealed some interesting asymmetries, as there was a tendency for pitch to be related to horizontal motion, ascending to the right and descending to the left, and ascent was also perceived as moving away. Descent, was also perceived as moving away and also downwards motion (Zohar Eitan and Granot 2004). Other similar work such as (Zohar Eitan 2007) asked participants to interpret whether a set of musical extracts were accelerating or de-accelerating. In fact none of the examples had any alterations to their tempo, but rather intensity contours formed via changes to pitch, textural density and loudness were presented. These extracts were interpreted as accelerating when intensity levels rose and de-accelerating when they diminished (Zohar Eitan 2007). A further study, with a group of 106 children (aged 6-8), captured responses to ascending or descending pitch, crescendo and diminuendo (loudness contours), and accelerando or ritardando (tempo contours) on the children's 'muscular energy, speed and shape' movements (Kohn and Eitan 2009), essentially they were asked to 'act out' the musical extracts they heard and subsequently observed differences in activated movements as a response to the different musical parameters and the course of these movements corresponded to the musical contours (i.e., growth or reduction, rising or falling).

This section has presented and discussed a wide range of literature and topics that concern both the structure and understanding of music. On the one hand there have been the intra-musical relationships between musical parameters, which create formal structures of musical works. On the other hand there have been those multi-modal and cross-domain relationships between the physical world (embodied cognition) and our conceptual approach to understanding and describing music. The composition work in this thesis draws upon and refers back to music theory in Chapters 3, 4, 6 and 8. Chapters 3 and 4 concern matters of composition, thus music theory is used here to guide compositional choices. Chapter 6 presents a reflective musical analysis of the work charted in Chapter 4, thus music theory is used to aid discussion. And finally, Chapter 8 presents a framework of guidelines for composing locative soundtracks, which evidently will draw significantly on music theory. The notion of motion in music (i.e.,

embodied cognition, image schemas and conceptual metaphors) is a motivating factor for the work charted in Chapter 3.

2.3.5 (Display) Media soundtracks

We now direct focus on to the application of music soundtracks in media experiences and consider their function and affect on the user experience.

2.3.6 Film soundtracks

The first documented musical accompaniment to a film was as a result of the Lumière family's screenings in Paris and London during 1895 and 1896 (Davis 2010). The music was not composed for the films, just drawn from a variety of published music (Davis 2010). During the era of the silent movie, having a live musical accompaniment was commonplace. The choice of music was largely at the whim of the accompanist and its function was primarily to mask the sound of the projector, rather than to support the narrative of the film (Gorbman 1987). During the 1920's synchronised soundtracks of dialogue were being explored (Cooke 2008) and since this period film soundtracks have become an established currency in most of our display media^{*} experiences; but why music and what does film music do? *"Music greases the wheels of the cinematic pleasure machine by easing the spectators passage into subjectivity"* (Gorbman 1987, 69). It ought to be noted at this point that by 'soundtrack' the author refers only to non-diegetic music – sometimes called incidental music or background music – music that does not live in world of the visuals, but rather is overlaid onto the diegetic sound (Gorbman 1987; Chion, Gorbman, and Murch 1994; Collins 2013; Sonnenschein 2001).

There are many different cuts through the question of the function of soundtracks, which have been attributed a range of functions (M. Boltz, Schulkind, and Kantra 1991; Gorbman 1987; Chion, Gorbman, and Murch 1994; Wingstedt, Brändström, and Berg 2010; Langkjær 2013). Davis (2010), for instance outlines three high-level functions, which are:

- *Physical functions*: which includes establishing the location and the time period (i.e., associationism (Cohen 1993)), and illustrating and intensifying

^{*} The term 'display media' is one used by the author in this setting to distinguish between media experience that are watched on a fixed display screen, as opposed to locative media experiences.

the action. This last function is described by Pauli (1981) as *paraphrasing*, where visual events are mimicked by the music.

- *Psychological functions*: regulating the mood and emotional content such as illustrating a character's thoughts and feelings, and revealing unseen implications or deception. According to Pauli (1981) when the visual imagery / narrative is semantically vague then meaning is then drawn from the music - termed *polarization*. This refers back to Cook's assertion (cited in Cohen 2001, 2) that music "*readily finds an object*" on which to impart emotional meaning. The psychological function of revealing unseen implications or deception is sometimes realised by means of *foreshadowing* (M. Boltz, Schulkind, and Kantra 1991). *Foreshadowing* refers to where the music looks ahead, preparing for visual events not yet seen. The clichéd example being the build up of musical intensity in horror films as a – soon to be – victim explores the dark cellar, where an attacker is lurking.
- *Technical functions*: such as providing continuity across scenes and the film as a whole. For example, a scene may be made up of multiple cuts that show the characters from different angles and perspectives. Music provides a layer of consistency that binds these segments into a coherent whole.

In comparison to Davis (2010), Wingstedt et al. (2010) list a set of six narrative functions of music: *emotive* (i.e., psychological); *informative* (i.e., physical); *descriptive* (i.e., physical); *guiding* (i.e., physical); *temporal* (i.e., technical); and *rhetorical*. The *rhetorical* function describes moments where the music "*steps forward*' to comment on the narrative events or situation" (Wingstedt, Brändström, and Berg 2010, 3), sometimes realised by deliberate contrast between the music and visual narrative referred to as *counterpoint*⁹ (Pauli's 1981). Gorbman's (Gorbman 1987) covers the same ground but adds *invisibility* (i.e., the mechanisms of the soundtrack should not be apparent to the viewer) and *inaudibility*. This is not to say that the music should be inaudible, but rather it should nearly always be secondary to the visuals, the dialogue and the diegetic sound. Specifically, music soundtracks should be placed in the background, after all the audience have "*come for, namely a story, not a concert*" (Gorbman 1987 p.76).

⁹ Not to be confused with melodic counterpoint in composition. Whilst similar in concept, i.e., lines countering each other moving freely in opposite directions, the counterpoint referred to by (Pauli 1981) refers to the meaning of the visual images countering the music.

Lastly, the American composer, Aaron Copland, who stated that the soundtrack is to “provide the underpinning for the theatrical build up of a scene and then round it off with a sense of finality” (as quoted in Prendergast 1977, 222). For instance, reflecting the contours in a narrative build up via musical contours of rising and falling intensity (e.g., crescendo), and the ‘finality’ of a scene realised by musical cadence, which studies have shown can drive the interpretation of narrative closure in films (Thompson, Russo, and Sinclair 1994; A. Boltz 1989).

2.3.7 Computer game soundtracks

Computer games soundtracks have the same overarching function as film soundtracks – to support the telling of the narrative (Collins 2008). The key difference is that computer games are non-linear media experiences (Phillips 2014; Collins 2013; Collins 2007; Collins 2009). A film is a composite of scenes fixed in their duration and sequencing, whereas a computer game is also constructed from a series of scenes, but their duration (and in some cases the order) is dictated by the player. Consequently this calls for the music to respond accordingly to these indeterminate factors. Phillips (2014) outlines three typical approaches to creating computer games scores, they are *linear music* and two variants of *interactive music*, which are (1) ‘rendered music’ and (2) ‘generative music’; the latter also referred to as ‘algorithmic composition’ or ‘procedural music’. *Linear music* is as it sounds, fixed in arrangement and duration, however, these sequences may be ‘looped’ to extend their duration or cut short, thus exited before completion of a cycle (Phillips 2014). Often linear music is used in specific scripted, cinematic scenes in a game where the player has no direct control of the narrative. *Generative music* can work in a number of ways, but simply a set of algorithms, or procedures, which may be random, control the choice and sequencing of musical features. Phillips (2014) uses the example of the wind chime, a pre-determined set of tones and that can interact in any order and create a ‘pleasing’ sound, which is then left up to the wind (i.e., game events) to control. This thesis’s particular interest is with ‘rendered’ interactive music, as regularly used in computer games. The use of the term ‘rendered’ refers to pre-composed musical elements that can be arranged and re-arranged to create multiple different larger musical sections (Phillips 2014; Collins 2013). Typically, rendered interactive music uses *cells* and *stems* (Davis 2010; Phillips 2014), as was discussed in Chapter 1, section 1.5.1. A number of seemingly interchangeable terms are used to describe this type of music, such as interactive, adaptive and dynamic (Collins 2007; Collins 2009; Collins 2013; Phillips 2014). Collins describes adaptive and interactive as types of dynamic music, whereas Phillips denotes differences

for all three. For the sake of clarity, the author has set out to use the term adaptive through the work in this thesis. The term adaptive is used to describe the triggering of *cells* or *stems* in response to users movements around a physical space. The term dynamic is avoided in this work, so as to remove potential confusion with the discussion of ‘musical dynamics’.

In addition to regulating mood and intensity of action, music is also used to cue or direct the player or particular games states. For instance, the presentation of silence to signify that a player has drifted out from the main area of game play, that they are not where ‘the action is’ (Collins 2013). Another common facet is the *stinger*, which share some similarities with the leitmotif. The stinger is an often used audio marker in computer games, which is generally a short musical section or theme that “*is to alert the player to a change in the current state of gameplay*” (Phillips 2014, 177). There are a number of *stinger* types such as victory, defeat, transition, hint and prize. Phillips (2014) notes that the composition of stingers can be particularly challenging as they need to be organically related to the overarching music, yet they are also required to have a degree of prominence thus noted by the player, and also stand up to numerous repeated instances throughout the course of a game.

2.3.8 Audio visual congruence

Turning once more to the field of psychomusicology, we explore the affective nature of music on the perception visual imagery. There is strong consensus that music shapes and drives an audiences referential and emotional interpretation of imagery (M. Boltz, Schulkind, and Kantra 1991; Chion, Gorbman, and Murch 1994; Cohen 1993; Meyer 1956). In film soundtracks, for instance, the addition of a non-diegetic soundtrack has been shown to exert an additive effect. When music is placed in combination with visual imagery the music enhances the viewers perceived enjoyment of visual imagery (Cohen 1990; Sirius and Clarke 1994; Chion, Gorbman, and Murch 1994; Collins 2013). When the mood of the music is congruent with the visual images – meaning it is deemed appropriate, or fitting – a process of ‘spreading activation’ can be observed, which refers to a transfer of associational attributes – such as emotional context – from the music to the visual imagery (Cohen 1990). In a similar vain is ‘conceptual resonance’; a cyclical progression where accompanying music affects a viewer’s perception of an image, which in turn affects the perception of the sound, which then further imparts on the interpretation of the image and so on. Interestingly, a study has shown that music does not need to be appropriately associated to heighten the

enjoyment of the visual images, but rather any music placed alongside visual imagery will enhance the viewers visual perception (Sirius and Clarke 1994). Additionally, Cohen (1990) brings to attention that film music is often reported to make the images seem more real, which is clearly at odds with its non-diegetic function. Audio-visual congruence seems to be an important factor in film and computer game soundtracks, as it partly explains why soundtracks are typically heard, but not directly attended to, thus lie in the background. There are a number of similar models to explain audio-visual congruence such as the ‘Congruence / Associationist’ model (Marshall and Cohen 1988), the ‘Attentional focus as a function of audio / visual congruence’ model from Lipscomb and Kendall (1994) and ‘Synchresis’ (Chion, Gorbman, and Murch 1994) who all generally agree that audio / visual congruence arises from the combination of two implicit factors: the first being a matter of association, specifically that the music should be perceived as appropriate for the visual imagery, i.e, associated (Cohen 1993), and the second, that there is temporal alignment between musical and visual events (Scott D. Lipscomb and Kendall 1994; Marshall and Cohen 1988; Chion, Gorbman, and Murch 1994). This temporal alignment refers to notable visual events, or edits, aligning with similarly notable musical events and accents. This does not mean that the music has to ‘Micky Mouse’ (Davis 2010) the imagery, just the alignment of some key events are required for the soundtrack to be perceived as connected to the imagery. When both association and temporal alignment are in place then the two modalities are perceived as one amalgam, thus explaining why film soundtracks often appear to blend into the background. Conversely, if either of these two implicit decisions are not the case, then viewer’s attention is drawn to one or the other isolated modalities (Lipscomb and Kendall, 1994). Chion (1994) states that audio-visual congruence means that we then “*see/hear*” rather than “*see and hear*” display media experiences.

The literature surveyed in this section is used to motivate some of the compositional approaches explored in Chapter 4, notably paraphrased accompaniment and foreshadowing, the application of silence, and stingers and leitmotifs. Furthermore, this literature is returned to support the discussion of that resultant work in Chapter 6.

2.4 Locative media

For the final section we move away from soundtrack for display media into the exploration of locative media, and specifically the presentation of musical sound in (i.e., location-based) or through location (mobility). The examples presented

here represent work of a similar direction, scope and intent to that that this thesis engages with. This section will present a short history of locative media, before focusing in specifically on locative music.

The term 'locative media' has been widely attributed to Karlis Kalnins who, so the story goes, first proposed it at the 2003 Art+Communication Festival in Riga, Latvia (Zeffiro 2012; Bilandzic and Foth 2012; M. Tuters 2005). The term was originated in an effort to distinguish the emerging body of creative work undertaken with new mobile technologies from the commercial impetus of location-based services (Marc Tuters 2004). Locative media experiences come in a range of types and a number of – sometimes interchangeable – terms are used to describe them, for example: *location-based*; *augmented reality*, where digital media is overlaid onto the real world (Izadi et al. 2002; Vlahakis et al. 2002; Zimmermann and Lorenz 2005; Gildersleeve 2015), *mediascapes*, a term coined by HP Labs to describe locative experiences, part in relation to their Mscape authoring tool (Behrendt 2005; Reid, Cater, et al. 2005); *context-aware*, often used to describe works where a range of contextual data is used other than purely positioning technologies (Yu et al. 2008; Elliott and Tomlinson 2006; Abowd et al. 1996); *mixed-reality*, to describe the combination of real-world activity combined with online activity (Benford and Giannachi 2011; Crabtree et al. 2004; Galani 2003; Flintham, Benford, et al. 2003) and specifically in relation to location-based games, the term pervasive games (Benford et al. 2003; Chamberlain et al. 2010; Waern, Montola, and Stenros 2009). For clarity, the author has adopted the term 'locative' for the work of this thesis.

The development of Locative media experiences was driven by advances in mobile technologies such as Global Positioning System (GPS), Geospatial Information Systems (GIS), Cell Tower and (WiFi) wireless networks, sensors such as accelerometer and magnetometer and mobile devices and portable computing devices such as PDA's (and later on mobile phones) (Hemment 2006; Bleecker and Knowlton 2006; Tanaka and Gemeinboeck 2008; Bilandzic and Foth 2012; Benford et al. 2005). Artists are often early adopters of technological developments (Rueb 2002) and in this instance they were consequently "*asking what can be experienced now that could not be experienced before [...] a new understanding of the relation between physical and digital* (Hemment 2006).

Various definitions for locative media abound, such as "*the use of mobile, networked, location-aware computing devices to involve participants in mapping processes, social networking or artistic interventions*" (Tanaka and Gemeinboeck

2008, 3) and a “set of tools and technologies involving computing, mobile technologies, physicality, and location” (Flanagan 2007, 1). This endeavour has been classified in a number of ways, for instance Hemment’s (2006) taxonomy of locative art contained three high-level themes, *mapping*, *geo-annotation* and *ambient*. ‘Mapping’ represents a dominant function of most locative media experiences “making data geographically specific or placing a digital object in space” (Hement 2006, 350). Bleecker and Knowlton (2006) formed a taxonomy for exclusively GPS driven locative media, which consists of four themes: *geographic space*, *map hacking*, *experiential mapping*, *cartographic legibility*, *mixed reality*, and *hyphenation*. This thesis is most closely aligned to that of *geographic mapping* (Bleecker and Knowlton 2006) and *ambient* (Hement 2006). For the purposes of this survey, attention is turned directly towards examples of sound and music related locative media, rather than the full gamut of media content (e.g., video, images, text). Thus this is not a survey of ‘Locative Media’ per se, but rather a focused exposition of pertinent locative and mobile sound and music experiences, the principal concern of this thesis.

2.4.1 Locative and sound and mobile music

A notable body of locative sound and music research has been published at a range of HCI venues, such as ACM SIGCHI, ACM SIGGRAPH, ACM Ubicomp, ACM Multimedia, ACM UIST and New Interfaces for Musical Expression Conference (NIME). New Interfaces for Musical Expression Conference (NIME) originated as a workshop at 2001 SIGCHI conference, but since 2002 has been held as a conference in its own right. Another group of note engaged in this area was that of the Mobile Music Workshop, steered by Nicolaj Kirisits, Lalya Gaye, Frauke Behrendt and Atau Tanaka (Kirisits, Behrendt, et al. 2008). The annual workshop was hosted between 2004 – 2008 provided a platform for the academic and artistic exploration of mobile music (Kirisits, Gaye, et al. 2008).

Frauke Behrendt’s taxonomy of mobile music (2010), partitions mobile music into four categories, *musical instruments*, *sound platforms*, *sonified mobility*, and *placed sounds*. The last two of Behrendt’s four categories (*sonified mobility*, and *placed sounds*) are most relevant to the work of this thesis and consequently covered here. These two categories are augmented by three others *soundwalks and audiowalks*, *sound and music audio tours in cultural settings* and *sound and music navigation*. This is not an exhaustive survey, but rather a collection of notable and pertinent examples.

2.4.1.1 *Soundwalks and audiowalks*

Soundwalking, or soundwalks grew from the work of the *World Soundscape Project*, led by R. Murray Schafer (late 1960s to mid 1970s) (Schafer 1993). Schafer was concerned that new technological developments were changing the natural soundscape of our cities, towns and rural areas. The project set about capturing ambient recordings of various locations so as to preserve the eroding 'soundscape' of environments (Schafer 1993; Truax 2008; Truax 2015). This led to the notion of the 'soundwalk': a walk through an environment with the specific intention of focusing on the naturally occurring ambient soundscape, where the listener also in part becomes the composer, or performer, as their chosen route and walking pace shapes the changing ambient sound events heard (Basco 2011; Adams et al. 2008; Drever 2009; Hochmair 2004; Schafer 1993).

'Audiowalks' grew out from the notion of 'soundwalks', here the listener is similarly encouraged to explore a physical space, but these explorations of ambient sound are augmented by the presentation of pre-recorded audio, listened to on some form of mobile audio player. The works of Janet Cardiff stand at the forefront of 'audiowalks' (1991 – on-going). These are fixed duration walking experiences, with no use of positioning or sensor technologies to connect the listener to the location. Typically her works overlay a narrative onto the space, such as *Her Long Black Hair* (2004) a 46 minute walk through Central Park in New York (USA) (Basco 2011) or *The Missing Voice: Case Study B* (1999) (Pinder 2001). In discussing the latter work, Pinder states that, "*testament to her own urge to construct scenarios and narratives around her everyday encounters, something she associates with 'a desire to dramatize my life, make it real by making it filmic or probably the result of reading too many detective novels or watching too many movies'*" (Pinder 2001, 8). There are many examples of 'audiowalks', too many to discuss here, but the intention of the medium is to construct sound in response to an environment, like audio guides for fictional tours, which now turns our attention to a brief view of context-aware technologies used in audio tour guides in cultural settings.

2.4.1.2 *Music in cultural settings*

In cultural settings such as museums, galleries, exhibitions, tourist routes the use of 'audio guides' are firmly established. Typically, they consist of some form of mobile device with headphones carried by the visitor that presents various media, such as narrated 'sound bites' or images, which describe an artefact, artist, or point of interest. Predominately, they are manually controlled where the visitor selects the corresponding media to the point of interest or artefact. In

comparison to these traditional audio guides, more contemporary systems place a focus on automation, personalisation and interaction, via a range of sensor equipped mobile technologies.

One of the earliest examples of a context aware guide was the Georgia Tech *Cyberguide* project (Abowd et al. 1996), that declared that “*applications for mobile environment should take advantage of contextual information, such as position, to offer greater services for the user*”. The Cyber Guide system was represented by a number of prototypes and scenarios for different uses, which explored how this contextual intelligence could be realised. Scenarios described a range of context-aware functionality such as directing visitors around a museum, displaying an overlay image on top of the real-world or the translation of languages.

The Fraunhofer Institute for Applied Information Technology developed *Listen* (Eckel 2001; Zimmermann and Lorenz 2008; Zimmermann and Lorenz 2005), an immersive multi-layered system in a museum setting. It was deployed in the Kunstmuseum in Bonn, in October 2003. Visitors wore motion-tracked headphones that could render three-dimensional space. This augmented reality system overlaid a virtual auditory space upon the physical space, so as one stimuli (real visual or auditory) is navigated the other is correspondingly traversed. Thus, only the content that is related to the artefacts they interact with is presented. A range of speech, music and sound effects were presented that were triggered by a visitor’s location and head orientation to an artefact. A series of *object zones* around the artworks triggered sound and music content, increasing in volume as a visitor approached. Within these *object zones*, *near-field* zones were placed, which focused on specific areas of the artwork. These zones – controlled by head orientation – triggered artwork related detail related to what the visitor is looking at. Sound cues, or ‘attracters’ are also broadcast to attract the attention of users towards objects not in their visual range (Eckel 2001; Zimmermann and Lorenz 2008; Zimmermann and Lorenz 2005). A user study revealed some challenges for the design of the system, such as how best to define the appropriate size of overlapping zones, which resulted in some visitors not recognising which zone related to which soundsource.

Bornträger et al. (2003) and Cheverst et al. (2000 a; 2000 b) developed several iterations of a city guide for Lancaster called *GUIDE*. The system presented – via pocket PC’s – a combination of media types such as audio, text, maps, video and web access to accompany both orchestrated trajectories and flexible user-led exploration of cultural experiences. A GPS receiver was used to trigger content in

relation to points of interest. A field study revealed that the audio commentary was deemed particularly effective, as it did not distract attention from engaging with points of interest or navigation tasks.

Contemporary work in this research area include Fosh et al. (2013), who designed a visiting experience for a sculpture garden using Benford et al.'s *trajectories* theory (2009). Fosh et al. (2013) developed a 'trajectory of interaction' where music and narration was introduced and withdrawn at key points of engagement. Although set in an outdoor environment, they opted for manual visitor control, rather than adopting a positioning technology to automate the media content. This was to avoid the 'seams' that result from the application of GPS technologies (Chalmers and Galani 2004; Benford et al. 2004; Cater et al. 2007).

These examples all share some similar qualities. First, audio content such as sound, speech or music can be an effective medium to accompany and enhance locative activities. As audio does not require the user to look at a screen, which can distract attention away from the artefacts and points of interest in the space and can be rich in imparting information and creating a fitting mood and atmosphere (2003; Cheverst, Davies, Mitchell, Friday, et al. 2000 a; Cheverst, Davies, Mitchell, and Friday 2000 b; Fosh et al. 2013). Second, they recognise that context can be a valuable asset in augmenting the user experience, such as guiding people through a space (Eckel 2001; Zimmermann and Lorenz 2008; Zimmermann and Lorenz 2005; Broadbent and Marti 1997; Abowd et al. 1996).

2.4.1.3 *Sound and music navigation*

Audio and music have been extensively explored in the study of mobile navigation systems, a briefly survey of this area now follows.

The first example concern a system called *Guideshoes* (Nemirovsky and Davenport 1999). The proposed system "*consists of a pair of shoes, equipped with a GPS, wireless modem, MIDI synthesizer, CPU, and a base station that acts as the central unit for data processing*" (p.1). The authors argued that using music would reduce the potential for cognitive overload in the navigator (as opposed to speech), so they promoted the notion of using the emotional quality of the musical fragments – "*emons*" – as navigational instructions, arguing that user would instinctively recognise their qualities and map them accordingly to spatial positioning. The authors do not go into great detail about what these mappings were, but presumably they used the spectrum of emotions (i.e., 'Acceptance, Anger,

Anticipation, Disgust, Fear, Joy, Sorrow, and Surprise' (Nemirovsky and Davenport 1999)) as a type of musical 'hotter / colder' interaction to inform the user regards their position to a destination.

A group of projects have explored the dynamic adjustment of loudness, frequency and stereo spatialization of sounds and / or music as a means to convey navigational instructions (Strachan et al. 2005; Etter and Specht 2005; M. Jones et al. 2008; Holland, Morse, and Gedenryd 2001). In *GPS Tunes* (Strachan et al. 2005) a PDA device used GPS for positioning and magnetometer for orientation displayed a map of the user's current location, in relation to their chosen destination position. The loudness of the music was characterised by comparing the user's current latitude and longitude coordinates to that of their destination – louder for closer, quieter for further away. Furthermore, the user's orientation to the destination was referenced spatially, by panning the music across the stereo field – pan to the right equating to the destination on the right, and pan to the left equating to the destination on the left. A user study returned promising results although with a very small sample size (Strachan et al. 2005). Similar to *GPS Tunes*, *Melodious Walkabout* (Etter and Specht 2005) used stereo panning to communicate spatial orientation, but explored equalisation attenuation to represent distance, i.e., a graduated low-pass filter, shifting the cut-off frequency in relation to the distance the user was from the destination.

A different approach – namely *audio beacons* – was taken with *Sound Buoys* (Blenkhorn and Evans 1997), as a sound-based navigational system for people with visual impairments. Points of interest (i.e., buildings) would be fitted with FM receiver beacons. The user then carries a FM transmitter that sends a signal to the receiver, which responds with series of 'beeps', the duration and rate uniquely combined to enable the user to identify different buildings. This example shares some similarities with stingers or leitmotifs as found in media soundtracks, in that specific sound signify a 'thing' (Phillips 2014; Collins 2007).

This thesis work does not engage in matters of sound navigation and thus it has deliberately steered away from using the stereo spatialisation, or filter equalization to represent relative position in the physical world. Nonetheless this body of work reveal some insights about how humans perceive sound and music, methods of presentation in location-based settings and some examples of connecting music and sound to objects in physical space. Now we move on to the two categories of Behrendt's (2010) taxonomy.

2.4.1.4 *Sonified mobility*

Experiences under the banner of sonified mobility take advantage of a user's movement (e.g., walking) around a location to either produce or manipulate the heard sound / music (Behrendt 2015; Behrendt 2010). Various sensor data types captured are then sonified via some mapping structure in a sound synthesis software platform. A selection of examples now follows.

Taking Soundings (Harris 2007) mapped GPS traces captured from walks on the Brittany coast to a static sound art installation, where the latitude, longitude and altitude, compass and inferred velocity readings were mapped through a Max/MSP environment to create an arrangement of 'clicks' and 'tones'. Whereas, *Score for an Open Car* (Harris 2007), similarly used live GPS traces captured whilst driving to create an abstract soundtrack (also mapped through a Max/MSP patch) listened to in real-time in the car, that overlaid an abstract soundtrack that respond to the journeys twists and turns.

Sound Mapping by Ian Mott, Marc Raszewski and Jim Sosin (1998) was a site specific 'mobile sound installation'. The site was the Sullivan's Cove district of Hobart, in Tasmania. The installation consisted of four players each wheeling a suitcase around the area. Three of the suitcases contained a radio transmitter and receiver, an odometer, two piezoelectric gyroscopes sensors and a public address system. The radio receiver was connected to the forth 'hub' suitcase, which also contained a GPS receiver and laptop running a four channel sound module. The arrangement of the music was controlled by two layers of interaction: a global level where the GPS was used to select specific algorithms attached to locales to process the sound sources for each suitcase; and then a local level, where the odometer and two piezoelectric gyroscopes attended to a finer detail of sound interaction. Behrendt (2010) observed this work as an important early example of attaching sound to physical space.

In producing *Sonic City* Gaye et al. (Gaye, Mazé, and Holmquist 2003) wanted to create a responsive real-time soundtrack using data captured at the point where the listeners body and environment intersect. The system infrastructure used a wide variety of sensors integrated into a jacket, which captured physiological and body positioning data (e.g., heart rate, walking pace, bearing, stopping / starting) and environmental data (e.g., light levels, ambient noise, and temperature, electromagnetic activity). The sensor data underwent a detailed set of mappings to control musical parameters in a Pure Data (PD) synthesis environment running on a laptop, which was carried in a backpack. The

mappings triggering a range of sample sounds and sound processing techniques such as filtering, frequency modulation and effects. For instance proximity to metal triggered filtered echoes, and stopping ceased any rhythmical content. A user study with seven participants produced positive results, they sought out opportunities for interactions, although at times did not recognise what had caused a musical interaction, they felt an enhanced awareness of their environment and formed connections between musical patterns and patterns in the physical world (Gaye and Holmquist 2004).

Sensory Threads (Bryan-Kinns et al. 2009; Fencott and Bryan-Kinns 2009), shared some similarities with *Sonic City* (Gaye, Mazé, and Holmquist 2003) and *Sound Mapping* (Mott and Sosnin 1997). *Sensory Threads* constituted of an urban group walk where each walker was equipped with a different wearable sensor. As with *Sound Mapping* (Mott and Sosnin 1997), this was also a social experience with quartet of player / listeners wearing wireless headphones. One carried the computer running an audio synthesis platform, who also wore a heart rate monitor, which controlled the pulse of the generated music. The second participant wore a noise sensor, and the third and forth a light and proximity sensor respectively. They used a variety of mappings of the sensor data to pitch, pulse, filter, and density of sound. In contrast to the previous examples they produced a soundtrack in the style of ambient electronica.

RjDj (*Reality Jockey Ltd*) produce a range of commercially available “*sonic experience*” applications for modern smart phones, under the banner of ‘reactive music’. The ‘apps’ uses a version of PureData¹⁰ as generative sound environment and use the phone’s microphone to capture and manipulate ambient sound along with the phones accelerometer, which controls other sound design parameters (Reality Jockey 2015). A unique aspect of this app was that people could download a scene generator to create their own ‘scenes’ (i.e., a PureData patch).

The examples above share some similar attributes. The first concerns the direct connection between facets of the environment (e.g., location, proximity, environmental conditions, ambient sound) and the music heard, as mediated by a user’s movements through the space. Second, specific mappings between sensor data and sound features / parameters are utilized as control mechanisms to create responsive soundtracks. Furthermore, in relation to this last point, the

¹⁰ <https://puredata.info>

majority of these mappings regulate parameters such as filters, effects, and equalisation, whereas little, or no attention is given to musical features such as melody, harmony and rhythm. This may just be as a result of stylistic choices, or might also be steered somewhat by the nature of the sound synthesis software platforms used (i.e., Max/MSP, Pure Data, SuperCollider). The final example in this section – *Ambient Addition* (Vawter 2006) – does consider traditional musical features. The system consists of a pair of headphones with a microphones attached to the earpieces and a programmable DSP chip. The microphones capture the ambient noise, whereupon a Fast Fourier Transform (FFT) extracts its fundamental pitch. The system is essentially a phase vocoder. “*With a phase vocoder, you can say, ‘I want everything to sound like [the note] A right now’*” (as quoted in Swanson 2007). Ambient sounds are captured upon which harmonic and rhythmic patterns are generated “*lending rhythm and harmony to a dissonant world*”. Ambient Addition is the only example that discusses traditional musical features in its design. However, the harmonies and rhythms extracted are still generative and completely dependent on the unforeseen and randomised combination of the ambient sound input. Thus, these are ‘musical’ snapshots, detached musical events, rather than a coherent musical form constructed by a sequence of related and crafted musical events.

2.4.1.5 *Placed sounds*

Placed sound experiences refer to sound or music experiences that utilize pre-composed sounds triggered by some form of positioning technology, such as GPS, Bluetooth or wireless network (Behrendt 2015; Behrendt 2010). As such, these are similar to those ‘rendered’ interactive computer game soundtracks (Phillips 2014), as they share the same non-linear construction, i.e., a user explores the space and the duration and sequencing of the audio is responsive to there routes and pace. Moreover, placed sound experiences are site specific. Behrendt (2015) notes a range of different types, such as historical, fictional, tourist (e.g., GPS My City 2015; TrekExchange 2014), educational, experimental, game, and musical.

Riot! 1831 (Reid et al. 2004; Reid, Hull, et al. 2005) was a historically based locative audio drama. The locative experience took place in a public square in Bristol, and was authored using HP Labs Mscape platform¹¹, which facilitates the

¹¹ Mscape is short for mediascapes, which is the term HP Labs used to describe locative media experiences.

drawing of polygon zones (regions) that trigger prepared audio files. The square was partitioned into a number of zones that presented a selection of narrative sound effects and mood music. Over 700 people tried out the experience and subsequently conveyed positive feedback. Some of the key observations were that people form unforeseen connections between the virtual and real world; the audio soundtrack provokes a different perspective on a listener's environment; there can be some uncertainty as to whether sounds heard are in the real or virtual world; and finally, to create an immersive experience transitions between sections need to be smooth and 'non-jarring' (Reid, Hull, et al. 2005).

The digital artist, Teri Rueb has been at the forefront of locative sound and music experiences. *Trace* (Rueb 2002) is an early example of a placed sound work. Participants – carrying a rucksack with a prepared laptop and a GPS receiver – hiked a network of trails in the Canadian Rockies, where their position triggered the prepared sounds, which the artist described as “*memorials and contributed to this sonic cemetery where, instead of visible monuments, visitors would weave their way through a series of sounds that punctuated the landscape, itself a memorial record of natural history*” (Rueb 2002, 3). Rueb's work typically consists of a combination of spoken word and accompanying sounds or music. Other works include *Core Sample*, which combined a mixture of processed and natural sounds that accompanied a walk around Spectacle Island in the Boston harbour (Rueb 2014b; Behrendt 2013); *Drift* (Rueb 2015), *No Places with Names* (Rueb and Phan 2012) and *Other Order* (Rueb 2014a). Rueb's work shares some similarities with the 'audiowalks' of Janet Cardiff, a key distinction being Rueb's engagement with positional technologies (i.e., GPS) to place or attach the sounds to specific locales.

Savannah (Benford et al. 2005) is an example of a locative game, in this instance for groups of children to “learn about the ecology of the African Savannah”. The game is played out in an open, empty field, where a group of 6 children role play a pack of lions needing to undertake certain activities to survive, such as marking their territory and finding food. In this instance the location is just a stage, an empty platform upon which a virtual world is placed. The user study of the game revealed some of the challenges inherent with using unseen positioning technologies, in this instance GPS, which is prone to errors (Benford et al. 2005).

Location33 (Carter and Liu 2005, 33) set out the discovery of a locative music album. A series of '20 nodes' (GPS hotspots) were located in Culver City California, where each node triggered a fragment from a song such as verse or a chorus. Some additional narrated speech gave clues and directions to aid the

discovery of other song fragments. The complete album was authored over a period of a week, so the mappings of musical fragments evolved over the course of seven days (i.e., different song mapped to the same locales each day). A HP iPaq PDA reported the listener position over WiFi network to a server that would stream back the appropriate audio fragment.

The majority of these and other works (including those in the category of sonified mobility) were produced between 1999 and 2007/8 and used varying types of PDA pocket computers as the mobile device. The sensor equipped smart phone was introduced in 2007 (Bilandzic and Foth 2012) and the iPhone in 2008, which represented a step forward in the availability, accessibility and functionality of mobile computing devices. Interestingly, as stated by Varnelis, “[l]ocative media remained the stuff of demos and art-technology festivals until 2008 when Apple released the GPS-enabled iPhone 3G. Paradoxically, the mass realization of locative media seems to have taken the wind out of its sails as an art form. Although courses on writing apps proliferate in art and architecture programmes, the promise of locative media seems to remain just that: a promise” (quoted in Zeffiro 2012, 1). Whilst there does appear to have been a decline in academic investigation of locative sound and music, there has in contrast been a rise of commercially released examples of locative media such as the ‘location-based album’. As these examples are not rooted in academic research there is little ‘behind the scenes’ information as to their approaches and mechanisms. These location-based albums come in the form of downloadable mobile ‘apps’ and can only be heard by attending the site for which they have been authored.

Jorge Drexler composed a set of three ‘app songs’ (i.e., n1, n2 & n3) each using a different context aware interaction (Small World Music 2014). For instance, n2 (*Driftwood*), places the user in control of the orchestration of the song’s instrumentation. As the user explores the site, they unlock – via GPS – the various instruments of the song, thus they progressively construct a personalised arrangement. BlueBrain, often considered pioneers of the ‘location-based album’, have to date produced three: *The National Mall*, to be listened in the National Mall Park in Washington DC, in USA; *Listen to the Light* composed for Central Park in New York, in USA; and *The Violet Crown*, which was commissioned for the 2012 SxSW festival¹². These are all large-scale musical works that appear to contain a

¹² SxSW: is an annual interactive media, music, film festival hosted in Austin, Texas, USA <http://www.sxsw.com>

fusion of contemporary and orchestral styles¹³. For example, a Washington Post blog review of *The National Mall* states that there is over three hours music and 264 zones distributed across the Mall (quoted in Behrendt 2012). As with the majority of placed sound works, they use GPS positioning via an authored mobile application. Behrendt (2012) proposes that placed sound experiences involve a process of re-mixing, where the user in response to their chosen route and pace acts as the arranger of the music.

In 2015, Swedish folk band *John Moose* released their debut album, where every song represents a story about a fictional character called John Moose who quits his job moves into a forest (Moose 2015). This is also an app only album, but rather than being site specific, it is specific to a certain environmental feature – forests. The app works by identifying the particular colour green that Google Maps uses as a signifier of the forest habitat, so once the user's smart phone (or any GPS enabled IOS or Android device) establishes that they are situated in this habitat, the app will commence playback (Blistein 2015).

2.5.2 Summary of locative (sound and music) media

The examples highlighted in this section have revealed a number of pertinent themes. First, locative and context-aware systems are used for range of functions, such as information guides for cultural visiting, novel navigation systems and a wide range of sonic art experiences. This highlights the recognised and exploited potential, and value that music and sound can impart on locative experiences. Behrendt argues that one of the issues with locative media is the reliance on the mobile display, which is counter-intuitive for the setting, thus a balance should be sought which draws on a 'multi-sensory' approach (e.g., the application of sound / music is one of the ways to address this) (Behrendt 2012). At the core of locative work is an intention to form connections between place or artefact and the user as mediated through an audio soundtrack. Evidently, locative audio guides and navigation systems are there to support an activity (i.e., discovering artefacts in a gallery or way-finding between two locations) and as such take 'second billing' to the main event they facilitate. Whereas, with exploratory sound art (*placed sounds* and *sonified mobility*) the sound and music is the lens through which the experience is framed, it shapes how the environment is re-interpreted or re-appropriated, and as such it is the primary modality. In external

¹³ Little information is available, however some promotional videos play snippets of the music. <https://vimeo.com/24252332> (The National Mall); <https://vimeo.com/31024982> (the making of Listen to the Light)

settings, GPS is the predominant positioning technology, although a number of challenges and restrictions have been well documented (Reid, Cater, et al. 2005; Benford et al. 2005; Benford et al. 2004; Modsching, Kramer, and ten Hagen 2006). The majority of the technical infrastructure and systems used in these experiences are bespoke hardware and software designs, and a ‘systems focus’ is often the fundamental direction of the work. This is not particularly surprising given that this body of research was unfolding in parallel to the development and increasing accessibility of these new technologies. Nonetheless, this appears – in the author’s view – to have diverted attention from reporting detail about creative matters such as the fine ‘musical’ detail of generative synthesis or rendered sounds. Furthermore, not many of the locative sound / music experiences have been well documented from the perspective of the user experience and this is an unfortunate omission (with the exception of *Riot! 1831* (Reid, Hull, et al. 2005) and to a lesser extent *Sonic City* (Gaye and Holmquist 2004) which has only published brief accounts of user feedback and observations. This stands in contrast to many other types of locative media experiences, particularly the in realm of locative games which has seen extensive user studies (e.g., Benford et al. 2004; Flintham, Anastasi, et al. 2003; Björk et al. 2001; Paterson et al. 2013; Benford 2010; Benford et al. 2006; Chalmers et al. 2004; Bell et al. 2006). Consequently, little is known about how these differing locative music experiences are perceived by users. Moving on to matters of musical style, as noted previously, the majority of the music in these examples would be described as *musique concrète* or electro-acoustic music, with the exceptions of those commercial examples by Bluebrain (Bluebrain 2015b; Bluebrain 2014a), Jorge Drexler (Small World Music 2014) and John Moose (Moose 2015).

2.5 Position of thesis

The work charted here is an attempt to define an idiom for composing locative soundtracks, which Tanaka and Gemeinboeck (Tanaka and Gemeinboeck 2008), whilst developing *Net_Dérive*, first called for. As discussed, soundtracks are integral to many of our everyday activities, particularly in display media. The role of the soundtrack is typically to support the visual narrative, thus to be a secondary modality (Gorbman 1987; Davis 2010). In most prior locative music experiences the soundtrack constitutes the primary modality, the shaping feature of the experience. It seems surprising, therefore, that musical soundtracks in a filmic sense have not yet been widely explored as accompaniments to locative experiences. This appears to represent a gap in this field of research and is one that this thesis aims to address. By locative experiences, the author is referring to

those type of formally orchestrated activities such as cultural visiting, nature or urban walks, tourist trails, and pervasive games; locative experiences that have an ingrained purpose that take users on a journey in, through and out of engagement with a range of locales and points of interest. Yet another under explored area in locative media concerns the techniques employed to create locative music. Prior research discusses general, high-level principles, predominately referring to generative synthesis, but little that actually ‘drills’ into a finer granularity of compositional craft. This, then, characterises another key facet of this thesis investigation. Moreover, whilst film and computer game soundtracks explore and exploit a wide range of musical styles from popular music to musique concrète, tonal music in the western tradition still appears to be (in the western world) the dominant musical language; presumably as this is what we are most used to listening to. The use of tonal music in locative experiences has been largely reserved for those commercial, undocumented examples (Small World Music 2014; Collier 2015; Moose 2015). In sum, the author intends to explore the development of some guidelines for composing locative soundtracks, where the function of the soundtrack is to support a location-based activity, from a subordinate position, using traditional western diatonic methods of composition with a placed sounds infrastructure. Additionally, user studies will be undertaken to capture a detailed picture of how musically accompanied locative experiences such as the ones charted here are experienced, to further augment the guidelines and understand the nature of this area of research.

Chapter 3 - Follow the music

3.1 Introduction

Chapter 3 presents the first research activity; a quasi-experimental study which investigated how music can interface with walking experiences by considering how adaptations to certain musical features may influence walking behaviours.

Twenty-two participants walked around an open field while listening to four contrasting musical compositions, having been asked to “*follow the music*”. The creation of each composition was motivated by concepts of spatial metaphors within musical features which were dynamically adapted by the participants’ movements around the study area, using GPS location services running on a smart phone. The findings reveal that participants applied different interpretative approaches and strategies for interpreting the musical features in relation to the physical space, which influenced on their choice of stopping destinations. The following discussion presents some notional connections between musical structure and spatial structure to be taken forward. This chapter charts the design, implementation, analysis and discussion of this study.

3.2 Objectives

The objectives of this research activity were as follows:

1. To compose a series of short compositions that each adapts a different musical feature (i.e., melody, harmony, timbre, and dynamics), whilst maintaining a coherent musical structure.
2. Each composition to draw upon one or more music related conceptual metaphors (as discussed in Chapter 2, section 2.3.4), which represent the features under adaption.
3. To deliver these compositions via a bespoke ‘app’ authored in *AppFurnace* to run a smart phone. The smart phone will use the mobile device’s location services (GPS) to initiate musical adaptations.
4. To study how a group of participants perceive, interpret and respond to these musical adaptations when asked to ‘follow the music’ around an empty field.

3.3 Compositional motivation and approach

This section describes the method, approaches and motivating factors used to shape the composition and delivery of music in this study.

3.3.1 Classes of musical features

A key outcome of this study was to explore the adaptation of some fundamental features that make up traditional western tonal music (i.e., melody, harmony, rhythm, dynamics and timbre). Therefore, for the purposes of this study the author / composer categorized these features into three classes: *melodic*, *dynamic*, and *colour*, which are described below:

- *Melodic* class: contains both melodic and harmonic elements (e.g., melodies and chord sequences).
- *Dynamic* class: relates to any adjustment of musical dynamics or intensity. They include dynamic contours (e.g., crescendo or decrescendo) and dynamic events (e.g., accents).
- *Colour* class: colour refers to an instrumental timbre or combination of timbres (i.e., texture); articulation; and sound production techniques (e.g., spatial positioning, modulated or spatial effects and synthesized sounds).

The notable omission is *rhythm* as a discrete class in its own right. The rationale for not classifying rhythmical features in this way was principally related to the functionality of the *AppFurnace* mobile ‘app’ authoring platform. *AppFurnace* uses geo-location trigger zones to initiate playback of media and as such it extends no straightforward method of ‘musical’ synchronisation. This means that a musical cell or stem is instigated in relation to a user entry into or exit out from a trigger zone, with no bearing or relation to any other audio currently playing. Thus it was considered problematic to attempt adjustments to the music’s rhythmic content given that rhythmic synchronisation of cells and stems was not possible.

3.3.2 Motivation

As discussed in Chapter 2, a key characteristic of human’s perception, understanding and communication of the nature of music is one that is enveloped within metaphors of spatiality and physicality, to construct a tangible form around something intangible – embodied cognition (M. L. Johnson and Larson 2003; Larson 2012; Zohar Eitan and Granot 2006; Saslaw 1996; Zbikowski 2008; Z. Eitan and Rothschild 2011). This study drew motivation from the concept of image schemas and their related conceptual metaphors as detailed here. First, when considering the composition of adaptive music for walking experiences a series of questions are immediately presented, such as ‘what do you adapt and why?’ The image schemas such as the *container* (e.g., this music is in the key of ‘D’); *verticality* (e.g., ascending / descending pitch) *force* and *balance*

(e.g., tension and release / cadence); and *source-path-goal* (*melody is movement along a path*) promptly presented a sense of purpose, regarding the type of musical features to adapt and how they may in turn shape the structure of the composition. Second, these conceptual metaphors offered a starting point for investigating whether humans spatial conceptualising of music can in turn function as an influence on walking activities (see Objectives in section 3.2).

3.3.3 Methodological comment

Although this study was undertaken predominately in a controlled manner a degree of creative freedom was given to the composition of the study's music; meaning that fully formed musical structures were used as opposed to a set of discrete 'musical sounds' (e.g., an isolated melody, where the adaptation changes the pitches; or a sustaining drone that adapts just the tonal quality; or a sustained chord with no other embellishment that adapts to another chord harmony). The utilization of 'musical sounds' would have also been a valid approach and one that may have offered a tighter investigation of how the participants perceive and respond to the musical features. However, the rationale for using detailed musical structures that contained a range of musical elements such as counter-melodies, accompaniments and embellishments in addition to those musical features under adaptation was justified by the following rationale:

- As this thesis endeavours to address guidelines for the composition of locative music soundtracks and as such it considers the perspective and practices of the composer. Therefore, it was important that the music used within this study was created via traditional compositional practices, with all the normal demands and considerations that fully composed music entails.
- The composer then needs to consider how to successfully balance those musical features adapted against the other competing musical features that form the general orchestration of the musical structures.
- By using fully formed musical structures the participants' were presented with a listening experience that felt authentic, thus one that assisted in capturing a range of subjective data such as their thoughts and feelings.

3.4 Study design

This section details the study design with accompanying descriptions of the design rationale.

3.4.1 Study setting

The study was undertaken in a sports field next to The National College for School Leadership, The University of Nottingham. The field was free from constructions or obstacles, was unmarked (e.g., no marked boundary lines for a football pitch) and was bounded by a series of fixed boundaries such as hedgerows, paths and buildings and a car park. Two footpaths intersected across the field on either side that were situated towards the outer edges. No other public activities were engaged or occupying any part of the sports field during the days and times this study took place.

3.4.2 Music compositions

Four music compositions were composed for the purposes of this study. They were all instrumental and each in a different style, which incorporated a range of acoustic and synthesized sound sources.

3.4.2.1 Composition 1: Increasing voice density

The adaptive elements of this composition (C1) drew from two feature classes: *dynamics* and *colour*. The composition was constructed around five stems that each contained a single instrument part of a contrasting timbre (*colour class*) and melodic and rhythmic content. Each successive geo-located trigger zone introduced a single stem, which in turn increased the textural density of the composition, thus creating a rising contour of dynamic intensity (*dynamic class*) (see Figure 2Error! Reference source not found.).

Z1	Z2	Z3	Z4	Z5
				Voice sample
			'Synth' rhythmic pulse	
		Electric Piano melody		
	Choir 'style' harmonic sequence			
Bass drone				

Figure 2: Voice density

This composition was motivated by the conceptual metaphor of *crescendo* (*growth*) *infers motion towards* and *diminuendo* (*reduction*) *motion away*. Thus, this composition explored whether participants interpreted the increasing density of musical layers as suggestive of movement towards a location (e.g., 'getting closer to' or 'entering into') and the inverse, would a graduated thinning of musical texture imply the feeling of 'moving out of' or 'away from' a location? What

influence, if any, will this have upon their choice of destination location for instance would the rising contour lead to a destination? The illustration in Figure 2 **Error! Reference source not found.** shows five trigger zones and the arrangement of stems that enter at each.

Error! Reference source not found. Table 1 presents a description of the five stems used in composition 1 and their mappings to the *AppFurnace* trigger zones. Composition 1 can be heard alongside an accompanying animation showing the mapping of musical features to trigger zones at: <https://youtu.be/LVmLxsBYL4s>

Table 1: Description of the musical stems in Composition 1

Stem	Zone No.	Title	Description
1	1	Ground Bass / Drone	This layer consists of a sustained D octave with a processed Double Bass / Cello timbre
2	2	Choir harmony	A processed ‘choir’ style timbre states a series of harmonies in the key of D minor
3	3	Delayed Pulse	An sine-wave synth sound, filtered with a heavy vibrato and echo
4	4	Electric Piano	Sparse melodic fragments of random rhythmic and melodic construction
5	5	Voice sample	A heavily processed voice sample that progresses through a filter and echo

Compositional description, approaches and considerations

Stylistically this musical structure was ambient and abstract, making use of largely synthesized and heavily processed sound sources. Although it contained melodic shapes and themes, their arrangement and production created a ‘wash’ of musical textures rather than a ‘melody and accompaniment’ arrangement. The tempo was slow (60bpm). The process considered the following two aspects:

First: each stem needed to be audible upon entry, so the participant would recognise a change in the texture of the music. This was achieved by: (1)

composing each stem to a contrasting timbre, so when combined with others stems' each occupied its own tonal space; (2) each stem was separated vertically across a wide pitch register, so each layer occupied its own pitch area; and (3) the total number of stems was limited to five, as it was deemed that the texture make become to dense to recognise further stem additions.

Second: to address the absence of rhythmical synchronisation in *AppFurnace*, most stems were composed with vague rhythmic content (not regular cycles, with the exception of layer 3) in an attempt to reduce the impact of the uncontrolled horizontal arrangement of stems and their subsequent interaction. Careful choice of timbre and sound processing was also used to create rhythmical ambiguity, such as sound sources with a slow, soft attack, and liberal use of reverberation an digital delay to further blur note onsets.

3.4.2.2 Composition 2: Harmonic motion & Dynamic punctuation

The adaptive elements of this composition (C2) also drew from the *melodic* and *dynamic* feature classes. The composition was constructed around five cells that each contained multiple instrument parts. Each instance of a cell presented the same melodic themes and orchestrations, but their notes were re-voiced to a different chord harmony (*melodic class*). The sequence of chord harmonies if transitioned from zone 1 through to zone 5 presented a familiar chord sequence; a I-IV-II-V-I progression in the key of A minor (Ami-D-G-E7) (see Figure 3). The *dynamic class* was realised via a single accent placed at the initiation of each cell. This composition was motivated by the conceptual metaphor of *source*, *path*, *goal* and *balance* image schema. The chord progression sets out from the tonic chord (source) of the music's key and takes a journey (path) that leads it back to conclude on the tonic key (goal). The balance is formed from the source (tonic) and goal (tonic) that stabilities the harmonic shape of the music. Composition 2's focus was to observe whether the participants' perceived these harmonic shifts and whether they imparted any influence on their choice of destination. Additionally, how would they respond to the isolated accents that sound? Figure 3 illustrates the 5 zones and placement of chord harmonies within each zone. The red mark to left of each zone represents the presentation of the accent.

Z1	Z2	Z3	Z4	Z5
 A minor	 D Major	 G Major	 E7(b9)	 A minor

Figure 3: Harmonic movement

Table 2 presents a description of the five cells used in composition 2, their AppFurnace mappings and a brief description of the harmonic relationship between the chords. Composition 2 can be heard alongside an accompanying animation showing the mapping of musical features to trigger zones at: <https://youtu.be/t4g6VfZepCU>

Table 2: Description of musical cells in Composition 2

Cell	Zone	Chord	Description
1	1	A minor	Root chord
2	2	D Major	IV chord of the key
3	3	G Major	II chord of the key
4	4	E7b9	V chord of the key. Perfect cadence - produces a strong resolution back to the root chord. This chord contains significant dissonance: E-D (b7th) and E-F (b9th).
5	5	A minor	Return of root chord – an additional melodic theme is added to separate it from the A minor chord found in zone 1

Compositional description, approaches and considerations

The dominant content of this music was constructed around a repeated 1 bar arpeggiated piano figure, played at a tempo of 90bpm. The piano part was embellished by some other textures that were mixed at a lower level of loudness, which supported and embellished the orchestration, they were: a low cello pattern doubling the piano's bass line; two atmospheric synthesized sounds that picked out certain notes from the piano part; a low register synth bass, which presented short melodic phrases. The dynamic accent was formed by a single note event, formed from a combination of a 'bass drum' sample and a high register electric piano chord, processed with a large reverb effect.

In considering the composition of this music the following approach was taken: Each of the 5 cells of music contained identical musical material and structure apart from the altered harmony. The intention was to provide a repetitive

musical texture free from other evolving musical stimuli that might distract participants' attention away from the adaptive musical component (i.e., harmonic shifts). There was one exception to the above, which was applied in Zone 5. In order to distinguish it from the first instance contained in Zone 1 (both zone 1 and 5 presented the tonic harmony) an additional simple melodic theme played by a piano was added to its orchestration.

3.4.2.3 Composition 3: Ascending / descending melody

The adaptive elements of this composition (C3) drew from the *melodic class* of features and contained a combination of stems and cells. Upon entry into Zone 0, a single stem presented a consistent backing track, which continued to play unaltered by entry into, or exit out from, the other trigger zones. Following the initiation of the backing track, the successive five geo-located trigger zones (Zones 1-5) each introduced a single sustaining melodic pitch, which formed a simple step-wise ascending melody (when transitioning zones 1-5, then descending when transitioning zone 5-1) structured around a G minor 7th arpeggio (i.e., root, 3rd, 5th, 7th, root (octave higher)) (Figure 4). This was motivated by the *Verticality* image schema (*ascending pitch moves up, or towards* and *descending pitch moves down, or away*) and the *source-path-goal* image schema (*melody is motion along a path*). Composition 3 explored whether the participants would acknowledge and respond to the ascending / descending melody and whether it will influence their choice of destination location. The illustration in Figure 4: Ascending / descending melody shows the five trigger zones and the arrangement of stems that enter at each.

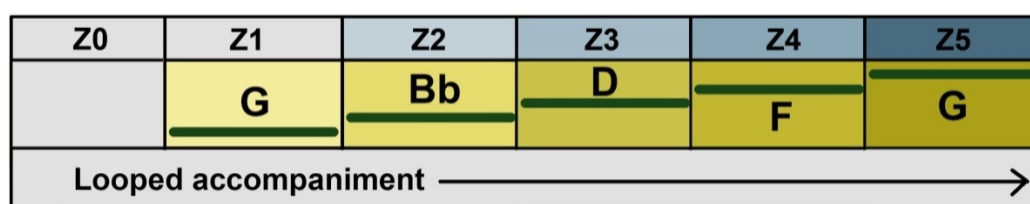


Figure 4: Ascending / descending melody

Table 3 details the structure of composition 3, with a breakdown of cells and stems their zone mappings. Composition 3 can be heard alongside an accompanying animation showing the mapping of musical features to trigger zones at: <https://youtu.be/yAaoDRZ7mYY>

Table 3: Mapping of zones to scale pitches

Cell / stem	Zone No.	Signifiers
0	0	Backing track (plays throughout all zones)
1	1	G (octaves at G2 & G3)
2	2	Bb (octaves at Bb2 & Bb3)
3	3	D (octaves at D3 & D4)
4	4	F (octaves at F3 & F4)
5	5	G (octaves at G3 & G4)

Compositional description, approaches and considerations

This composition was distinct in style, being the only one to employ a drum kit, which lent it a strong underlying rhythmic pulse as common in pop, rock and dance music. The backing track contained a repeated drum and bass guitar figure (1 bar cycle) and some synthesized textures (4 bar cycle) played at a tempo of 120bpm. It was deliberately created as a repetitive pattern, thus the only noticeable musical alterations were those presented by the melody. The melody was performed with a string ensemble sound.

In contrast to the other three compositions, this composition's spatial mapping contained six trigger zones. The rationale for this variation lay in need to separate the backing track – which contained no adaptive elements, from the ascending / descending melody. Thus the backing track was introduced first, before the introduction of the five adaptive melodic pitches. In C3 the adaptive feature was contained within a single instrument part (string melody), whereas in the other three compositions they were integrated across all musical voices. For instance, in C1 the five stems were each an adaptive feature; in C2 the underlying harmonic structure of each cell represented adaptive feature; and finally in C4 (see section 3.4.2.4) the timbre of the instruments in each cell characterised the adaptive feature. The requirement for five melody notes (thus the total number of zones being six), concerned one of melodic resolution. The *source-path-goal* image schema (*melody is motion along a path*) describes the notion that a melody typically

commences on a note that is consonant with the underlying harmony of the music (*source*) then moves through a contour of notes (*path*) before resolving (*goal*) again, typically, on another consonant note. Whilst, the first and last notes of melody by no means are required to be the same – as they are in this instance (G) – the intention with C3 was to present a simple instance of a melody with a strong *source*, *path* and *goal*; thus a ‘signposted’ resolution. This intention was considered to be best achieved via a melody that moved up and down the notes of music’s static harmony (G minor 7th arpeggio), requiring five zones.

3.4.2.4 Composition 4: Timbre

The adaptive element of this composition (C4) drew from the *colour class* of musical features. The composition was constructed around five cells that each contained the same musical material (i.e., themes, rhythms and arrangement) but each one presented by a different instrument timbre or collection of timbres (texture) (*colour class*). Consequently, each entry into or exit out from each successive geo-located trigger zone adapted the instrumental tone colour that presents the music. In this instance C4 reflected the notion of the *container* image schema. The timbre represents the container from within which the music emanates. Whereas the other three compositions used metaphors of motion, the *container* describes something that is held, or fixed. Consequently, transitions through different timbres are not viewed as a progressive treatment, but rather discrete changes of state. The interest in this composition was with how participants would interpret these changes of state.

Z1	Z2	Z3	Z4	Z5
Piano	Guitar	Flute & Piano	Woodwind & Brass	Strings

Figure 5: timbre

Composition 4 can be heard alongside an accompanying animation showing the mapping of musical features to trigger zones at: <https://youtu.be/ATrkpYiT7jM>

Compositional description, approaches and considerations

The music contained in C4 presented a series of melodic phrases that were punctuated by periods of rest. The tempo was slow (60bpm) and the music had a melancholy mood. The musical structure across the five iterations remained consistent, with only minor alterations to the orchestration in each, which

predominately reflected the nature of the instrument performing the music; for instance, in the second iteration presented by a guitar, some of the chords were arpeggiated, thus mimicking a finger-style technique commonly associated with that instrument.

3.4.3 Mapping the compositions to trigger zones

Playback of the music compositions were triggered via a set of geo-located trigger zones authored in *AppFurnace* (see Figure 6). The zones were constructed on a pattern of concentric circles fanning out from a central zone (zone 1 = outermost zone: zone 5 = innermost zone). Each composition used the same structure of five zones, with the exception of *Composition 3 Ascending/Descending melody* that contained 6 (see section 3.4.2.3). Here the size and shape of the five zones remained unadjusted, but a further outer-zone (zone 0) was added. Figure 6 illustrates the zone structure overlaid on the field where the study took place.

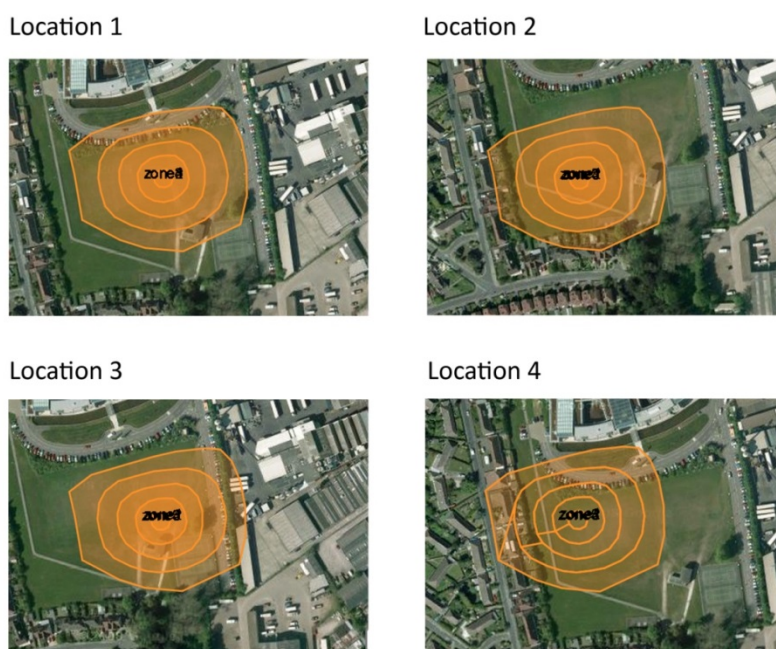


Figure 6: Placement of zones

Clearly, the surface area of each zone is different, becoming gradually smaller as they advance towards the central zone. In designing this study a number of alternative zone configurations were considered, such as zones in the shape of blocks laid adjacent to each other. However, the decision to use a set of nested concentric circles promoted: (1) access into the outer zone when approached from any direction; (2) nested zones would most likely result in participants walking in, through and out of the zones and therefore hearing the musical adaptations from both perspectives (i.e., in and out); and (3) it was deemed harder to

comprehend the shape of circular boundaries, whereas a series of adjacent blocks would have created a virtual 'corridor' which may have potentially reduced participant exploration.

3.4.3.1 Entering and exiting trigger zones

Prior to entering the outer trigger zone no sound is delivered to the participants. Having once entered the zoned area playback commences. If a participant then exits out of the zoned area then playback fades to silence (2.5 second fade). If they then re-enter the zoned area the music restarts as before. The set of nested zones were placed in four different positions in the location (Figure 6), so as to enable randomisation the 'active' area used for each of the four compositions, thus the participants were unaware of where the music would sound.

3.4.4 Study tasks

Each participant completed four separate tasks during a single study session, which all followed the same procedure. The following instructions represent those given to each participant during the pre-study briefing:

1. You are to stay within the boundary of this field as demarked by the trees, hedgerows and fences. You are not to walk down any path that takes you away from the field.
2. Task instructions: "Just walk around the field and enjoy the music. Imagine that the music is taking you on a journey, so follow it to where you think it is leading you and if you feel you find a destination at any point, stop there and indicate to the investigator, who will come to you and stop the applications running on the mobile phone. If you don't feel the music is leading you anywhere, then stop when you feel you would like to".
3. Walk for as long as you want on each task, however, if you spend longer than 15mins the investigator will approach you and conclude the task.

No further explanation as to how the participants should interpret these instructions or the music were offered. They were not informed that the system used GPS positioning to trigger playback of the music, but rather they were told that the music would start at some point during their walk and that it may stop at others; how they chose to respond to periods of silence was of their own volition. Each task was randomised. A mapping matrix was drafted from a randomised order of the four compositions and the four placements of nested zones. So each participant completed all four tasks, at all four locations, but in a unique combination and order. This randomisation was employed to offset any

learning effect and proceeding modifications participants may have applied to their behaviour as a result.

3.4.5 Participants

Twenty-two participants completed the study who were recruited from University of Nottingham students and staff from various schools on campus, none of whom were aware of the author's research. The participant group consisted of an approximately even number of males and females, and spanned an age range of 18 – 35 years. For the purposes of consent the participants' names and contact details were recorded. At the commencement of each study, each participant was assigned a reference number recorded on the participant paperwork, which was used to anonymise the captured data set. No deliberate attempt was made to recruit participants who were either active musicians or had received musical training. All participants were awarded a £10 Amazon voucher in way of compensation for their time.

3.4.6 Data capture

The study captured a selection of data types as listed here:

GPS capture of walking routes: a GPS tracking application (*GPS Tracks*¹¹) installed on the iPhone 4s captured the participant's movements around the study space. GPX files were then exported from this application, which when processed to illustrate the participant's start and end location, their route, walking pace and duration.

Field notes: the author captured field notes throughout the study onto a Dictaphone regarding observations of the participants' on-task behaviours.

Post task interviews and questionnaire: at the conclusion of each of the four tasks a semi-structured interview captured onto a Dictaphone documented participants' subjective interpretation and experience. A series of pre-defined questions were used to stimulate discussion such as their responses to the music, choice of destination, placement of attention and emotional responses. A further discussion upon conclusion of the four tasks probed the participants prior musical experience and typical music listening habits. The recorded post-study interviews were transcribed and a thematic analysis was undertaken.

¹¹ <https://itunes.apple.com/gb/app/gps-tracks/id425589565?mt=8>

Additionally, a short questionnaire was also completed following each task, which contained 2 questions using a rating scale from 1-9 (1 = not at all: 9 = very much so): “How much did you feel led by the music?” and “How enjoyable was the music to listen to?”

Interview questions:

- 1 Tell me how the music made you feel?
- 2 Did the music change or enhance your perception of the environment?
- 3 Do you think the music influenced where you walked?
 - a) If so, how did it affect where you walked?
 - b) What was it about the music that made you respond like that?
- 4 Do you think the music led you to a destination?
 - a) What made you define the destination you chose?
- 5 How did the music affect your journey around the space?
- 6 What did you think about the music?

3.5 Findings

These findings are presented in three parts: first, a general report of walking behaviour such as walking pace, duration and distance covered; second, the focus is placed on spatial exploration, such as the participants interpretation of the task instructions, awareness of the musical adaptations and any influence these had on their walking routes and choice of destinations; third and finally, the participants emotional experience is surveyed. The data revealed from this study is also charted in the publication, ‘Walk This Way: Musically Guided Walking Experiences’ (see Published Works).

3.5.1 Walking behaviour

These findings were extracted from several sources that included the exported GPX files captured from the *GPS Tracks* application running on the iPhone 4s; the *Calvium AppFurnace Player* logs (.txt files); and the investigators field notes. The GPX files were viewed and processed using GPS Visualizer¹⁵.

A clarification is required regarding the quantitative data capture. The participants commenced all the tasks from the same locale, however, as the placement of the trigger zones were situated in different locations unknown to the participants, an initial period of discovery prior to finding music playback

¹⁵ <http://www.gpsvisualizer.com> – An online utility for viewing, converting and exporting GPS data.

ensued. This period is not included in the data detailed here, rather data capture of walking pace, distance covered and task duration were commenced upon entry into the first trigger zone. The time stamps contained in the GPX files and *AppFurnace* logs were used to synchronise the two data sets.

3.5.1.1 Walking pace

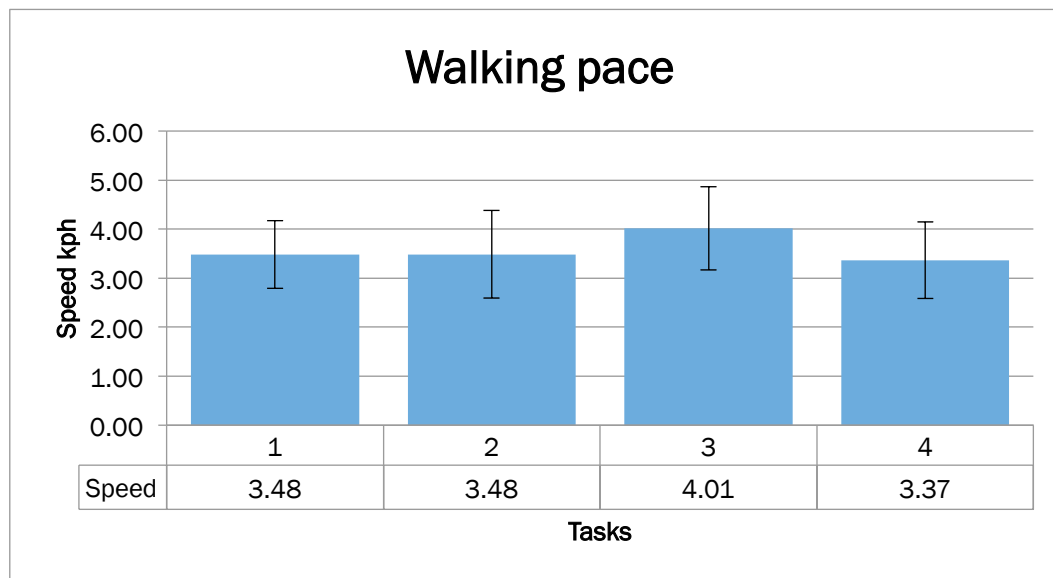


Figure 7: Walking pace

A mean walking pace of 3.59kph was observed across the four tasks. Individual comparison reveals that task 1 (3.48kph), task 2 (3.48kph) and task 3 (4.01kph) returned similar mean walking pace, whereas task 4 was faster (3.37kph) (see Figure 7). A repeated measures ANOVA was applied to this data set. *Mauchly's Test of Sphericity* was assured reporting a p -value of .987. Sphericity Assumed from *Test of Within subjects Effects* shows a significant difference ($F(3, 63) = 11.251$, $P < 0.0005$). The data set did not satisfy the criteria for a normal distribution so a non-parametric test was applied. *Post-hoc* analysis with Wilcoxon Signed-Rank Tests with a Bonferroni correction was conducted to reveal pair-wise comparisons. There was no significant difference between T1 – T2 ($Z = -0.374$, $p = 0.709$); T2 – T4 ($Z = -1.408$, $p = 0.159$); or T1 – T4 ($Z = -0.877$, $p = 0.381$), however significant differences were observed between T1 – T3 ($Z = -3.133$, $p = 0.002$); T2 – T3 ($Z = -3.507$, $p = 0.000$); and T3 – T4 ($Z = -3.442$, $p = 0.001$). This indicates the participants' mean walking pace was significantly different within task 3.

The statistical difference in walking pace observed was also noted – subjectively – by six participants, who perceived that they walked faster on task 3, “*made me walk in some kind of velocity*”, and “*I carried on walking, just getting into that pace*”.

3.5.1.2 Task duration

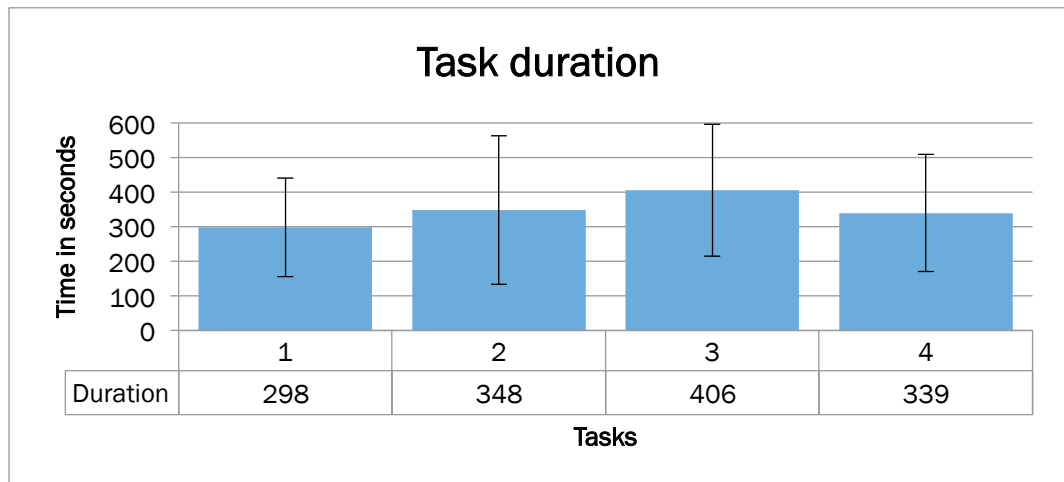


Figure 8: Mean task duration

The participants mean walking duration was 5:48s (348 seconds) across the four tasks. Figure 8 lists the differences of task duration between tasks. No statistical difference was found in this data.

3.5.1.3 Distance covered

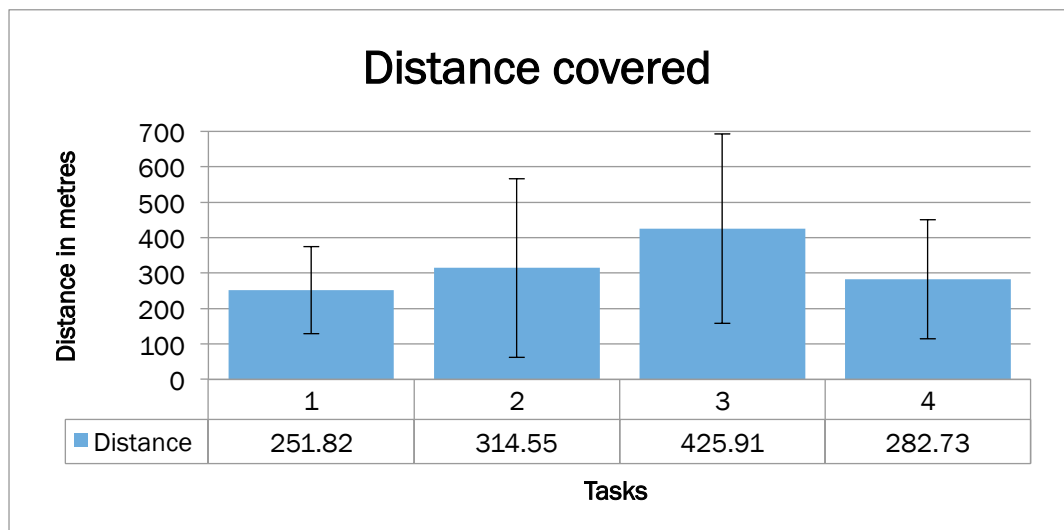


Figure 9: Distance covered

The distance travelled over the course of all conditions shows an overall mean of 318.75 metres. Figure 9 details the mean distance for the four tasks. No statistical difference was found in this data.

3.5.2 Spatial exploration

3.5.2.1 General strategies

First, a note on the general strategies adopted by the participants as a result of their interpretation of the study instructions will assist in establishing an understanding the context of some of these findings. The study instructions were intentionally ambiguous – “follow the music”, “find a destination” – they consequently required participants to interpret the instructions. The post-task transcripts reveal three different readings of the task instructions:

- *Encoded in the music are route directions*: this approach was employed by the majority of the 22 participants, who attempted to identify clues contained within the music, which could be then be translated into route instructions.
- *Representing musical style to environmental artefacts/locations*: a small selection searched for the best visual / physical representation of the music they heard.
- *Using music conditions to inspire a virtual world*: only one participant adopted this approach. When discussing their actions in the post-task interviews, this participant would describe an imaginary world the music instigated for them. Their rationale for stopping (i.e., destination choice) was not influenced by particular musical or environmental events, but rather at the moment they had formed their virtual world.

3.5.2.2 Awareness of adaptive musical features

The participants were not primed beforehand about the adaptive compositional features, nor were they questioned directly about them during the post-task interviews. Thus, the details contained here were drawn from unprompted questions about the music and their experience. Predictably, the language used in participants’ explanations of the music is very descriptive in nature.

Task 1: Voice density

Half the participants in Task 1 reported an awareness of the increasing / decreasing voice density. The specificity in which the participants’ described the musical adaptations varied across the participant group, spanning from the exact identification of instrument layers – “*I gradually moved across the space, sort of music sounds were coming in and more instruments*” – to a more descriptive use of language, such as, “*the music grew stronger at first, then grew weaker and weaker*”.

Task 2: Harmonic motion and dynamic punctuation

In the second task, 12 participants' noted the dynamic accents, and 8 noted the adaptations to the chord progression. Typical comments regarding the dynamic accents were: *"came to another spot marked by a percussive ring sound"* (p21); *"I heard some signal, some special ring tone"* (p2); *"and the music, just 'dong'"* (p3).

A small number of participants described the accents as harsh or heavy, inferring that they stood in contrast to the remainder of the music: *"I heard that harsh tone"* (p15); *"So, the sort of heavy notes, the scary notes!"* (p22).

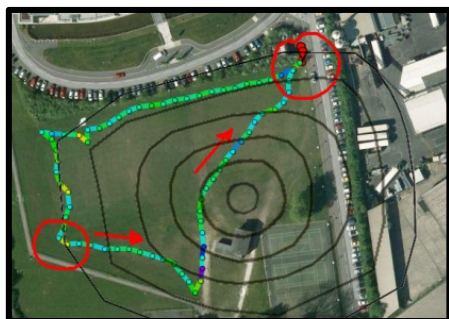
Whereas some likened hearing these accents to the act of discovery, *"when I listen to this music it's like I'm finding a treasure, something really cool. I try to explore the whole field to find that signal, that bell"* (p3).

In comparison to the accents, participants' recognition of the harmonic progression was not as vivid. A few reported some musical adaptations but were unsure what and how best to describe them: *"I think the tone changed at some point, it seemed to get lower at one point, or go down a scale or something"* (p20); *"I think the changes were all over [...] I'm not really sure, but was aware of something different happening"* (p10).

Only one participant (who had received some degree of music training in their past) directly reported hearing changes in chord harmony, *"the key of the piano music changed"* (p21).

Task 3: Ascending / descending melody

In task 3 only 5 participants noted the ascending / descending melody. Some of these statements were quite specific: *"I feel like the organ just raising the pitch higher and higher"* (p2); and *"I got gradually drawn to this area because that's where the bits of music seemed to get added in, definitely a violin piece in there"* (p21).



"I think there was another sound added to this music and so it's like a star passing by. At first it flied around me and then gradually it flew away, further and further. I stopped at the moment when the star sound stopped" (p16).

Figure 10: P16 route in Task 3

Observing the final section of p16 walk in Figure 10 (following red arrows) illustrates their walking trajectory took them through Zones 1-5, which elicited the ascending pitches of G-B-D-F. This was then reversed as the participant walked out from Zone 5 back down to Zone 1 initiating the descending pitches F-D-B-G (resolving to the root of the music's harmony – G minor). It would appear that the melody entering, ascending, descending and resolving maps effectively onto this subject's description; *"like a star passing by"*.

Three thought that the volume of the music was altering as they walked, which may represent an alternative interpretation of the rising and falling melody. In contrast to the above examples – and the other tasks – the majority of the participants reported hearing no adaptations or development to the music throughout: *"Did not notice any changes"* (p15); *"exactly the same all along"* (p9); and *"It was the same everywhere"* (p11).

Task 4: Timbre

Thirteen participants were explicit in their description of the music, acknowledging the changing timbres presenting the music: *"Yeah, the instruments. First it was just the piano, and then the guitar started playing, and then violin"* (p10); *"the music changing is instruments"* (p14); and *"this time it was just separate instruments playing in separate areas"* (p2).

3.5.2.3 Constructing a spatial map

The participants were asked how they approached the task of exploring the study space in response to the music. A number described the formation of associations between the changes heard and their location – effectively mapping out the musical adaptations to the environment. Eight participants discussed this process when discussing task 1, six for task 2, none in task 3, and four in relation to task 4: *"I map the location with the music and I try to find where it makes me feel good (T1)"*; and *"Piano is level 0, Guitar is level 1 and Flute is level 2. So, sometimes when I walked into a different area where I think level may be going down to the previous levels. So, I stop and change a bit"* (T4). These comments imply a journey of discovery, exploring the space and attempting to remember the particularities of the music at each locale. One, who took this mapping process a step further, reported deliberately re-arranging the music for their pleasure in task 2, *"It felt as if I was kind of composing a rough score to something as I was walking along. I noticed you could interleave the two samples of the slightly higher and slightly lower versions [changes of harmony] if you kind of zig-zag along here which was kind of enjoyable"*.

3.5.2.4 Impact of zone boundaries

The author could broadly estimate where the musical adaptations should occur from the location of the participants' as they explored the space, but there was no precise method of knowing when trigger zones were instigated (during the study). However, some participants' walking behaviour offered persuasive clues as to when these events occurred. Just over half of the participants were observed engaging in the following behaviours that appeared to be in response to musical adaptations: an abrupt abatement of walking pace, or transitory halt, followed by a return to typical walking behaviour; *"The first time when I noticed the music change, I just stopped for a few seconds"*. Whereas, others were observed to stop and then walk slowly backwards and forwards over a small area, appearing to test the location of a zone; *"It sounded like another layer of music over here, and I tested it out by walking backwards and forward a couple of times"* (T1). Finally, some walked repeatedly in tight circles, as though straddling one or more trigger zones.

3.5.2.5 Route behaviour and destination choice

The participants' were questioned about their rationale for destination choice. Their responses revealed a number of recurring themes, as listed in Table 4.

Table 4: Rationale for destination choice

Rationale	Task 1		Task 2		Task 3		Task 4	
Stopped in response to a musical feature	12	54.5%	10	45.4%	6	27.3%	8	36.4%
Stopped in response to silence	5	22.7%	2	9.1%	1	4.5%	1	4.5%
Stopped after repeated instances of silence	2	9.1%	1	4.5%	2	9.1%	2	9.1%
Just wanted to stop	2	9.1%	4	18.2%	7	31.8%	4	18.2%
Environmental factors	0	0%	3	13.6%	4	18.2%	5	22.7%
Other	1	4.5%	2	9.1%	2	9.1%	2	9.1%

The data in the first three rows all refer to choices made in response to musical features, including silence, whereas the fourth row details the choices that did not draw on any particular factor, meaning that the participants' could not find a rationale for a destination, they 'just wanted to stop'. The fifth row specifies those who made destination choices on the basis of an environmental factor, and finally those outliers not related to any of the above. This data set does not seek to offer a statistical analysis, but rather a crude overview that compares destination rationale across the four tasks.

These destinations, as latitude and longitude points, were then mapped onto the triggers zones, thus revealing the music heard at the moment that the participants concluded their tasks, as detailed in Table 5. The numbers in the 'task' columns represent the numbers of participants who stopped in each zone for that specific task. Zone 0 signifies a participant's destination location that was outside of a trigger zone.

Table 5: Destination zones

Zone	Task 1	Task 2	Task 3	Task 4
0	2	4	2	3
1	7	8	7	4
2	6	6	4	8
3	1	1	6	4
4	3	1	1	2
5	3	2	1	1
6			1	

Armed with the overview of the participants' rationale (Table 4) and zone choice (Table 5), the following sections present a finer granularity of detail regards the music's role in guiding, or not, participants' destination choice.

Task 1: Increasing voice density

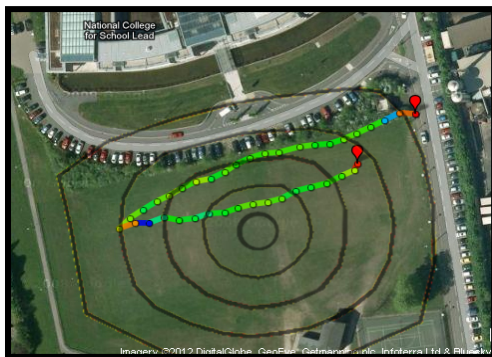
In task 1 the majority of participants cited musical reasons for influencing their choice of destination, although their individual interpretations led them to a range of different locations, as charted in these subsequent examples.

Rationale 1: music of greater intensity represented the destination.

Six participants stopped task 1 when located in either Zone 4 or 5, stating that they were attracted to areas where the music was denser: *“I found it here where the music plays strongest, where all the instruments play, where it gathers all the instruments in the song”* (p2). In addition to these participants’ acknowledging the changing intensity of the music they interpreted the higher intensity music as representative as the peak of its development, which they in turn interpreted as the end point.

Rationale 2: music of lighter intensity represented the destination.

Fourteen participants chose destination locations that contained a lighter density, or intensity of layered music (Zones 1, 2 & 3), *“So, I think I might choose the background music, one or two layers, so I walk back here, because I like that”* (p12) (Destination = Zone 3). Participant 9 concluded their walk in Zone 2. Their method of exploration was linear as illustrated in (Figure 11). Their outward leg, progressed sequentially through Zones 1-2-3-2-1. Upon re-entering Zone 1 (bass drone) the participant turned around and walked back on a trajectory that took them through zones 2-3-4-3-2. Here the participant describes the experience in the form of a musical arc:



“The music has been quite slow all along (z1,2,3,2,1), and then when I was coming back it started to get up-beat (z4), and then when I was walking in this area it went slow again (z3,2), so it was natural, just felt like stopping” (p9) (Destination = Zone 2).

Figure 11: P9 walking route

Rationale 3: contrasting musical features

Two of the three participants who stopped in zone 5 were drawn to the contrasting sound quality of the vocal sample presented, *“this one had a bit of distorted vocal in it at one point, and I think the human voice just grabs your attention”* (p21). Participant 15 also described being influenced by the vocal sample. They actually ceased their walk in Zone 4, due to a playback failure, but their description highlights a desire to remain in the area where this sample plays, as illustrated in Figure 12.

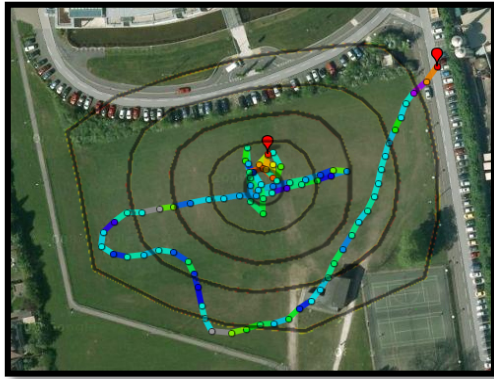


Figure 12: P15 walking route

“Around this spot in the centre you could hear a vocal, like someone speaking or saying something and it’s like, that’s what you’re drawn towards, some sort of human interaction. And at that point I found the music most pleasant, so I stayed here” (p15).

Task 2: Harmonic motion and Dynamic punctuation

Task 1 witnessed the majority of the participants citing musical reasons for guiding their destination choice. The following scopes their rationale for Task 2.

Rationale 1: a perceived pull towards the tonic chord

Of the 18 participants who halted the task within the zoned areas, ten stopped in either Zone 1 or Zone 5, which both presented the tonic chord of the progression (A minor). Although indirect, they infer a pull to this cadence, *“It was more forceful, I want to say, more drawing to here (zone 1) (p5).* In the next example terms such *“a lower pitch”* and *“relaxing”* may also indirectly describe the harmonic resolution experienced upon a return to zone 1: *“It had just gone to a lower pitch when I stood here and that just seemed like a nice relaxing place to stop” (p20).*

Participant 7 spent the majority of their walk moving between zone 1 (A minor) and zone 2 (D Major) (Figure 13). This IV–I progression is known as a plagel cadence, a harmonic resolution regularly utilized in a wide range of tonal music. That this participant chose to interweave these two harmonies may be a further example of the pull of the tonic chord, as apparent in the following quote.



Figure 13: P7 walking route

“Was more interesting and enjoyable in this area than elsewhere. I felt that this time it was much more constricted as to the kind of parts of the field that had music I enjoyed listening to. I felt very led to this strip here really” (p7).

Other examples of destination choices seemingly in response to harmonic movement were also observed in other zones. For instance, p2, who stopped in zone 4 noted *“I think this one has the strongest level of signal, the sound is different”*. Their description of the sound being *“different”* may relate to the tonal quality of the chord harmony in z4 (the chord of E7b9), which contains a significant amount of dissonance as formed by the addition of the notes D (b7) and F (b9) into a minor triad. Finally p16 described their choice of destination zone – zone 2 – as being *happier* compared to the *mysterious* sound that preceded it (z1). Harmonically the transition from zone 1 to zone 2 saw a shift from a minor harmony (A minor) to a major harmony (D Major). Although, an established and often used cliché, minor harmonies are typically described as having a sad, or dark quality, whereas major harmonies are happy and strong. This convention may explain this participant’s description.

Rationale 2: a contrasting musical feature

Zone 5, included an additional melodic theme not present in the other zones as a way of differentiating it from the similar music contained in zone 1. Those participants who terminated their walks in zone 5 all made reference to the additional theme and concluded that this contrasting feature represented a point of arrival for them, *“as this was the only place I heard this, I thought this must be the place to stop”* (p21).

Task 3: Ascending / descending melody

This task was reported somewhat differently to the other three, as fewer participants cited a musical rationale for a choice of destination, with a slightly greater emphasis on ‘just wanted to stop’ and environmental reasons.

Rationale 1: adapting melody

Only six participants reported a destination choice related to a heard musical feature and only three of these hinted at this feature being the adapting melody. Participant 2 singularly recognised the rising variant of the melody – *“just raising the pitch higher and higher”* – concluding their walk in zone 6, *“I stopped where the pitch was at its highest”*.

Participant 6, who reported that the sound in zone 5 was different to the other zones, *“it just seemed a little more interesting, I think it may have got a little louder here”*. Zone 5 presented note ‘F’, which is the flattened 7th degree of the G natural minor scale. While this note is member of the key of G minor, its interval is close

to the root note of the scale (two semi-tones below), which creates a dissonance. Therefore, this note, and its corresponding dissonance may have drawn the attention of this participant, who then perceived this sound as “interesting” and “a little louder”.

Task 4: Timbre

Rationale 1: preference for an instrumental timbre

Eight participants chose a destination on the grounds of a musical feature, which were all characterised by a preference for a particular instrumental timbre: *“I was feeling like I was listening to the music and then trying to find where the music plays the most beautifully. I think this should be the place where the music was most beautiful”* (Zone 5 = Strings) (p2).

Others, who also noted the changes in instrumental timbre, did not choose a destination based on preference, but rather were searching for some guiding musical feature, which they did not find. Thus, they just stopped when they felt they had heard all there was to hear, for instance, *“I think I was trying to let it lead me somewhere, but it just wasn’t happening! I felt like I heard all the parts there were to the piece”* (p20).

The impact of silence

Occurrences of silence (when participants were situated outside of the trigger zones) appeared to function both as a driver of route behaviour and destination choice across all the tasks, as summarised in Table 5. This study contained 88 individual tasks (22 participants × 4 tasks each) and on 35 instances the participants spent the full duration of their walks contained within the trigger zone areas (having once entered the first, outer-zone). The remaining 53 tasks saw participants exiting the outer-zone on one or more occasions (a maximum of 7), having entered the first outer zone, upon which the music playback would faded to silence. On these occasions the following behaviours were observed.

The majority of participants (38) adjusted their course in an attempt to re-discover the music and repeated this behaviour if multiple occurrences of silence were found (see example in Figure 14). Eventually, these 38 participants selected a destination location within one of the trigger zones.

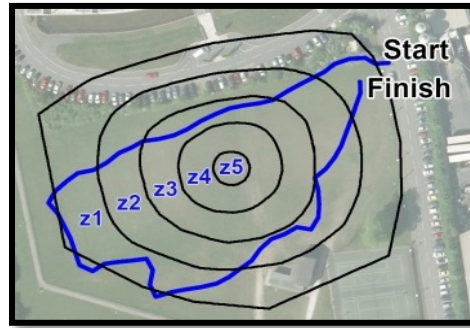


Figure 14: Task 1 – P3

"I went to one point and I felt, like 'oh, this is the place', and I went the music stopped and then it was like "no", this is not the place I want to be because the music stopped there" (p3).

In contrast, seven participants concluded their walk upon first exposure to silence, *"I think the music stopping aborts the experience, so I didn't feel the urge to necessarily start it again" (p19), and "the music stopped, so I felt like I had reached somewhere"*. Whereas others felt that the fading to silence formed a natural 'winding down' of the music: *"The music seemed to come to a conclusion when I got there. I kind of flowing nature seemed to...it slowed...and I thought it was a reasonable place to stop, like it was an end of a song I guess" (p7 in task 4).*

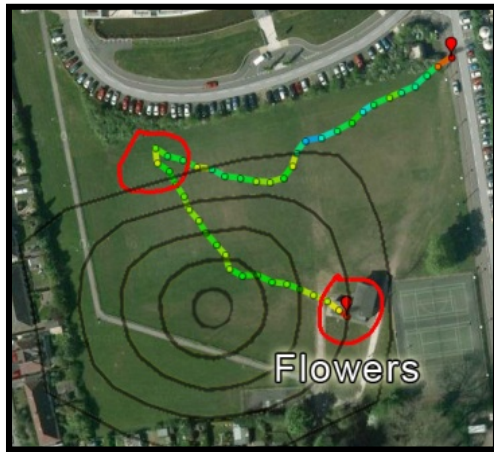
The remaining eight participants, having initially encountered silence, were observed to adjust their heading so as to re-discover music playback. If they experienced multiple occurrences of silence they eventually terminated their walks outside of the zoned area (min 2 - max 6 instances of silence), *"so, I keep walking, it's quite frustrating and when I'm walking it stops again, so I think I don't want to listen to that anymore, and stop here"*.

Perceived, reported, but not actual instances of silence in task 1

Task 1 stood in contrast to the others regarding the participants' perception and reporting of silence as destination choice. Of the nine participants who reported terminating their walks in response to music playback stopping, only two of these actually stopped outside of the outer-zone (p4 & p10). Six of the nine actually concluded their walks in zone 1 (p7, 8, 16, 17, 18 & 22) and one in zone 2 (p14) where music playback was still active. These participants' stated that music playback had stopped and interpreted their progression towards silence – as they perceived – as a signal for the end of their walk. The following quotes describe a reduction of the music's intensity, rather than silence as signifying their decision to stop, *"this is where it got weaker and weaker. I don't know it's like the sound just disappeared" (p16).*

A focus on environmental features

Tasks 2-4 all witnessed a number of participants reporting destinations related to environmental features (3 in task 2, 4 in task 3 and 5 in task 4). The majority of these responses were still guided by a musical interpretation – albeit indirectly – as they portrayed a process of matching the location to the mood of the music, for instance, *“the waves of repetitiveness in the music seemed to be reflected in this row of trees”* (p22 in task 3).



“I was about to go near the trees, I wanted to look at the trees, enjoy the view and listen to the music at the same time, but it wasn’t playing there at that point, so I thought I needed a nice view, so I came back here again, I liked the flowers and the music was playing here. The guitar was playing here where I stopped” (p10 in task 4).

Figure 15: P10 in Task 4

In Figure 15, p10’s trajectory initially led them towards the upper left-side towards a cluster of trees. They exited the zoned area and shortly afterwards changed their course and headed to the other side of the field (re-entering the zoned area) towards the location of the flowers, as described in their quote (note: the Google map view is out of date. The small structure visible at this destination location has since been removed, and an overgrown area of grass and flowers now reside).

Other rationale

The remaining outlier justifications for destination choice are now presented, which represents just seven task instances (one from task 1 and two each from tasks 2-4). Four of these seven reported that they were *“not sure why I decided to stop here, I’d had enough of it in a way”* (p13 in task 1); and *“nothing to do with the location, just dull music”* (p19 in task 4); or *“the music starts to repeat, and I think there are not going to be any other changes”* (p18 in task 2). A single participant (p11) who interpreted the task instructions differently formed an imaginary space as inspired by the music:

“[I stopped here] because I figured out what I want to say to you, you asked me to tell you when I feel this music has taken me somewhere. It’s very calm and soothing, it’s like I’m somewhere very beautiful and serene, like maybe a hill station – cold, nice weather, very calm”.

3.5.2.6 The repetitive nature of task 3

As noted in section 3.5.2.2, task 3 reported a large number of participants state that the music contained no changes, but rather it was just repetitive. This is further reflected by seven participants who terminated their walk unable to choose a destination: *“It just felt that I was not being led anywhere, so I thought I would just stop and tell you”* (p10); and *“I felt like I’d explored the space enough and the music didn’t seem like it was going to change, so I stopped”* (p20).

3.5.3 Perceptions and responses to the music

This section covers the results of the study questionnaire and the participants thoughts and feelings about the music, the experience and where their attention was placed during the walks.

3.5.3.1 Results of the Questionnaire

The results of the study questionnaire are summarised in Figure 16. The rating scale of 1-9 as used in the questionnaire is shown on the left-hand side of the figure, whereas C1, C2, C3 and C4 refer to the four compositions and BL (being led) and ME (music enjoyment) are shorthand for the questionnaires two questions: *“How much did you feel led by the music?”* and *“How enjoyable was the music to listen to?”*

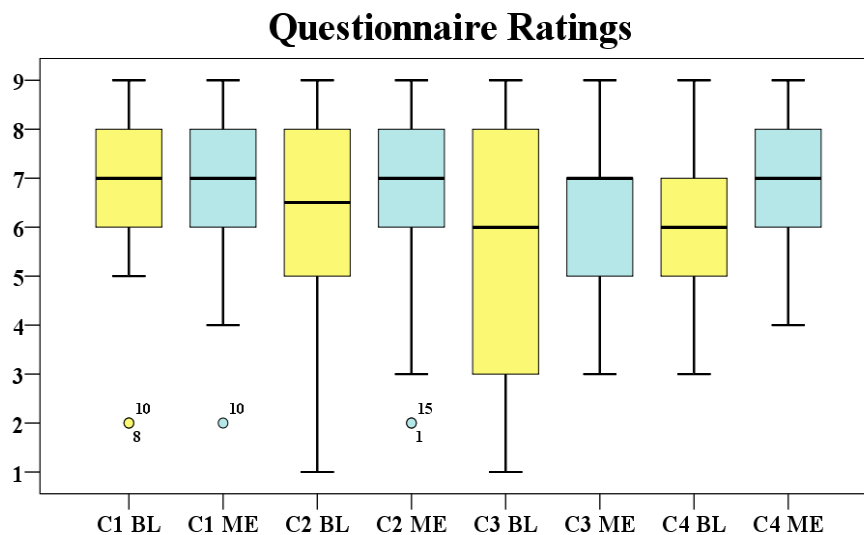


Figure 16: Questionnaire ratings

The participant group reported a similar mean rating for Q1: *being led* (6.10) and Q2: *music enjoyment* (6.60), illustrates a largely positive response to the music. Bivariate correlations were undertaken on the questionnaire scores, which did not reveal any statistical significance. However, task 3 is an outlier, receiving the lowest mean rating for ‘being led’ whilst similarly rated as enjoyable. This is consistent with participant reports of not hearing any adaptation in the music.

3.5.3.2 Participants on-task attention

Post-task the participants were asked where their attention was during the walks. Responses exposed a set of recurring themes as summarised in

Table 6, below.

Table 6: On-task attention

Area of attention	Task 1	Task 2	Task 3	Task 4
Music	7	6	4	4
Environment	7	7	6	9
Imaginary environment	5	4	2	1
Thoughts	3	5	4	8
Don't know	0	0	5	0

Table 6 paints a broad picture that reveals a number of interesting details. First, there was a common tendency to focus on either the music or the environment, for instance: *“I was mostly listening to the music”* (p6 on Task 1) or *“it made me interactive more with the environment, the birds I was noticing a lot and the trees”* (p7 in Task 3). Whereas a others used the music to inspire an imaginary world, *“I thought like there was a light at the end of the road, its shining more and more, and the more I walk down that path the more I feel the sunshine, like I'm getting out of the forest”* (p2 in task 1). Others, rather than focusing on one stimulus throughout the whole of a task reported a shift of focus during the a task:

“When it changed [music] you attended back to the sound rather than the physical space and then I was kind of waiting for it. So, paying less

attention to what was going on around me was just moving until something happened” (p19).

Task 4 was notable for more participants attending to thoughts, reporting strong feelings of contemplation and nostalgia: *“So I felt like it’s music for the deep thoughts when, you know like, you feel a bit gloomy and you want to feel about the philosophical side of life” (p8 in task 4); and “I love this piece of music! It reminds me of something. It’s about the memory of someone! Of course it’s good, it’s a happy time” (p3 in task 4).*

Finally, task 3 stood in contrast to the other three as 5 participants’ were unsure where their attention was placed, *“It didn’t really make me feel anything; I don’t know what I was doing. I was just walking around observing something, not nature, not the music. I don’t know. I was just randomly walking around” (p13).*

3.5.3.3 Emotion and mood

Participants were asked about their emotional responses in each task, a summary of their responses is contained in the following.

Task 1: Voice density

Of the 15 that answered the question directly, 10 reported positive feelings towards task 1, with only 5 participants’ describing it using words of a neutral or negative connotation. The *bass drone*, which formed the music presented in zone 1 was highlighted by seven participants’ who described this music – only upon first exposure to the zone – as *scary, tense, or dangerous*. However, when participants’ had transitioned into and through the other zones these feelings of suspense and fear were replaced by the largely positive emotional responses.

Task 2: Harmonic motion and dynamic punctuation

Six of the group reported feelings of unease in response to the music, which they felt affected their physical behaviour. One subject discussed their dislike of the music and upon exiting the outer-zone where the music faded to silence, did not want to re-discover it, *“makes me feel tense, I want to find somewhere that is safe”*. The ‘dynamic accents’ were described by participants’ as *“unpredictable”, “nervous”* and *“danger nearby”*. Conversely, other participants’ discussed feeling at ease with the music, making use of descriptors such as *“relaxed”, “energetic”, “interesting”, “good”* and *“happy”*.

Task 3: Ascending / descending melody

As with task 2 above a wide spectrum of moods and emotions were reported here. Although the majority of the participants found the music repetitive, they did reported largely positive feelings towards it: *"Makes me feel positive"*; *"I really liked it"*; *"It made me feel ok"*; and *"I felt like I enjoyed that one more as a piece of music, because it felt less sharply connected to where I was"*.

Task 4: Timbre

This composition appeared to provoke the strongest emotional response out of the four, with strong feelings of sadness, contemplation and nostalgia reported by eight participants, *"it's more like listening to a sad story"*; *"very calm, actually"* and *"It reminds me of something. It's about the memory of someone"*.

3.6 Discussion

The study demonstrated that the music influenced where the participants walked, how they felt and what their train of thought was. They interpreted and responded to the musical features in each task differently and there were some distinct approaches to the interpretation of the study instructions. The discussion focuses on the impact of the musical features on aspects of participants walking behaviour. The discussion focus on four high-level themes as drawn from the findings: the impact of *musical intensity contours*, the *perception of arrival*, the *music as a container* and the *emotional experience*.

3.6.1 Musical intensity contours

The findings reveal that the participants, on the whole, acknowledged the *voice density* feature and interpreted the cross-domain mapping of musical motion to physical motion, as a number reported it as a guiding influence on their walking behaviour. Furthermore, the highest mean rating for "being led" (7, see Figure 16) was reported on task 1. A study by Kohn and Eitan (2009) who investigated the effects of musical features on children's physical movements, how they 'acted out', physically, the music they heard exposed a number of correlations between growth and decay in music and spatial representation. Similarly that rising, or increasing intensity of music was mapped to lateral movement. Although there appears to be some purchase in 'being led' by the intensity contour, where the participants were led to, was less clear. Some participants sought out a destination at the peak of the musical intensity, but conversely, others did the opposite, they followed the contour to where the music decayed to a low intensity (e.g., *diminuendo infers motion away*) and chose to stop there. In order to

pick apart a deeper understanding of this finding the nature of dynamic musical contours is briefly discussed.

3.6.1.1 *Crescendo*

Musical intensity contours build and retract tension and lead the music from a place of one dynamic level to another and as such they can be characterised as periods of transition. In the case of rising tension, such as a crescendo or *accelerando*, a moment of reconciliation will come to pass, where the tension is released. This may take the form of the introduction of new thematic material or a harmonic or rhythmic shift, thus a musical resolution, a point of arrival (Ratner 1983). In composition 1 there was no resolution to the rising musical intensity, just a peak, no point of arrival. Consequently, the participants' would not have known with any certainty when they had reached the peak of the musical contour, or whether there was a subsequent zone of resolution not yet discovered. Thus, for some, this may have resulted in them walking in, through up to the peak and then out the other side.

3.6.1.2 *Diminuendo*

As speculated, some may have not found a resolution to the composition 1's crescendo, but rather continued on and eventually chose a lower level of musical intensity as a destination (the end of the *diminuendo*). Prior research has long understood that humans, following historical exposure to music, learn to expect certain musical conventions such as common harmonic resolutions, even cycles of bars and phrases and – which may be of relevance here – the ubiquitous 'fade out' during the final chorus of pop song recordings (Meyer 1956). The following quote illustrates this point, "*I was walking in this area it went slow again, so it was natural, just felt like stopping*" (p9). More supporting evidence may be found regarding those participants in task 1 who described stopping where the music went silent, but in actual fact they were situated in zone 1, where the *bass drone* was sounding. There could be a number of readings of this anomaly. For instance, the sound's attributes may explain this interpretation. As a sustained note the sound is melodically and rhythmically static, there is no variation within its timbre, and the pitch was in a low octave. Thus, it was possible that the sound was masked by ambient noise (e.g., wind noise travelling between the headphones and the listener's ear). However, some referenced the continuation of the music contained in zone 1 when discussing their rationale for choosing a destination. Additionally, approximately a third of the participants discussed the sound of the bass drone when entering zone 1 for the first time, so it seems that

this stem was clearly audible. Another reading might focus on the lack of musical activity in this stem when compared to the others, there was so little musical activity, that it was the equivalent of silence, i.e., *“the music is playing here, but I feel this is the destination”* (p18).

In summary, growth and decay of musical intensity was noted and followed by a section of the participants, but in order to stimulate a sense of arrival, especially on an ascending contour a resolution is required.

3.6.2 Perception of ‘arrival’

The participants rational for destination choice took on a variety of forms that responded to both their interpretation of the study task and also the individual nature of the music presented in each task. Some chose destinations on the basis of a musical preference, or matching of music to a location or artefact in the environment, or in response to a specific musical feature. It is the latter that is discussed in this section.

3.6.2.1 Arrival by diminishing intensity

As reported, some participants in task 1 perceived the lowering dynamic intensity of the music when walking from outwards from the zones ($> z1$) as a natural conclusion to the music, thus as a signifier of arrival. This appears to refer to the ubiquitous fade-out in popular music. Issues related to music cessation are further discussed in section 3.6.3.2.

3.6.2.2 Harmonic arrival

Harmonic motion, applied in task 2 was not commonly acknowledged by many of the participants, however a moderate number chose the destination in the two zones containing the tonic chord of the music’s harmonic progression. What was apparent from the post-task interviews was that the participants had difficulty describing these harmonic changes, which for a group of mostly non-musicians is not surprising. Additionally, the dynamic accents presented at the onset of each adaptation were prominent in the mix of the music and thus they were widely noted and reported by the participants. Speculatively, these accents may have partly masked the shifts of harmony. A strong cadence (resolution) was presented to those participants who chose zone 1 or zone 5 regardless of their route of access. For instance, those who concluded their walk in zone 1 (once situated in the zoned areas) would have been reached via zone 2 (D major chord $>$ A minor = plagal cadence) whereas those who stopped in zone 5 could only

have accessed it via zone 4 (E7b9 > A minor = perfect cadence). Brower argues that the fundamental attraction of the tonic chord in western tonal music necessitates its return at the end of a musical section, or composition, thus resolving and securing the underlying tonal assembly (Brower 2000). This bookending of the tonic chord underpins the *balance* image schema (Zohar Eitan and Granot 2006). Tentatively, the *balance* image schema appears to have exerted some purchase here communicating a perception of arrival.

3.6.2.3 *Dynamic event arrival*

The dynamic accents were widely noted and provoked some strong reactions. Participants described these as points of discovery (“*I got a feeling like I’m finding treasure*”) or a signal of some description (“*make me want to stop and look around*”), or some cue to alter course (“*Every time I heard that harsh tone I felt that I should change direction, maybe it was leading me somewhere*”). In themselves, the accents offered no resolution or conclusion that incited a sensation of completion, nonetheless they appear significant as markers, but in the context of this study the participants were, understandably, unsure what they denoted. In discussing these accents, the participants used terminology of a spatial or physical nature that corresponded with the musical characteristic of the accents, such as “*spot*”, “*point*” and “*bit*”, which are suggestive of small, localized spaces. This appears to relate to the short musical duration of these features, being the only musical elements that did not sound continuously while participants were situated in any corresponding zone.

3.6.2.4 *Arrival by contrast*

This final example of musically prompted arrival draws on some findings from both task 1 and task 2, where a small number of participants cited the introduction of musical sound sources that contrasted the reminder as a signal for arrival. In task 1 the vocal sample used in zone 5, although heavily manipulated through production techniques almost to the point of disguise, still contained a sound quality distinct enough to separate it from the other sound sources. Whereas in task 2 the introduction of the piano melody in zone 5 introduced content not heard elsewhere. As with the dynamic event arrival, these contrasting sounds do not offer a musical treatment that is typically associated with the end of a section, or song (i.e., resolution), but similarly to the accents they appear to mark out sections as notable.

3.6.2.5 *Summary on arrival*

The study has shown that a range of musical features (i.e., dynamic contours, harmonic resolutions, and contrasting musical events) all had the capacity to either signify arrival or mark a point. Evidently, in the context of the study instructions, the participants were primed to discover and draw on the musical events presented to form an interpretation. Thus, no claim is being made that would suggest unsolicited presentation of these musical features would provoke listeners to feel a sudden sense of arrival.

3.6.3 **Music as a container**

The container image schema was originally used as a motivator for the application of timbre within task 4; however, the findings reveal the container, as a musical metaphor was integral to many aspects of this study.

3.6.3.1 *Mapping music onto spatial structures*

The composition used in task 4 – the initial container model – found a number of participants electing a destination on the grounds of a music preference. Rather than reporting a sense of being guided by the changes in timbre, they formed mental maps of the different tonal colours discovered via their exploration of the study space, upon which they returned *into* the locale (container) of their preferred musical timbre. Thus the container appears to be an appropriate metaphor for timbre. This process of mapping out the physical space in response to recognised musical adaptations was also seen across the other tasks, for instance in task 1 (entry/exit points of stems). In describing these instances these participants used terminology such as “*area*”, “*region*” and “*place*” (which in turn imply the container metaphor), distinct to the ‘tightly localised’ terminology used to describe the dynamic accents (e.g., “*point*” or “*spot*”). Seemingly the differentiating characteristic between timbre (task 4) or layers of music (task 1) and the dynamic accents are that the former are continuous musical events (i.e., sounding for the duration that a user is situated in a zone), thus they cover a larger area of physical space.

3.6.3.2 *The impact of silence and maintaining engagement*

The impact of silence on the participant experience had not been predicted and thus warrants some discussion. As presented in the findings, being confronted with silence when a participant exited an outer zone was met by one of three distinct behaviours:

- Heading adjustment in an attempt to re-discover music playback.
- Participant choosing to terminate the task.
- In response to several occurrences of silence a dissolution of engagement, leading to a termination of the task.

Exemplified from these three responses is the loss of containment, which in turn provoked a behavioural reaction. The findings do not reveal specifically why some participants chose to re-engage or stop, but what is clear is that while music playback is active the participants were engaged and loss of playback resulted in disengagement. However, it is necessary at this point to consider the nature of the study instructions, as the participants were asked to ‘follow the music’, so it is not surprising that they turned round or stopped when there was no music to follow. Nonetheless, the pre-study briefing informed them that they may be presented with periods of silence and they were to interpret these as they saw fit, in the same way as they were asked to with the music. The purpose of this notification was to position silence on the same footing as music, and also to remove the likely assumption that silence equated to some technical malfunction. Thus, whilst not irrefutable, this reading takes the impact of silence on participant behaviour and their post-task descriptions on face value. In light of this the music can be said to function as the *container of the experience*. A parallel can be drawn here with the extensive work undertaken by Michael Bull on the nature and function of iPod listening, where he proposes that iPod users also contain their physical walking experiences through a personalised sound world (M. Bull 2001; Michael Bull 2005; Michael Bull 2006). Furthermore, silence is a tool used in interactive computer games scores to signify that a player has strayed away from the gameplay action (Collins 2013).

A closer inspection of task 3 will further clarify the notion as music being the *container of the experience*. As outlined, the majority of participants perceived no significant musical adaptations, but rather just repetitive music in this task. Some commented that the music was not fitting for the environment or task and as a result they felt disengaged. This absence of engagement was seemingly not down to a dislike of the music, as this music was rated similarly to others for ‘music enjoyment’. Hence, the central distinction between the reported disconnect of music and space in task 3 and the reported connection in the other tasks would appear to rest in the lack of perceived musical adaptation. This, therefore, suggests that continuous musical playback is not enough in itself for the music to function as a *container of the experience*, but rather, listeners need to be aware of

regular, distinguishable musical adaptations in direct response to their walking trajectory in order to feel connected and engaged with the space.

This association between musical events and the physical space represent one type of music-to-space connection observed in this study. The second form arises from those participants who took an alternative reading of the study instructions.

3.6.3.3 *The aesthetic interpretation*

As seen, some sought out distinct musical events by means of walking exploration and discovery of the planned adaptations, whereas others formed aesthetic connections between the music and the physical space; they sought out locales of flora or artefacts that represented the best match between the mood and style of the music and the available features contained within the study environment. This describes a blending of the study's two principal modalities – auditory and visual – so as to align them aesthetically. This *aesthetic alignment* is not about containment, but is more reminiscent of interpreting the music as a soundtrack for the environment in the filmic sense; forming associations between musical style and the visual content of the environment. This refers back to the body of work on associationism (Cohen 1993; Scott D. Lipscomb 2005; Meyer 1956) and referential listening (Sonnenschein 2001) discussed in Chapter 2.

3.6.3.4 *Walking pace in Task 3*

The study findings reported a significant difference in the mean walking pace between task 3 and the other three tasks. Although the statistical analysis returned a significant difference, it ought to be noted that a high variance of walking speed was observed across all four tasks, highlighting the individual approaches to walking pace across the participant group. Three reasons may be pertinent in understanding why the composition in task 3 may have influenced walking pace.

- The tempi of the four conditions were generally slow with the exception of composition 3 (composition 1 = 60bpm, composition 2 = 90bpm, composition 3 = 120bpm, composition 4 = 60bpm). We know that humans have a tendency to synchronise physical movement to music tempo and that 120bpm falls into the preferred tempo range for physical synchronisation (Moelants 2002b), which may account for why the other three tasks whose tempi are very much outside of the preferred range did not appear to exert an influence.

- Composition 3 was the only task with a percussive orchestration, i.e., a drum beat backing track. This strong percussive pattern, in conjunction with a ‘driving’ the bass figure created *“the sort of music you would exercise to or have, kind of like motivational music”* (p19).
- The third reason considers the participants inability to recognise any notable evolving musical features, upon which to find a destination. This task also saw the longest duration (mean duration 406 seconds) whereas task 1 witnessed the shortest duration (mean duration 298 seconds). In task 1 the participants reported the strongest sense of ‘being led’ by the music, which may account for a shorter duration in determining a destination location. Whereas on task 3 participants may have spent longer and walked faster in an attempt to find some musical adaptation to respond to.

Although presented as separate set of inconclusive reasoning’s, in all likelihood a combination of the above is perhaps responsible for the anomaly of walking pace observed in this study.

3.6.4 The emotional experience

Participants were questioned about their emotional response to the four compositions. Obviously this was a leading question as it assumes that music can have a direct effect on listeners’ emotional responses (see section 2.2.4 for a discussion on music and emotions).

The findings revealed a collection of largely positive emotional descriptions across the four tasks. The descriptive nature of the comments illustrates a general sense of being *“just relaxed and chilled”*. However, three distinct examples of emotional responses from tasks 1, 2 and 4 merit some exploration.

The compositions employed here were composed solely for the purposes of this study and obviously they all exhibited a stylistic hue, notwithstanding a deliberate attempt to distance them from any existing recognizable composition that may inadvertently detract attention. Nonetheless, participants’ picked out and referred to some musical conventions:

- The ‘bass drone’ in the first stem in task 1 was highlighted by seven participants’ who described the sound as, *“very scary and dark”*, and *“it feels like some music for scary movies”*. Sustaining low bass sounds are often used in horror and suspense films as an underlying tension builder, a platform off which other more dramatic sounds can leap. This would appear to relate to

episodic memory (associations) and *musical expectancy* emotion mechanisms (Juslin 2013). Interestingly all of these participant quotes refer to their initial exposure to the music in zone 1, prior to hearing the other zones. Seemingly, once participants had moved beyond this initial zone and thus experienced the combination of other musical stems, these early feelings were replaced by positive responses and references to the music as “*chilled*” and “*relaxing*”.

- The *dynamic accents* found in task 2 also held a ‘negative’ bearing for some: “*It makes me feel unsafe somehow [...] actually, unpredictable rather than unsafe*”, and “*it made me feel a little bit nervous*”. These accents were deemed prominent and thus may have been reminiscent of shock techniques used in the horror/suspense film genre, described by Juslin (2013) as the *brain stem reflex* mechanism of emotion. On-task the presentation of the accents would have been unpredictable, as the participants were unaware of the placement of the trigger zones and therefore not party to any impending transitions.
- Finally, strong feelings of nostalgia and contemplation were reported as result of task 4. This music used here was slow, minor key and emotive in style, the type of music that might be used in a soundtrack that accompanies a reflective narrative or a scene (i.e., *episodic memory* (Juslin 2013)).

3.7 Conclusions and implications

The presentation of any conclusive findings at this juncture would be premature; nonetheless some interesting, though tentative, observations have come to the fore that warrant further exploration. Generally, a moderate number of participants were aware of the adaptations to musical features in tasks 1, 2 and 4, then interpret them broadly in line with the spatial metaphors characterised, and then adjust their behaviours. Notable themes were:

- The music provoked a sense of physical arrival for some in response to harmonic resolutions, gradual dissolution of musical intensity and the introduction of silence.
- Short, dynamic events and contrasting musical material were effective as markers, to signal a point of interest.
- Dynamic contours can be followed whether ascending or descending. In order to communicate a sense of completion (i.e., arrival) when using ascending contours a resolution is required to complete and transition out from the rising contour.

- Musical accompaniments for walking experiences can influence the interpretation of visual imagery and artefacts in a similar manner as film soundtracks.
- Different styles and moods of music can promote emotional responses that extend beyond an internal response to music listening, but also to affect the perception of the surrounding physical environment.
- Dynamically adapting musical features, when regularly perceived, can create associations between the musical features and the physical locale that promotes a sense of engagement; thus *music as the container of the experience*.

This final point warrants some further discussion and expansion. The conceptual metaphor of the container appeared to function on several levels in this study, which the author notionally terms as *attachments*.

- First, silence – unsurprisingly – formed a boundary for both the music and the walking experience. When presented with occurrences of silence participant engagement was lost. Deeper observations concluded that engagement was only maintained when regular adaptations to musical events were acknowledged in response to their walking exploration. This is termed as *global attachment*: the association, or attachment between music and physical space, where the boundary of the experience is framed by the evolving presence of music (see Figure 17).
- Second, those musical features such as changes of timbre or introduction of contrasting instrument stems and to lesser extent harmonic shifts were perceived as occupying spaces. These are the regularly occurring adaptations that maintain *global attachment*, but they also define regions – sub-sections – within the global boundary. These are referred to as *regional attachments*: the demarcation of a physical area by means of a musical section of consistent and distinct timbre, harmony or orchestration (see Figure 17).
- Third, those short duration dynamic events, such as the accents in task 2 that do not continue to sound beyond their initial presentation. These were considered to signify points of interest by the participants. They are termed *local attachments*: small, highly localised areas marked by the presentation of a contrasting, short duration musical event (see Figure 17).

These three levels of *attachment* are illustrated in Figure 17.

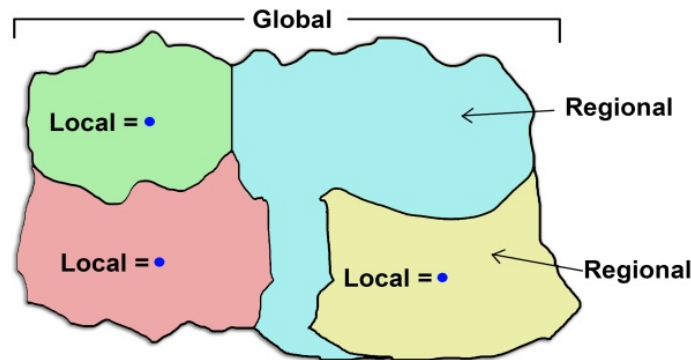


Figure 17: The Attachment model

Attachment offers some purchase in the conceptualisation of musical accompaniments for locative experiences, primarily as a method for devising mappings between musical structures and the spatial structures; one that may compliment both modalities (visual/physical and the auditory). On the one hand the global, regional and local structure convenes gracefully onto the topology of spatial structure, i.e., defining the outer boundary of the experience; sub-regions within that can be accompanied and made distinct by different musical treatments, and finally local points of interest encountered along the way can be musically marked. Then on the other hand this *attachment* structure offers the beginnings of a template around which the composer can start to construct a musical soundtrack; one that may suggest musical arrangements, a dynamic structure and changes of harmony and orchestration.

It must be stressed at this juncture that this is very much a notional concept based the observations from a single research activity. Its intention is to prepare the ground for a deeper and more robust exploration of adaptive musical soundtracks in a real-world setting. An exploration that considers both the composer's perspective (how can the nature of the location based setting guide the compositional process?) and the users experience (what influence would an adaptive musical soundtrack have upon a walking experience, where the role of the music is there to support the experience's principal activity?). It is this move into a real-world setting that is charted in the following chapter.

Chapter 4 - Sculpting a real-world soundtrack

4.1 Introduction

The work detailed here represents the next step from the *Follow the music* study presented in the previous chapter. The main feature of this ‘next step’ was the development of a large-scale adaptive soundtrack for an established walking activity at a cultural visiting site. In contrast to the previous study, where the process of listening and responding to the music constituted the activity, here the musical soundtrack assumes a subordinate function, to act as an accompaniment for the activity of exploring the site.

The notion of *attachment* and some of the compositional approaches explored in the previous study were utilized as the catalyst for the design of this soundtrack. These approaches were integrated, explored, tested, extended and refined through a course of iterative development. This chapter describes this process from the perspective of the composer of the soundtrack’s music.

4.2 Objectives

- 1 To develop a soundtrack ‘app’ to accompany a walking activity at a real-world site.
- 2 Source and choose a suitable venue for the soundtrack.
- 3 Use a *placed sounds* approach, which uses GPS locations services on a mobile device to facilitate playback.
- 4 To apply, develop, refine and expand on the findings revealed from study 1 (*Chapter 3: Follow the music*) – such as the notion of *attachment* – through an iterative process of composition, ‘app’ authoring, testing and piloting.
- 5 To prepare a robust soundtrack for deployment in a user study.
- 6 To capture and chart the above process, to reveal and analyse key challenges faced, alongside the compositional and spatial design methods developed and applied over the course of this work.

4.3 The setting – Yorkshire Sculpture Park

The chosen site needed to fulfil a number of perquisites, which were:

1. A site with a purpose, one that offers an activity that encourages visitor exploration and interaction with a number of artefacts, or points of interest

contained within. The broad aim of the soundtrack is to accompany the 'narrative' of the walking experience; therefore, the experience requires some actions, goals or interactions for the soundtrack to scaffold.

2. The layout and structure of the site should permit for flexible walking routes (i.e., not a single track A to B to C structure). A key element of locative media work, particularly placed sound experiences is for the user to be able to explore and 're-mix' the music by their choice of route (Behrendt 2012).
3. An external site that covers a substantial area containing some variation of landscaping or visitor activity. The resultant adaptive mobile 'app' will be GPS driven, which is largely ineffective in indoor environments (Reid, Cater, et al. 2005; WAAS T&E Team 2015). A large physical space is also required to permit the development of an extensive and wide-ranging soundtrack.
4. And finally, a location that would facilitate on-site design, development and testing by the composer that would not impact negatively on its day-to-day running of the site and its visitors.

A number of locations were considered and the Yorkshire Sculpture Park (YSP)¹⁶, UK, was chosen, as it was deemed to best match the above criteria.

4.3.1 The Yorkshire Sculpture Park – an overview

The Yorkshire Sculpture Park (YSP) is set in over 500 acres of parkland¹⁶. It is home to a large collection of contemporary artworks situated in a diverse range of spaces such as formal gardens, hidden trails and rural countryside. Additionally, there are internal galleries and exhibition spaces. Approximately 60+ exhibits¹⁷ are located outside, at different points within the grounds.

4.3.2 Visitor demographics

The YSP receives over 300,000 visitors annually¹⁶. The *April 2013 – March 2014 YSP Visitor Survey*¹⁸ exposes a broad overview of visitor demographics, such as: only 4% of respondents visited the YSP alone, whereas 40% come as part of an adult party and 37% as a family group with children. 57% of visitors are aged

¹⁶ <http://www.ysp.co.uk/>

¹⁷ For the purposes of the work described here, an exhibit is one or a cluster of sculptures, which represent a single artwork by a single artist.

¹⁸ Face to face survey of 1808 visitors to Yorkshire Sculpture Park from April 2013 to March 2014. Approximately 75 interviews were carried out each month.

between 35-64 years. A range of rational for visitation is seen, with 59% attending the park to view the sculptures, 58% to view the landscape, 43% to walk and 8% for the free entry. Almost half of visitors (45%) spend between 3-4 hours within the park, 28% between 2-3 hours and 22% between 1-2 hours. Unfortunately, the survey does not reveal a deeper granularity of detail about visitor interaction within the different areas of the external parkland and exhibits.

4.4 Design preparation – orientation and observation

Having chosen the venue a number of initial visits to YSP were undertaken for a process of orientation and observation. This activity represented the first step in understanding the nature of the park and its function for visitors. It aimed to reveal and capture the physical structure of the park, including key elements of its topology, identification and placement of exhibits, and record some visitor demographics and behaviours. Collectively, this information exposed the holistic narrative of a visit to the YSP, an understanding of the context of the site (Schmidt, Beigl, and Gellersen 1999), which was then used to shape and drive the compositional design for the resulting soundtrack. This process could be described as *spotting*, which refers to the activity undertaken by film soundtrack composers who watch the edited film for the first time in order to consider how music will be used within the film (Davis 2010). The following sections (4.4.1 – 4.4.4) detail the observations captured from these visits.

4.4.1 Topology of park

The first ‘spotting’ session captured photographs of the exhibits and a GPS tracking device¹⁹ running on a smartphone captured the location of exhibits, the author manually added *waypoint* markers when standing in close proximity to them. In an attempt to account for the potential of GPS error, which may skew the capturing of exact positions, a further set of markers were captured on a second visit. These were then exported as GPX files from the smartphone, and the pair was manually averaged by overlaying both sets and remarking any discrepancy by taking the centre position between the two. This compiled version was then used to produce a global map of exhibit locations, which guided elements of the authoring process.

¹⁹ <http://www.gpsessentials.com> - An Android application that utilizes the Global Positioning System (GPS) receiver in the host mobile device to track and map location data.



Figure 18: Satellite view of Yorkshire Park

The YSP divide the park into a set of nine areas, which are illustrated on visitor maps as illustrated in , termed as: *Gardens* (formal gardens), *Hillside*, *Driveside* (also contains an access road to a car park), *Sculpture Trail* (a slightly hidden away path through a set of exhibits), *Lower Park*, *Lakeside*, *Country Park*, *Longside* and the *Upper Lake*⁸. Some of these are made distinct by their landscaping (e.g., *Longside* = rural and wooded; *Gardens* = formal gardens) and defined in part by naturally occurring or man-made boundaries (trees, hedgerows, lake and river and fencing). Whereas others share similar environmental characteristics, thus one area subtly blends into another without marked alterations to their environmental features. The vast majority of the park is made up by grassland, which is dissected by only a few manmade pathways. These pathways, for the most part, do not connect the locations of exhibits to each other, but rather they provide generic routes into, through and out of areas of the park. One exception to this is found in the *Sculpture Trail* area - situated between *Driveside* and *Lower Park* – where most of the exhibits are placed in close proximity to the snaking path that runs through it (). The vast majority of the exhibits are situated on and surrounded by grass and the structure of the parkland permits for a multitude of routes between areas and the location of exhibits (with the exception of the *Sculpture Trail* area described above). As part of these observational visits, notes were recorded about the park's structure such as changes of landscaping, physical borders, placement of walkways and restrictions of route access.

4.4.2 Sculpture exhibits



Figure 19: Selection of exhibit photos

An extensive range of contemporary sculpture exhibits – created by a host of artists – are housed within the YSP parkland (see Figure 19 for a few examples). The majority of the exhibits are situated within the *Gardens*, *Hillside*, *Driveside*, *Sculpture Trail*, *Lower Park* and *Lakeside* areas of the YSP (see & Figure 19). Although, other exhibits are located within the other areas of the park, they are fewer in number and not so localised. The majority of the exhibits can be approached and touched, with only a few having restricted access via rope cordons surrounding them (see top left exhibit in Figure 19 for an example).

4.4.3 Visitor behaviour

Further visits were made to the park with the singular purpose of observing visitor types and their behaviours on site. Four broad types of visitors stood out: (1) *walkers*, those who attend for the purpose of rambling across the park; (2) *student groups*, who visit the site for educational purposes; (3) *leisure visitors*, who relax, picnic and play ball games on the open grassed areas; and (4) *exhibit viewers*, the target audience for this soundtrack. Those who attend YSP chiefly for the purpose of exploring and viewing the exhibits. This group extended a broad range of ages and social groupings, for instance families, couples or friends.



Figure 20: Exhibit Viewers at YSP

The noted behaviours of the *exhibit viewers* were as follows. Typically, families with younger children walked at differing speeds and explored the exhibits for varied durations. The children often ran ahead of their parents and would linger at exhibits if particularly engaged with them (for the most part the YSP are comfortable for visitors to be tactile with the sculptures, placing the notices at only a few specific exhibits requesting that they should not be touched), whereas their parents and adult groups would generally walk at a slow and unhurried pace, and engage with the sculptures together. The walking routes *exhibit viewers* chose, were generally direct trajectories between exhibits. Typically, they did not use the walkways as this would frequently result in longer, non-linear routes between exhibits. Rather, they would approach the exhibits, touch them and view them from multiple angles by circling around them. Due to the large park area, most groups had their 'own' space and could move around and interact with exhibits in their own time. However, for those smaller or more densely clustered areas, *exhibits visitors* would take turns, often slowing their approach if other visitors were engaging with exhibits ahead of them, waiting for them to move on before approaching the exhibits themselves. Conversely, at larger exhibits, multiple groups were observed to interact concurrently. They would take individual routes through the park, although access to some areas required visitors to funnel through restricted walkways, notably when accessing the *Lower Park* and *Lakeside Areas*, which required walking through a car park.

4.4.4 Summary

This 'spotting' process revealed a large number of distinct sculpture exhibits set in rich and diverse spaces of unique character, which apportion the parkland. Walkways are present, but do not typically present routes that connect exhibits. Visitors appropriate the park for a variety of purposes, but some groups come to engage primarily with the sculpture exhibits, generally groups of adults or families (termed *exhibit viewers*). *Exhibit viewers*, for the most part, roam freely at

their own pace and route access to the sculptures' is flexible and primarily across grass. The visitors enjoy touching and interacting with the exhibits.

4.5 Preliminary compositional design brief

The period of orientation and observation as outlined above was coalesced with the original objectives to construct a compositional design brief, which is detailed in the following. This design brief covers matters of musical style and the application of the compositional techniques as utilized in study 1, alongside the findings from the orientation and observation process as described in section 4.4.

4.5.1 Musical style and provision

The aim of this soundtrack was to reflect and accompany the YSP experience holistically. The decision was taken early on not to compose music – for the most part – that deliberately paraphrased, reflected, or brought attention to the nature of the sculpture exhibits; specifically, to avoid direct musical interpretation of the sculptures (there were four exceptions to this, the rationale for these explained in within). Rather, the aspiration was to deliver a subtle and enjoyable soundtrack accompaniment that reflected the wider experience of exploring the park and the exhibits. Subsequently, on a purely musical level, the majority of the music composed for the soundtrack is considered interchangeable; it could function equally effectively if re-arranged, or placed at other locations within the YSP. Nevertheless, the composer also recognises and acknowledges the difficulty of removing all external influences from the compositional process, particularly as the musical cues created for this soundtrack were composed for, and in response to, the observed characteristics of the sculpture park. Therefore, it would be disingenuous to state without exception that the nature of exhibits did not colour the compositional process in any way. All that can be stated, therefore, is that the composer was mindful of this throughout and a best effort was made to avoid a musical interpretation of the exhibits.

The musical style chosen for the soundtrack could be best described as a blend of ambient electronica and nu-classical, which was felt, by the composer to offer ample scope for melodic and textural variation. A number of rationales account for this chosen stylistic approach:

- To produce a subtle and contemplative soundtrack accessible to the wide audience who visit YSP (*exhibit viewers*), which may include families and some older visitors.

- To deliver a soundtrack that would assume a background role within the walking experience. In direct reference to the aims of this work, the soundtrack's role was to inform, describe, colour and guide the visual-physical activity of exploring and interacting with the sculpture exhibits, in much the same way that display media soundtracks do. The ambient, melodic nature of the chosen musical style was felt to reflect the type of music often found in films and television documentaries.
- Related to the above, to deliver a soundtrack that would support continuous listening for potentially extended durations.

4.5.2 Musical language for the Yorkshire Sculpture Park

The following outlines the initial decisions taken regarding how to work with the YSP space and techniques for composing the music. The notion of *attachment* was carried forward from study 1 but then refined in this specific setting. Listed below are the starting points for the soundtrack authoring and composition.

- 1 The YSP site covers 500 acres and thus an early decision was made not to treat it in its entirety, as the sheer size was prohibitive to compose, author and then capture a visitor study. Rather, the soundtrack would cover those areas that contained the largest concentration of exhibits (*Gardens, Hillside, Driveside, Sculpture Trail, Lower Park and Lakeside* areas) (see). As a result of this decision, the soundtrack would then have an auditory boundary – where the music stops – situated within the confines of the parkland, rather than extending to the full extremities of the YSP boundaries. This in turn presented an opportunity to further explore the notion of *Global Attachment*.
- 2 Drawing from the observations of the YSP as illustrated in section 4.4, the physical structure of the park suggested a number of spatial regions delineated by physical borders, boundaries, distinct types of landscaping and areas surrounding collections of sculpture exhibits. A visitor's exploration into, through and out of these regions collectively represent the unfolding 'narrative' of the visitor experience. Using the analogy of a 'narrative' – in a filmic sense – to describe the YSP experience then suggests that these physical regions can be readily viewed as similar to 'scenes' from a film, each one containing unique sculpture exhibits and landscaping. Naturally, the soundtrack should accompany these scenes with music of 'individual purpose and character'. The notion of *Regional Attachment* may assist here, to demarcate areas of physical space through unique musical treatments. This in turn raises a series of questions such as: how precisely do the musical scenes

have to match the physical regions (i.e., a transition between two musical regions happening in synchronisation with the crossing of a physical boundary); what about those physical regions that do not have clearly marked boundaries or do not contain artefacts to engage with, but rather gradually transition from one into another? These important questions will be explored and addressed in an evaluative visitor study and subsequent discussion (Chapters 5 and 7). It is anticipated on the back of the preceding study that regular and perceptible musical change will promote a sense of engagement with the physical environment (i.e., *global attachment*).

- 3 A key behaviour of *exhibit visitors* (section 4.4) was the act of engaging with the sculpture exhibits at close quarters. Consequently, this was considered a key activity to reflect via the soundtrack. Inspiration for addressing this was drawn from two areas: first, Fosh *et al.*'s work on interactive visitor trajectories, also set in sculpture garden (Fosh et al. 2013), that drew on the *trajectories model* (Benford et al. 2009; Benford and Giannachi 2011) to design visitors passage through engagement with exhibits, a 'trajectory of interaction' (TOI). This TOI was sub-divided into five stages, *approach*, *engage*, *experience*, *disengage* and *reflect* (Fosh et al. 2013). Whilst music was also an integral feature of their experience it was not a continuous attribute, but rather playback accompanied specific moments. Thus, key stages of their TOI were constructed, in part, around preparing the users to don headphones and initialise music playback (*engage*) in preparation for the *experience*, proceeded by the removal of headphones (*disengage*) (Fosh et al. 2013). Whilst their setting shared some similarities to the YSP, the manner of user interaction is different, as the YSP visitors will be listening to the soundtrack music continuously. In tandem with Fosh et al.'s (2013) TOI, inspiration was also drawn from film and computer game soundtracks, such as the notion of *foreshadowing* (M. Boltz, Schulkind, and Kantra 1991) and leitmotifs to represent points of interest (i.e., exhibits). In response to these examples the intention here was also to prepare, accompany and signify facets of visitor interaction with exhibits by developing an appropriate trajectory of interaction (TOI) for this soundtrack. It was anticipated that some of the musical methods used in study 1 would assist in developing this TOI, such as dynamic contours that increase and decrease the level of musical intensity, harmonic closure, short duration accents (i.e., *local attachment*) and contrasting thematic material to signify points of interest and arrival.

What follows is a detailed description of the implementation of this compositional design brief over an iterative process of composition, *AppFurnace* authoring, testing and piloting.

4.6 Iterative design

The process of composition and ‘app’ authoring was one of constant evolution. Nevertheless, for the purpose of description five iterations of the soundtrack’s development are detailed here. These five iterations are used to illustrate the core developments, challenges faced and lessons learned from this process.

4.6.1 YSP Soundtrack - iteration 1

4.6.1.1 *Forming regions and musical scenes*

Prior to commencing any music composition, the first step undertaken entailed structuring the physical space within the ‘app’ authoring environment (*App Furnace*). This was achieved by drawing trigger zones within the *App Furnace* authoring environment (see Figure 21 and see *Chapter 1: Technical solutions*). First circular trigger zones were drawn around the immediate proximity of each sculpture exhibit (Figure 21) using the exhibit location map prepared from the spotting sessions. The drawing of some physical regions that would become musical scenes followed, guided by the notes captured from the ‘spotting’ sessions, alongside the Google Map view in *AppFurnace*. The nomenclature applied here is as follows (Figure 21): R = region; numbers identify regions (they were assigned predominantly in the order that the regions were drawn in *App Furnace*, and some change over the course the iterations); examples where the same number is used with the addition of a proceeding letter (e.g., R1a and R1b) represent what are termed here as *associate regions*, this is explained within the forthcoming section.

This initial stage did not cover the whole of the chosen soundtrack area, but rather it aimed to quickly establish a set of regions that contained exhibits to support some initial composition and testing. The following discusses some key points that directed how and where regions were identified and the placement of trigger zones within the *AppFurnace* authoring environment.

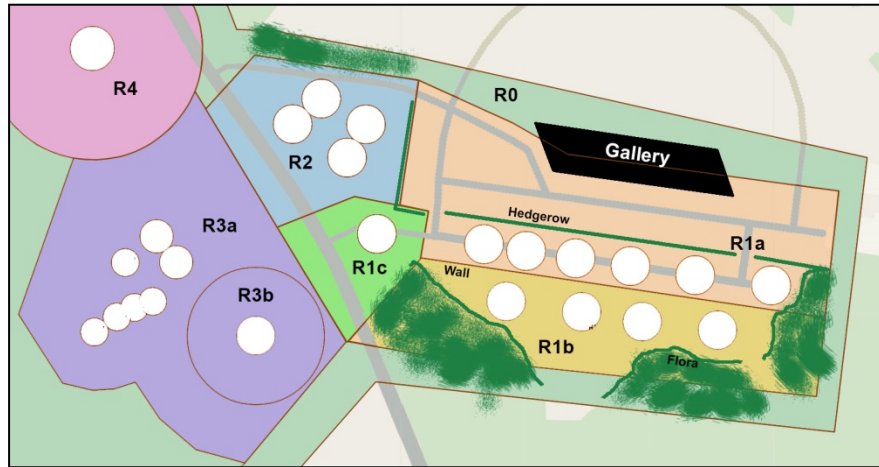


Figure 21: Regions in the Gardens area

The first four regions to be defined were contained in the *Gardens* and *Hillside* areas of the park (R1a, R1b, R1c and R2) (Figure 21). For the most part boundaries lines for these regions were derived in direct response to existing demarcations, such as hedgerows, trees, walls, fences and changes in landscaping. So the size, shape and placement of these existing physical constructions guided the drawing of regions in *AppFurnace*, with some provisos, i.e., the implication and treatment of walkways needs qualifying. Figure 21 outlines the location of some walkways situated within this section (grey lines). When studying the park the walkways neatly dissect areas of grassland that contained sets of exhibits and thus these walkways appeared to neatly delineated boundary lines for adjacent regions. However, if boundary lines were placed along the length of walkways, visitors journeying along them would undoubtedly straddle the two trigger zones that formed adjacent regions. The result of this, factoring in some GPS error, would most likely have resulted in continuous triggering from one region's music to another, or multiple re-triggering of a region, presenting a disjointed and unmusical experience. Whilst, *exhibit visitors* were largely observed not using the walkways – generally taking trajectories across the grassland from exhibit to exhibit – it was nonetheless considered prudent to account for the walkways within the structure of the soundtrack design. Consequently, where the boundary of two adjacent regions is identified by the presence of a walkway, the trigger zone was drawn approximately 5-10 metres parallel to one side of the walkway to avoid the potential retriggers, as illustrated in Figure 21.

For those areas of the park that did not have existing physical affordances present to define the size, shape and placement of region boundaries, their assignment was guided by a number of factors. For the most part a region aimed to encompass one exhibit (an exhibit often constituting multiple sculptures,

created by an artist). Region 1a, R1b & R1c formed one exhibit, as did the four sculptures situated in R2, similarly those located in R3 (see Figure 21). Ideally, the drawing of a region would place the exhibit(s) approximately at its centre, thus defining a broadly similar distance from the outer edge of the region to the location of the exhibit regardless of the direction of approach. In practice this was rarely possible as the presence of physical boundaries and objects (e.g., trees, walls, or buildings) or other exhibits in close proximity would compromise the available space. Consequently, an evolving process of concessions and best judgements ensued. There were a few instances of unconstrained exhibits free of physical restrictions and thus the drawing of these boundaries had a free rein. This process raised a number of questions, such as: how far away from the exhibit does a visitor need to be before they feel like they are approaching, or interacting with it? And, can a change of music instigate this feeling for the visitor? Or if the user is too far away from the exhibit upon the musical change, will they assume the music and exhibit unrelated? Will they notice either of these? Whilst there were no immediate answers to these questions, they were deliberated throughout the iterative creation of trigger zones. Typically, these decisions or judgements were made using a selection of cues drawn from the landscape (open space or concentrated flora), the size of the exhibit (the larger the exhibit, the larger the region) and 'line of sight' (typically, no musical change was initiated without the user being able to see the related exhibit).

Another, method of structuring *scenes* also came to the fore in this iteration, which are termed *associate regions*. The following example concerns the first two regions (R1a and R1b). Here, R1a encompasses two walkways divided by a tall hedgerow (Figure 21 and). The first walkway contained no sculpture exhibits, whilst the other situated on the other side of the hedgerow housed a line of exhibits set down its centre (Figure 21 and). A stonewall presented a physical boundary between R1a and R1b (see Figure 21, &).

R1b was situated to the other side of this wall, accessed via steps. Although R1b neighboured R1a this region's landscaping contrasted the former, being a grass area lined by trees and bushes ().

What was interesting about these two regions is that the set of sculpture exhibits contained within both regions formed a single exhibit; thus the two regions were strongly related by means of the sculptures they contained, but were nonetheless quite distinct in their topology. The challenge was how to represent both the

regions' relationships and distinctions musically, which is described in the following (see Figure 24).



Figure 22: Region 1a, as viewed from both ends



Figure 23: Region 1b, as viewed from both ends

The music for R1a was composed first; a slow moving 4 bar phrase in the key of A minor containing a melodic theme played by cellos, accompanied by a sustained string ensemble presenting a simple chord sequence. Supporting this was a pizzicato style bass line (Figure 24). The composition of the music for R1b maintained some musical relationship to R1a, so as to reflect the relationship between the two regions' exhibits. These relationships were:

- R1b was composed at the same tempo and in the same key centre (A minor) presenting a variation of the same harmonic sequence.
- A section of timbres used in R1a were carried over to R1b, such as the string ensemble and the synthesized bass tone.
- Some of the motifs used in R1a were re-used, but altered to form new thematic material presented in R1b. First, the ascending / descending synth bass line in R1a was used as blueprint for a more elaborate ostinato figure played by the piano in R1b (see red circles in Figure 24). The second example refers to the higher-level contour of the cello melody in R1a (blue brackets). 'Higher-level' in this context means stripping back the melody to its simplest form, which in this case leaves the first, third and fifth notes. This

descending pattern is then used – with some alteration to address the harmonic sequence – in the bass line.

To reflect the distinction between the two regions (topology of landscape):

- New timbres were combined to those carried over from R1a: Piano and synthesized tone used in the upper melody (Figure 24).
- Introduction of new thematic material: Synth melody and piano figure.
- Re-balancing the hierarchy of roles between the instruments. This refers to which instruments, or themes, take a principal or secondary function. In R1a, the principal role refers to the melody played by the cellos, which is placed in lower-middle pitch range. Whereas in R1b, attention is shifted to a higher pitch range via the synthesizer melody and rhythmically dense piano figure. In addition to presenting key motifs or themes in different pitch ranges, the dynamic level (volume) of instruments was also used to make particular material more or less prominent.

R1a $\text{♩} = 62$ A_{M1}^9 G/A A_{M1}

Strings p

Cello melody mp mf mp

Synth Bass $pizz.$

R1b $\text{♩} = 62$

Synth Melody mp

Piano p $Red^* A_{M1}^9$ G A_{M1}/D

Strings p

Synth Bass p

Figure 24: Comparison of R1a and R1b

Associate regions were used in a number of other areas of the YSP. They were all treated with a similar compositional approach – simply one of retaining some relationships between musical features whilst simultaneously introducing musical diversity

4.6.1.2 *Maintaining global attachment*

The ‘spotting’ sessions (Section 4.4) revealed some substantial areas within the park that did not contain any exhibits, some of which were represented by more ‘practical’ built environments such as a car park. Nonetheless, to reach other areas populated with exhibits – such as the *Sculpture Trail* and *Lower Park* – these ‘empty’ had to be traversed to access them. How to address these ‘passive’ areas of the park was addressed fairly early in this iteration. Provisionally, two options were considered: one, to not have any music in these areas, thus the presentation of silence would signify no artefacts in the immediate vicinity; or the second would be to maintain consistent music playback so as to communicate the experience as still active. The latter refers directly to the notion of *global attachment* discussed in *Chapter 3* and was thus deemed the route to explore. In response, a global boundary was drawn that encompassed all of the ‘active’ regions (those containing exhibits), so that when a user exits a region that does not adjoin another active region they enter this ‘holding region’ (i.e., R0) where music of low intensity is presented (see Figure 30). Thus the soundtrack tenders a stepping down of auditory activity to indicate to the user that they are not in areas of interest, but maintains the auditory stimulus to signify continuation of the experience (i.e., *global attachment*). If a user happens to exit this global boundary (R0), then a further step down to silence is presented, signifying exit from the experience. The music for R0 was a ‘dark’ synthesiser sound sounding a sustained E minor chord. Presented alongside this was a higher pitched piano sporadically presenting a simple three-note theme, treated with a large reverb and mixed at a comparatively low volume level, so as to place it – virtually – in the distance.

4.6.1.3 *Developing a trajectory of interaction*

As detailed in Section 4.5.2, the intention was to reflect musically visitors’ interaction with exhibits when they are located within regions. An provisional trajectory of interaction considered three stages, to accompany the visitor as they *approached*, *engaged* and *withdrew* from engagement with exhibits. This section explores the initial efforts to address this objective.

Approaches

The aim of an approach was to foreshadow arriving at an exhibit, motivated by the notion of foreshadowing in film soundtracks, where the music prepares the viewer for events yet to come (Wingstedt, Brändström, and Berg 2010). Musically, inspiration was drawn from the preceding study, where participants

acknowledged a increasing musical intensity (i.e., crescendo) as representing motion towards a point of interest. To realise this in practice a sequence of trigger zones fanning out from the location of exhibit were defined in *App Furnace*, where upon entry into each successive trigger zone initiates the next step of musical intensity. The format for these *approach* zones were, for the most part, circular or elliptical shape; ideally comprised of three to four zones (not including the outer zone that defines the region or the inner 'exhibit' zone), dependent on available physical space; the distance between adjacent approach zone boundaries was approximately 10 / 13 metres.

During the process of forming regions (Section 4.6.1.1) it was clear from the outset that *approaches* could not be applied to all exhibits, for two principal reasons: not enough physical space in a region to permit *approach* zones; and secondly when collections of exhibits were too densely populated within a region, which would have led to *approach* zones overlapping each other. This last reason, although experimented with in this iteration was considered ultimately undesirable separate musical parts intended for different *approaches* would sound in combination and clash. Consequently, the treatment of *approaches* was addressed on an individual basis, which led to three distinct methods:

- No approach:
No *approach* in response to tightly confined regions (e.g., R1a, R1b, R1c, R2 and some exhibits in R3) (Figure 25). Consequently, the music in these regions was all single 'cell' arrangements (i.e., one layer of music).

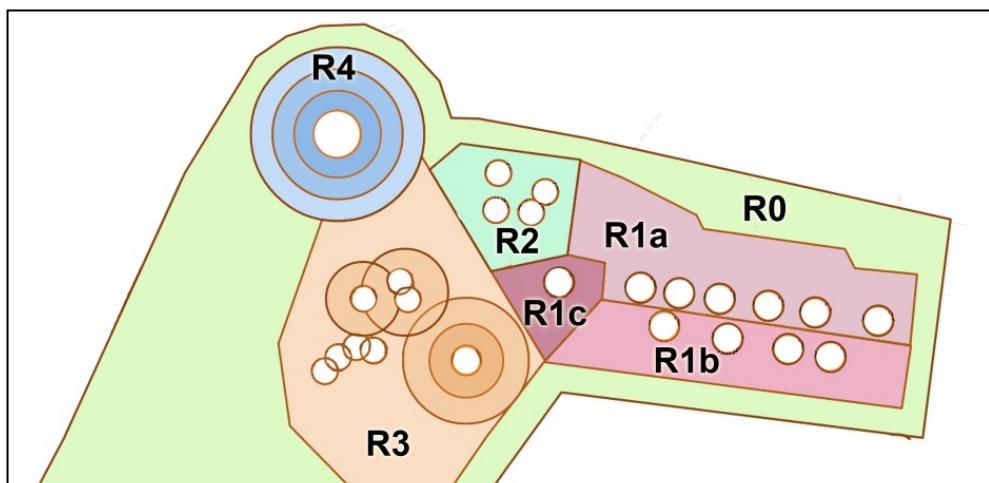


Figure 25: No musical approaches (except one in R3 and R4)

- Partial approach (single-stage approach):

A *partial approach* refers to the presence of only one *approach* zone 'sandwiched' in-between the outer zone of a region and the inner 'exhibit' zone. The term *partial* is used here as there is limited opportunity to increase the musical intensity. Region 3 (Figure 25) illustrates an example of a partial musical approach, however this example also reveals some early experimentation with overlapping approach zones (as discussed above), which were abandoned after this iteration.

- Full approach (multi-stage approach):

A full approach indicates those exhibits that had two or more approach zones defined around it, such as R4 (see Figure 25) and R8a, R8b, R9a and R9b (see Figure 26).

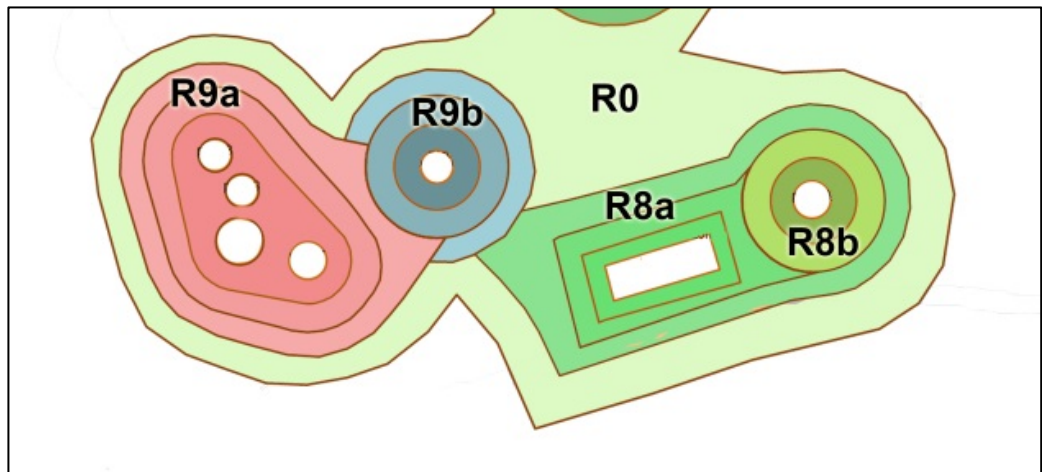


Figure 26: Examples of full approaches

The utilization of the terms *partial* and *full* and their representative number of zones is an arbitrary classification. The composer considered three steps of intensity adjustment as the minimum needed to fully shape a noticeable change of musical intensity from the outermost zone to the 'exhibit' zone.

A number of techniques were used to create a contour of musical intensity, as the following example will illustrate. Region 4 utilized a combination of techniques. Five distinct techniques were utilized, all of which individually contributed to the rising musical intensity as illustrated in the score (see Figure 27), which details 2 bars of music from each approach zone:

1. Thickening of the vertical texture: entry into each subsequent approach zone introduced a new instrument part. This ‘thickens’ the overall vertical texture of the music. Each new instrument part was a contrasting timbre.
2. Harmonic chord progression: the music in each zone is composed to a different chord harmony, thus the transition from one zone in to the next triggers a step along a chord progression. The chord progression in R4 is: C6 – Em11 – A9.
3. Rising voice-leading: the sustaining chords sounded by the ‘synth pad’ are scored with ascending voice leading in the upper voice of the chord harmonies.
4. Increasing rhythmic density: each zone introduces a musical part composed with increasing rhythmic density (shorter note values), which further contributes to the density of the vertical texture and also a perceived impression of increasing tempo.
5. Increasing volume: transition into each zone is also treated with a rise in the global loudness of the music.

This region – as stated above – applied five different methods of creating an ascending contour of musical intensity. Not all approaches utilized multiple techniques. For instance, R3b (Figure 25) and R8a (Figure 26) both presented an ascending sustained string melody, which sounded over a backing track arrangement that did not intensify in any way.

The figure displays a musical score for four instruments: Piano, Violin, SynthPad, and Perc. Tone, organized into three approach zones.
 - **Approach zone 1 (blue background):** Piano starts with a 68bpm tempo. Violin and Perc. Tone enter. SynthPad has a sustained chord.
 - **Approach zone 2 (green background):** Violin and Perc. Tone continue. SynthPad changes chord. Piano enters with a more complex rhythmic pattern.
 - **Approach zone 3 (yellow background):** All instruments continue with further rhythmic and harmonic complexity.
 Annotations highlight 'Increasing dynamic level' (p, mp, mf), 'Each subsequent voice has a different and increasingly complex rhythmic density', and 'Change of chord harmony with rising upper voice'.

Figure 27: approach zones for Exhibit in Region 4

Engage

As similarly seen with *approaches*, a range of different musical treatments were developed and composed for *engagement* stages, were visitors arrive and engage

with the exhibits at close quarters. Each exhibit (n.40 in this iteration) had an engagement zone that surrounded its immediate area. The size and diameter was largely dependent on the physical size of the sculpture exhibit (see region map in Figure 30). The radii of these zones were manually adjusted in response to testing, to find a balance between an area large enough for consistent GPS recognition and intimate enough that the adaptation felt connected to the exhibit in question. As with approaches, three types of musical treatments were used in these engagement zones:

1. Each instance of an exhibit (engagement zone) in all regions had a short duration musical statement that sounded upon entry into the zone (i.e., the moment of *arrival*), which was based on the interpretation of dynamic accents in Study 1 that were perceived as marking ‘point of interest’. Some of these were single musical events (i.e., an accent) but the majority were short 1 bar motifs, uniquely structured to complement the music of each region. To denote these motifs’ function – to make them distinct from the other music – they were all orchestrated with a vibraphone sound and tympani accent in the lower register. Consequently, the orchestration of music across the musical scenes avoided the use of these timbres, so that they always presented a contrast. Figure 28 presents an example of four variations of a *arrival* motif that were composed for the four sculpture exhibits situated in R2.

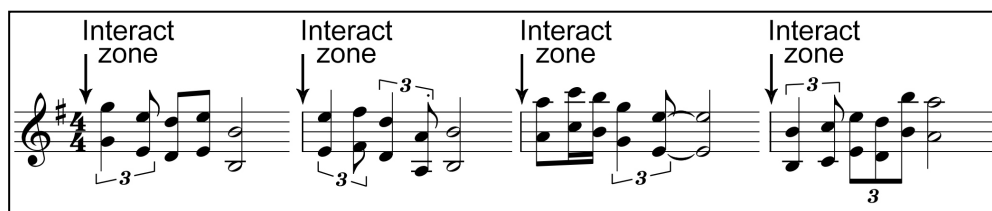


Figure 28: Short motif *Arrival* accents for the four exhibits in Region 2

These ‘arrival motifs’ were the only *engagement* features presented in those regions which contained clusters of exhibits in close proximity (e.g., R1a, R1b, R2, and R3a), thus the underlying music sounded in those regions would continue to play unaltered when these motifs were triggered. Had other, more substantial musical adaptations taken place in these *engagement* zones (e.g., change of harmony, introduction of new themes or instrumentation) the visitor would have experienced a string of musical changes in short succession as they journeyed in, through and past exhibits in close proximity. This was considered undesirable, as it would have disrupted the musical coherency. A balance was sought between the music’s

function as an accompaniment to the park artefacts and the presentation of an articulate musical soundtrack.

2. For those exhibits that were treated with an *approach* stage a conclusion or resolution of the ascending musical intensity was sounded in conjunction with the presentation of the *arrival* motif. For the most part the intention was to reduce the dynamic level of the music whilst a visitor was located in an *engagement* zone, to both promote the impression of arrival and also to clear space for them to engage with the exhibit. Methods used to resolve the ascending contour of musical intensity included:

- A harmonic resolution or modulation.
- A final step of ascending intensity: quickly followed by rapid lowering musical intensity in combination with the engagement motif.
- The lowering of musical intensity consisted of either a complete fading to silence (often interpreted in study 1 as an indicator of arrival) (e.g., R4E1 and R1bE1), or a reduction of intensity to a thinly orchestrated and noncomplex musical section (e.g., ‘pad’ sounds, or orchestrations with slow rhythmical complexity, a found in R8E1, R6aE1 and R6bE1).

Figure 29: Exhibit 1 in Region 4

Figure 29: Exhibit 1 in Region 4

The example in Figure 29 illustrates all three of the above techniques. The preceding *approach* music (see Figure 27) is modulated from C Major to D major upon entry into the *engagement* zone (i.e., C/Em/A/D), the increasing dynamic intensity of the *approach* stage reaches its peak upon the presentation of a single accent on the first beat of the *engagement* music (Figure 29), upon which the music starts to gradually subside as the tempo slows and the piano figure descends and the overall dynamic level gradually fades to silence over the course of 7 bars. This example represents one of the longer transitions composed for an

engagement stage. Although the ‘arrival’ accent is short (1 beat), the reduction of the music to silence takes place over a longer duration (7 bars), which in turn assumes that a visitor would stay within that zone engaging with this exhibit for long enough to experience the subsequent silence.

Withdraw

The process of *withdrawing* – a visitor’s departure from interaction with an exhibit – was the direct reversal of the *approach* stage. The same set of nested trigger zones that sounded the *approaches*, would present the opposite, descending contour of musical intensity on the route out. Evidently, these *moving on* stages were only found around those exhibits, which had an *approach* stage.

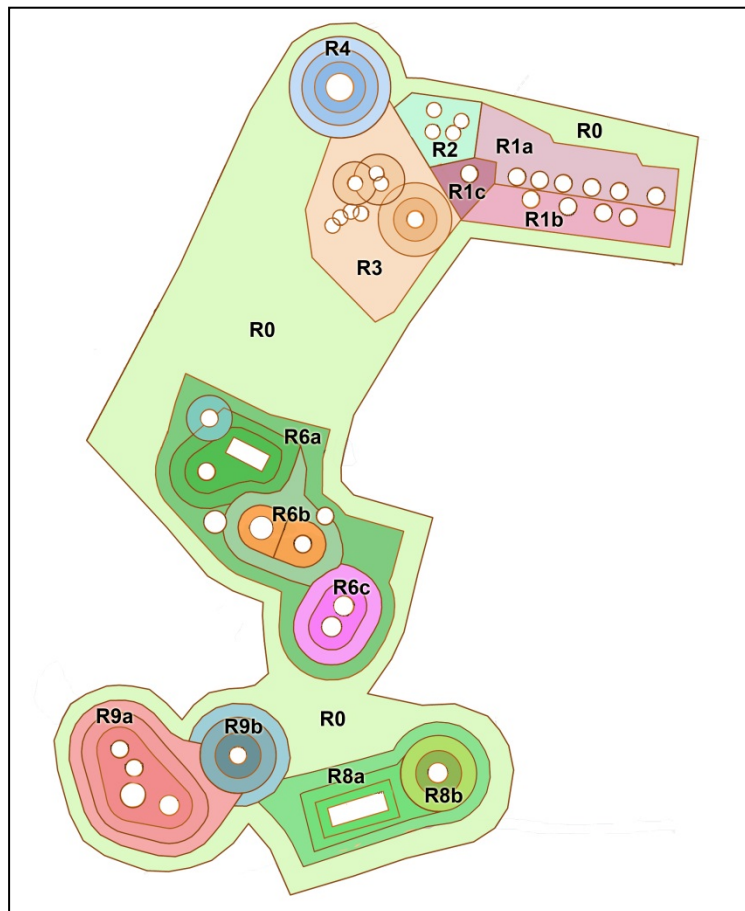


Figure 30: Region map for iteration 1

4.6.1.4 Summary

Significant early work on defining *regions* and *musical scenes*, in addition to the *trajectory of interaction* was undertaken in the early stages of the soundtrack’s design. This initial process highlighted a number of interesting challenges. Walkways, which often framed areas containing exhibits, were avoided as boundaries markers for regions, so as not to become transition points between

musical scenes that would result in undesired retriggering if visitors walked down their length. The notion of *Associate regions* was developed, where two adjacent regions that shared some common features prompted the need for musical scenes that were equally related, although distinct. The application of unique musical textures and key centres – as drawn from study 1 - have been used in guiding the composition of discrete musical scenes. Finally, within the scenes themselves, a multi-stage musical treatment of visitors' *trajectory of engagement* with the exhibits has been developed and applied. This three-stage process (where space permits) has drawn on the notions of musical intensity contours, harmonic resolution and contrasting musical features to foreshadow a visitors *approach*, accompany *engagement* and *withdrawal* from an exhibit.

4.6.2 YSP Soundtrack - Iteration 2

In this second iteration the on-going development of the soundtrack is continued; approaches applied in the previous were duplicated in other areas of the park, extended and refined; and external interventions not anticipated necessitated alterations to the soundtrack's structure.

4.6.2.1 Re-mapping location of exhibits

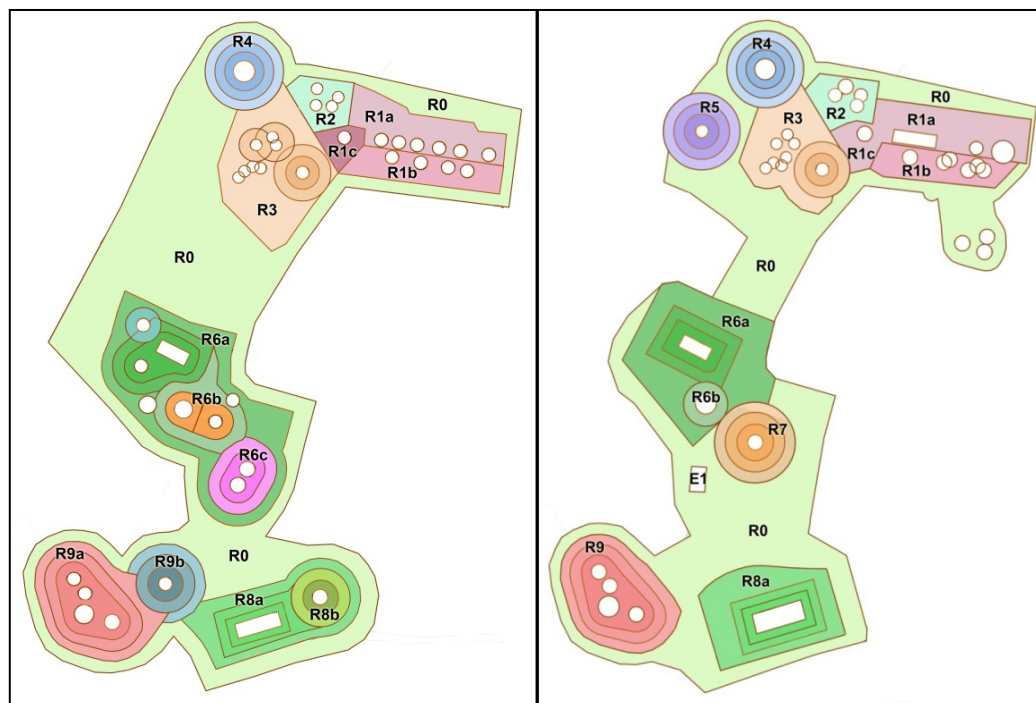


Figure 31: Region map iteration 1 (left) and 2 (right)

Visits to the park, largely for testing music and zone placement, were also accompanied by further re-mapping the location of exhibits. Comparing the region map of iteration 1 (Figure 30 and Figure 31) against that of iteration 2

(Figure 31) reveals many alterations to the position of the exhibits (white circles on region maps), particularly in R1a, R1b and R1c, R2 and R3a and R3b. The new set waypoint markers were compared against the previous sets to continuously fine tune the placement of these locales. Further adjustments to these positions were made 'manually' in response to on-going testing (i.e., 'best guess' adjustment of trigger zones within *AppFurnace*).

4.6.2.2 Exhibits changes

In between visits to the YSP a number of alterations to the exhibits had occurred: one exhibit had been moved to a different location and a new exhibit had been situated in the same general area (see R6c in iteration 1 and R7 in iteration 2 - (Figure 31); two had been removed (R9b and R6b in) and two new exhibits introduced (located within R5 & E1 in (Figure 31). These changes were unexpected and thus necessitated a number of additions and alterations to the configuration of the regions. One of the new exhibits was situated in area not yet treated with any musical scenes, which became R5. The placement of this exhibit afforded ample space to treat it with a set of multi-stage approach zones (Figure 31). The removal of the exhibit situated within R9b meant that there was no longer a requirement for a musical scene in that area of the park so it was consequently removed. The topology of R8a and R9a, which were both adjoined to R9b were correspondingly adjusted. The new exhibit located in R7 dictated a re-drawing of that region (Figure 31).

4.6.2.3 Experimentation with zones, exhibits and scope

This iteration revealed a process of experimentation with the adaptive structure of the soundtrack, such as the topology of the regions and also the soundtrack's coverage of the parkland and exhibits. Leading with the former topic, a comparison of iterations 1 and 2 as illustrated in Figure 31 exposes a number of adaptations to the size and shape of most regions (only R4 remains unadjusted), notwithstanding those exhibit changes described above (Figure 31). Some of these adaptations were merely minor refinements (e.g. R1a, R1b and R1c, and R2) and others were more pronounced such as R6 (see Section 4.6.1.1).

As stated the exhibit contained within R6c was replaced. This prompted a re-drafting of that region as well as a reinterpretation of all the R6 regions (which were *associate* regions). In its previous form many zones were tightly compressed into the available space and issues of GPS resolution became apparent during testing. GPS error would sometimes compress the space between trigger zones

further; meaning that sometimes the triggering of cells or stems might be delayed, by which time the listener may be near to, or actually inside the next subsequent zone. Consequently, there was not adequate space to allow the music to unfold in a dependable manner. Moreover, upon reflection the shape and position of the associate regions did not best compliment the structure of the physical area. Consequently, a decision was taken to simplify the zonal structure across these regions, which resulted in the following alterations:

- R6c became R7, a unique region in its own right.
- Several smaller exhibits had their *engagement* zones removed, so the focus was placed (for marking *arrival* and periods of *engagement*) on only the larger exhibits (Figure 32).
- *Approach* zones were re-drawn symmetrical to the shape of those treated exhibits.



Figure 32: Removal of *arrival* zones from R6 (iteration 1 (left), and 2 (right))

This streamlining process extended to other regions, such as R1a where a group of six sculptures (all part of the same exhibit) were grouped under one ‘exhibit zone’, as that they were positioned too close to each other for GPS resolution accurately distinguish individual positioning (iteration 2 (right) in Figure 33).

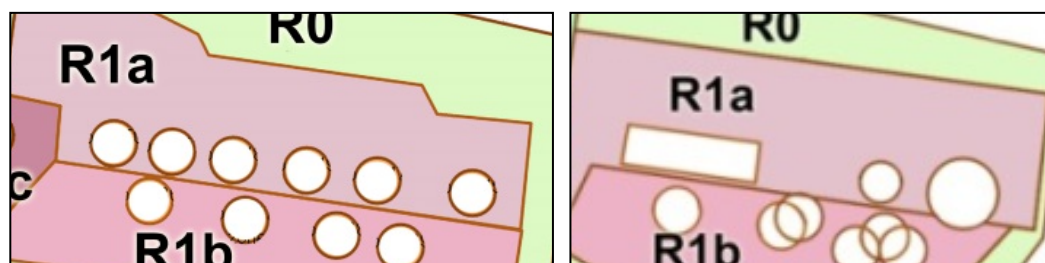


Figure 33: Reforming engagement zones in R1a

In iteration 1 all the *engagement* zones constituted of either just an *arrival* motif, or an *arrival* motif along with a reduction of music intensity for the period a listener was situated in the zone. Here a different musical treatment was defined. The

desired reduction of musical intensity for the *engagement* stage was replaced – conversely – with the introduction of additional musical material, forming an intensification of the music. The rationale for this choice is found partly in the iteration 1’s discussion concerning the need for the music to maintain some consistency and coherency. This set of sculptures was situated close to the visitor centre and consequently it was probable that they would be encountered first. The composer – as a result of testing – felt that this musical scene (possibly the first listened to by a visitor) would have been playing for a short duration and consequently it was deemed undesirable to reduce the music’s intensity at such an early stage. Therefore, an additional voice (piano) was added to the scene’s underlying music. The addition of the Piano figure in this *engagement* stage (see yellow section in Figure 34), a ‘snaking’ semi-quaver pattern contrasted the leisurely music of the underlying scene (see blue section in Figure 34). A further justification for this musical intensification around this set of exhibits drew on the experience of study 1, where the introduction of contrasting music features signified points of arrival for some participants.

Figure 34: Engagement music for set of exhibits in Region 1a

This iteration also witnessed further streamlining out of consideration for the visitor study that would engage with this soundtrack. During testing the author

was monitoring the approximate duration a walk around this area of the park would take, possibly 30 minutes to well over one hour. At this juncture it was felt prudent to restrain the scope of the soundtrack to constrain the duration of the visitor study. This resulted in the removal of R8b from this iteration and a general tightening of the soundtrack's global boundary. It ought to be noted that the coverage of the soundtrack expanded and retracted across all iterations.

4.6.2.4 Summary

Issues of GPS accuracy came to the fore in this iteration. Each set of captured 'exhibit' waypoints was different, which highlighted some of challenges of using this locative technology. The size and placement of trigger zones was in flux and under continuous (manual) refinement. A streamlining of the placement and configuration of the regions and the global boundary was also undertaken. The impermanency of this type of setting was unexpectedly exposed, as several exhibits were replaced and re-sited, which necessitated the redrafting of some regions and music. This issue represents a continuing challenge for these types of experiences and will be revisited later in the thesis. Some *engagement* zones saw the introduction of increased musical intensity, to mark 'arrival' which stand in contrast to those that reduced the degree of musical intensity.

4.6.3 YSP Soundtrack - Iteration 3

The third iteration details another set of unexpected alterations to the exhibits, in addition to the continual fine-tuning of regions and the global area covered by the soundtrack, and finally two pilot-participants tested the soundtrack walk.

4.6.3.1 Exhibit changes



Figure 35: New sculptures in Region 5

Some additional exhibits were introduced into the park during the course of this iteration. Primarily, these were situated in R4 and R5 (Figure 35). Accordingly, the outer boundaries of these regions were adjusted to encompass these new exhibits. For instance, the two sculptures in R5 were placed in close proximity to the existing sculpture around which the region was originally formed.

4.6.3.2 Re-forming regions

A change to the structure and relationship of regions was undertaken here. Previously, all 'active' regions (i.e., those containing exhibits) were located within the outer 'holding music' region of R0. To accommodate the additions of new sculptures the 'active' regions were enlarged so that their outer boundaries became the outer boundaries of the soundtrack (see Figure 36). This allowed for a larger working area to treat the exhibits contained within.

4.6.3.3 Pilot trials

Two pilot-participants (PP1 and PP2) were invited to test out the soundtrack application in this current incarnation. This initial 'pilot' process had two main functions: a technical 'shakedown' of the soundtrack applications functionality, and to reveal some objective insights on the soundtrack experience. Both of these pilot-participants were colleagues of the author, who have a research background in computer science and Human Computer Interaction, including interactive user experiences. Although, both were – broadly – familiar with the nature of the author's research, they were not privy to any specific understanding of this activity and moreover they were deliberately not informed about any specific details prior to undertaking their walks. They both undertook the pilot-walks independently commencing their walks from the location set in-between R9, R1a and R0a (see right-hand image in Figure 36). This process was also used as an opportunity to test out the study's pre-walk briefing. Post-walk, an informal interview took place together to discuss their experience. A brief summary of the key points raised is now presented:

- Both enjoyed the experience, which appeared to be over and above what they anticipated and neither experienced any significant technical malfunctions.
- When setting off on their respective walks, both were initially confused as to when playback would commence. As the chosen start location was situated outside any trigger zones consequently playback would commence upon entry into the first trigger zone, but evidently the location of these zones

were unknown to them. Both participants were informed, as part of their pre-walk briefing that the music would start of its own accord, all they had to do was to set off walking. Within a few seconds of walking away both turned to the author and indicated that the music had not started, manifestly considering it an issue. They were informed to keep walking, upon which both – after a short period – turned to indicate that music had started playing. This exact response was also witnessed several times in study 1.

- Neither of the participants discussed the *arrival* motifs during the post-walk interview and when questioned directly about them, appeared equally unaware of their presence, let alone their function.
- Both were, at times, confused by the presentation of silence, especially when presented during the *engagement* stage of an exhibit (e.g., R1bE1 and R4E1). They assumed these to be technical malfunctions, however this assumption was contradicted by their experience of R4E1 (as detailed in Figure 29), as here the musical accompaniment gradually faded to silence, rather than a sudden cut-off of playback; this did not quite fit the previously held notion of a break in the system.
- Neither of these pilot participants found their way into the lower half of the park, they stayed to the upper sections only. When questioned, they both remarked that they did not realise there was other areas there to explore.

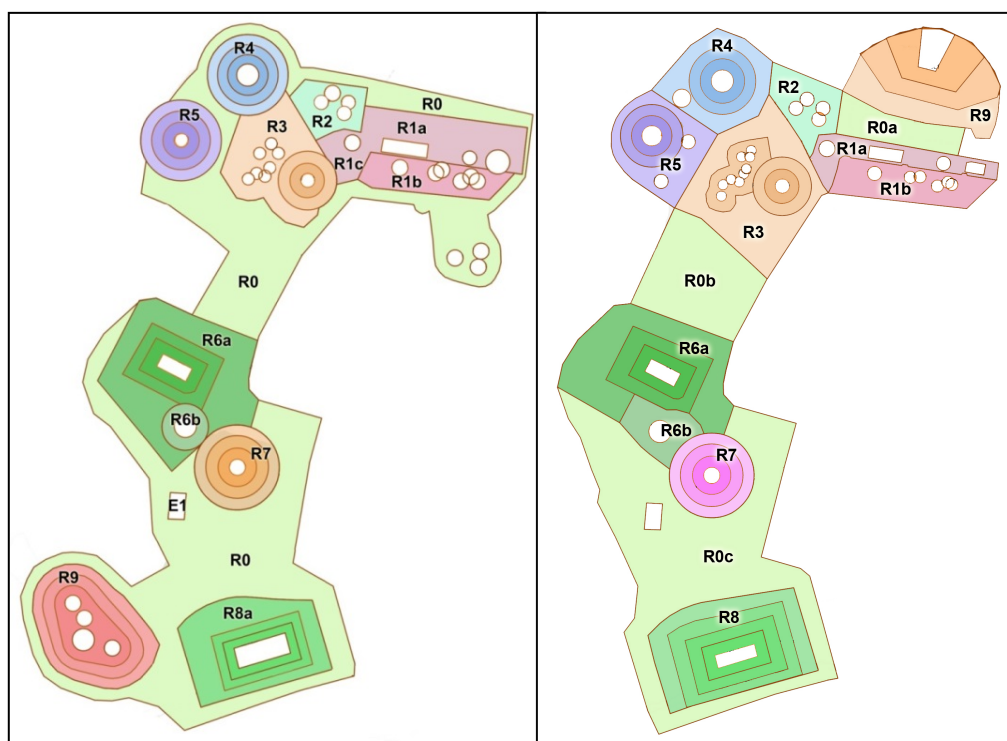


Figure 36: Region map for iteration 2 (left) and 3 (right)

4.6.3.4 Summary

The shifting nature of the park exhibits continued to catch the composer by surprise, as additional sculptures were introduced in the *Hillside* and *Driveside* areas of the *Upper Park*, which prompted further redesigning of regional boundaries. As also noted in iteration 2, a continual fine-tuning of both the global area covered by the soundtrack and the configuration of regions continued throughout this reiteration. A set of exhibits contained with R9 (in iteration 2) were removed from this version and finally, two pilot-participants tested the current version, which resulted in a set of action points (as detailed above).

4.6.4 YSP Soundtrack – Iteration 4

The period of work contained within this iteration witnessed some notable developments in the design of the soundtrack. Some of these were in response to the pilot trials detailed in the preceding iteration, and others in response to the composer's gestating observations and reflections.

4.6.4.1 Alterations in response to pilot trials

- **Introduction of manually operated intro and outro sections:** in response to the pilot-participants' confusion as to when the music playback would commence the decision was taken to place the start of the soundtrack into the hands of the listener. This was addressed by composing a short introduction section of music that would be manually initiated by the user as they set off on their walk, thus they would not commence walking wondering when playback would begin. This introduction segment was essentially a short decorative statement composed in the key of E minor. A button was added to the soundtrack's mobile 'app' user interface labelled 'start music' which initiated playback of this introduction. In practice, two stems were used, the first of which was the introduction section and the second, was the holding music of R0, which would then loop round until the user entered the first trigger zone, upon which the adaptive soundtrack took over control. This intro can be heard at the following URL: <https://youtu.be/9rtu1vySi4E> - the intro starts 00:05, R0 blends in at 00:22 and the first trigger zone of R1a enters at 00:29. This addition then prompted the inclusion of a coda section that was also manually selected via the user interface. This coda was similar to the introduction section in its style and musical structure. The JavaScript would fade out any currently playing musical region and initiate the coda, thus it could be instigated at any point

in the park / soundtrack. From the composers perspective the inclusion of an introduction and coda sections was also an effective means of framing the soundtrack experience, by being able to bookend the soundtrack with similar musical statements.

- **Removal of decorative *arrival* motifs in favour of generic *arrival* ‘chimes’:** up until this point each exhibit had been accompanied by short decorative motifs (e.g., leitmotif or stinger) to signify *arrival* at each exhibit. The pilot participants did not recognise the motifs or interpret them as signifying anything. In response to their feedback the composer deemed that they were not prominent or distinct enough, but rather that they were blending into the texture of the underlying music. Consequently, all of these motifs were replaced with a generic ‘chime’ accent. These were characterised by a single musical accent. The chime was constructed around (1) a vibraphone presenting a unison note an octave apart in an upper register, (2) a snare drum hit and (3), a tympani strike in a lower register. These three layers combined to present a full range percussive accent event. Twelve of these accents were created one for each of the 12 semi-tones of the chromatic scale. Thus, there was a choice of accent to suit any key centre in any region. For those regions which contained more than one exhibit, accents of different pitches were placed for each exhibit. Typically, they were the root, 3rd and 5th degrees of the underlying chord harmony. Thus, exhibits in close proximity sounded *arrival* accents of different pitches, lending a different character to each. An example of this can be seen in R1b at the following URL: <https://youtu.be/naniX7m2zOs> - at the time point of 02:00 – 02:30.
- **Removal of silent ‘engagement’ zones around exhibits:** a number of exhibits had been treated with silence at the ‘engagement’ stage, which was originally intended to signify arrival. However, the pilot participants’ were confused about music cessation and interpreted it as a technical problem. Thus these instances of silent *engagements* were replaced with musical treatments using the similar techniques previously detailed.

4.6.4.2 Adding regions

As illustrated in previous iterations the regional structure of the soundtrack continued to develop and adapt throughout this design process, and this iteration is no different. Of particular note was the addition of new regions in an area of the park previous not addressed, the *Sculpture Trail*. The *Sculpture Trail*, as

its name suggests, describes a walkway lined by a series of exhibits (see Figure 37). This trail represents the only (principally) linear section of the YSP. There is a single point of ingress and departure at the *Hillside* end, whereas the other extremity offers several routes out into the *Lower Park*. Once entered visitors' routes are somewhat restricted to the direction of the path. Exhibits are located on grassed areas either side of this path.



Figure 37: Entrance into the trail (left) and an exhibit within



Figure 38: Other areas of the Sculpture Trail

Here the landscaping feels more enclosed, due to a range of 'walled' constructions such as a covered pathway (Figure 37), or flora bordering the path (Figure 38). Moverover, the presence of and access to, the trail is not immediately obvious from the outside, particularly at the *Hillside* end. This promotes an impression of it being almost hidden away, which alongside its semi-enclosed snaking quality affords a sense of playfulness quite distinct from the rest of the park. Consequently, these qualities promoted a desire to treat this area quite differently (musically) from the others.

The trail, a confined area of space (notably across its width), did not grant opportunities to draw multiple zones for musical approaches around exhibits. Furthermore, the length of the trail from one end to the other was too long to support one musical scene, thus the trail was sub-divided into three sequential *associate regions* (R11a, R11b, R11c) (Figure 40). As with the previously illustrated

example of *associate regions* presented in *iteration 1*, variations of the same underlying musical material were utilized across these three regions. In this instance, the same instrumental timbres were applied in all three and the melodic and rhythmic material was largely constant in each, although R11a contained a thinner texture. The primary distinguishing feature between these *associate regions* were differing key centres (R11a = E minor; R11b = B minor; and R11c = F# minor), thus the same music was effectively transposed to three different keys with only minor alterations.

In the *associate regions* of R11 the music is rhythmically complex, dense, repetitive and syncopated, thus contains a greater intensity compared to the other regions (see Figure 39). The notes are played with a staccato feel, which contrasts the by and large legato sensibility present elsewhere. Furthermore, the presentation of unvarying compound rhythms (triplets) creates a ‘skipping’ motion to the music. In short this music contrasts the others and is potentially in conflict to the original aim of the soundtrack functioning as an accompaniment; would music of greater dynamic intensity draw undue attention? However, on reflection, exploring some music of differing dynamic intensity was viewed as a valuable test case for the proceeding visitor study (Chapter 5), to probe or prompt the issue of users’ focus of attention. These regions’ music can be heard at the following URL: <https://youtu.be/naniX7m2zOs> - R11a enters at 15:55, R11b at 16:42 and R11c at 18:40.

The musical score for Region 11b (B minor) is presented in 4/4 time with a tempo of 79. The score includes parts for Piano, Strings, Flute, Trumpet, Oboe, Basson, Contra Basson, Cello, and Synth Bass. The music is characterized by complex, repetitive, and syncopated rhythms, often using triplets and sextuplets, giving it a 'skipping' motion. The notes are played with a staccato feel. The dynamics are marked as *mf* (mezzo-forte). The score is written in B minor, indicated by the key signature of two flats (Bb and Eb).

Figure 39: Region 11b (B minor)

Also notable in these *associate* regions was the introduction of a new approach to tackling regional transitions. Up until this juncture the moment of transition between adjacent regions took the form of an unprepared shift from the music of one region into the music of the adjacent region, administered by a cross-fade of some duration; a largely blunt approach. The method explored here introduces a linking section that aims to bridge between the adjacent regions, thus to transition form the qualities and attributes of one into the next, essentially prepared transitions (see Figure 40).

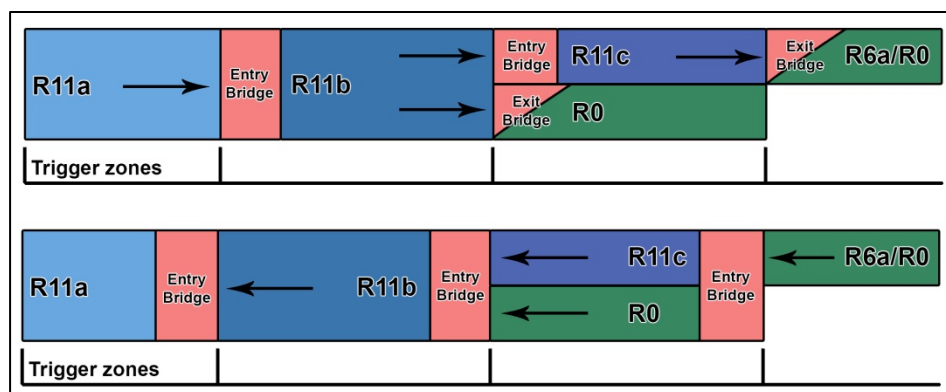


Figure 40: Bridge transitions

These bridging transitions are triggered upon entry to a new region, so rather than the immediate shift into the neighbouring regions music, a short phrase is sounded between them (Figure 40).

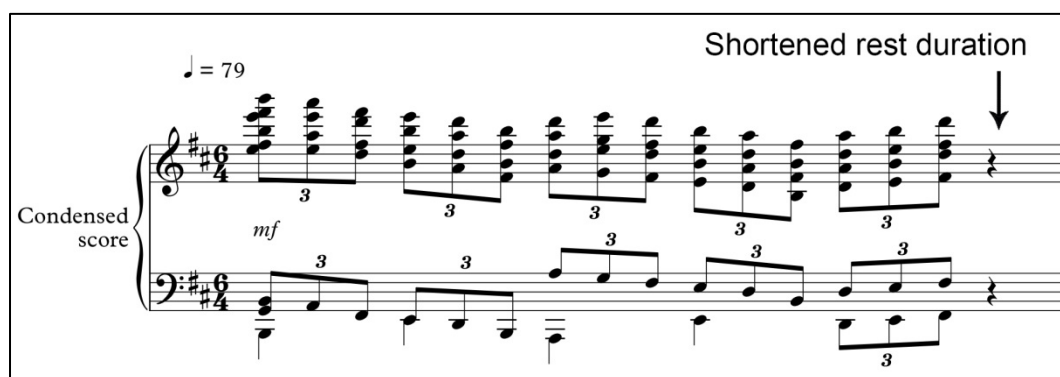


Figure 41: Entry Bridge

Two different transitional bridges were used: the first (*entry bridge*) on entry into either R11b or R11c and similarly on transition between R11b and R11c (see Figure 40 and Figure 41). Then the second bridge is presented on exit out of R11b and R11c (*exit bridge*) (see Figure 40 and Figure 42). Both bridges were founded on the musical material contained within R11 (a, b, & c), specifically an extension of the descending triplet pattern presented on the first beat of every bar (see Figure 39 and Figure 41). The *entry bridge* is 6 beats long, with the last beat left

blank, silent. This single beat of silence was deliberately factored in to address the slight hesitation that occurs in the *AppFurnace* player on the transition between audio files, thus the duration of this beat was reduced very slightly in length to account for this hesitation (Figure 41). This bridge can be heard at the following URL: <https://youtu.be/naniX7m2zOs> - Entry transition at 16:42.

The *entry bridge* did not intend to ‘smooth out’, or transform the music from one region into the next. Rather, it deliberately accentuates the strong dynamic intensity of R11 music’s by presenting a sudden musical statement, so as to introduce the playful nature of the R11 music. Conversely, the *exit bridge* (see Figure 40 and Figure 42) did attempt to manage the contrast of dynamic intensity contained in the regions that neighbour R11b and R11c regions (i.e., R0 and R6a: Figure 42). The method utilized to achieve this was a rapid deceleration (*ritardando*) of the tempo over the duration of the bridge (79bpm > 49bpm - Figure 42) to match the adjacent regions. The exit bridge can be heard at the following URL: <https://youtu.be/naniX7m2zOs> - enters at time point 19:34.

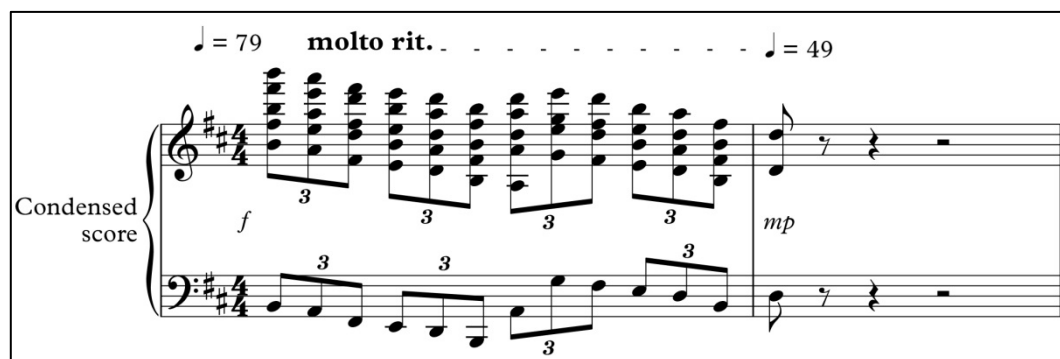


Figure 42: Exit Bridge

A final note on transitional bridges: from the composer’s perspective they were considered an effective device to manage this regional transition and thus could have been further explored and expanded into other areas of this soundtrack, although pressures of time and adjustment to previously composed music negated the option to introduce more instances at this juncture. This represents an area for future work discussion (see Chapter 8).

4.6.4.3 Development of *withdrawal stage*

A notable adjustment was made during this iteration for when a user *withdraws* from an exhibit. Up until this point a reverse of the *approach* stage had been presented. During testing it became clear that this was not desirable, as it did not present a logical musical experience. The purpose of the *approach* was to foreshadow *arrival* at an exhibit, but departing from an exhibit resulted in the

user stepping out from the *engagement* zone (i.e., low musical intensity) into the peak of music intensity that was the final approach zone, which then reduced as the subsequent approach zones were exited. This presented an unnatural shift of dynamic intensity not consistent with the action of departure. Departure, it would seem was not a process that required a dynamic contour as there was no element of anticipation or preparation. Thus, a distinct treatment for *withdrawal* stages was created. *Withdrawals* principally centred on maintaining a constant level of dynamic intensity across zones when walking out from an exhibit, rather than the presentation of a crescendo or decrescendo. This was realised by a lighter texture of orchestration, as often found in the outer zone of the regions. Figure 43 illustrates this method on an exhibit in R4, detailing the whole process of *approaching*, *arriving*, *engaging* and now *withdrawing* from an exhibit. To enable the presentation of different music when heading out from an arrival zone compared to heading into an arrival zone, a different scripting command was used. On the *approach* phase the scripts used in the authoring platform used a ‘move in’ command, so that when a trigger zone was entered the next music file was triggered. Conversely, on *withdrawal* a ‘move out’ command was used when a trigger zone was exited, thus different music files could be instigated dependent on the direction a walker was traversing them (i.e., in or out). Evidently, this then necessitated the composition of separate music for withdrawals, and this in turn presented options for further musical variation. For instance, in R4E1 (see Figure 43), an alternative chord progression was used on *withdrawal* than on *approach*. An example of this full can be seen at: <https://youtu.be/R6ac1hKksy4> - R4 is entered at 00:34, the moment of arrival is at 00:55 and withdrawal is at 01:51.

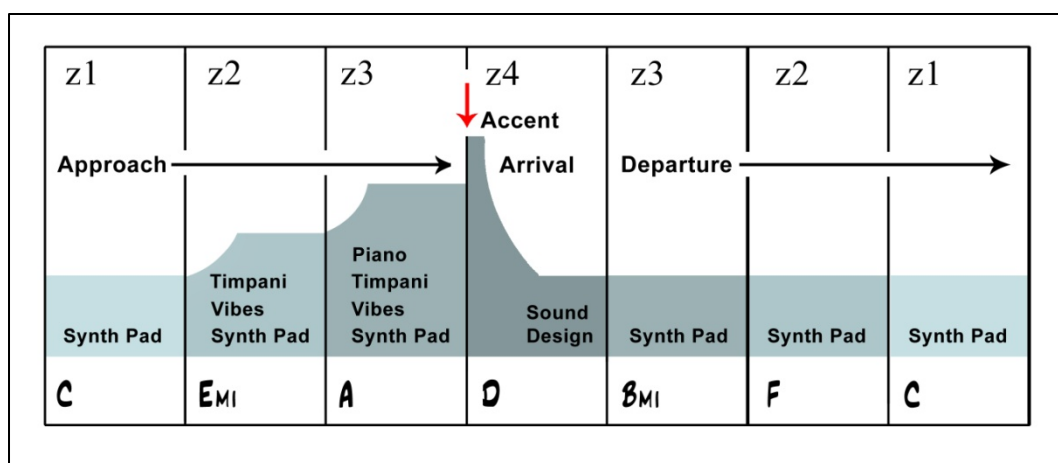


Figure 43: Region 4 Exhibit 1 withdrawal stage

4.6.4.4 Summary

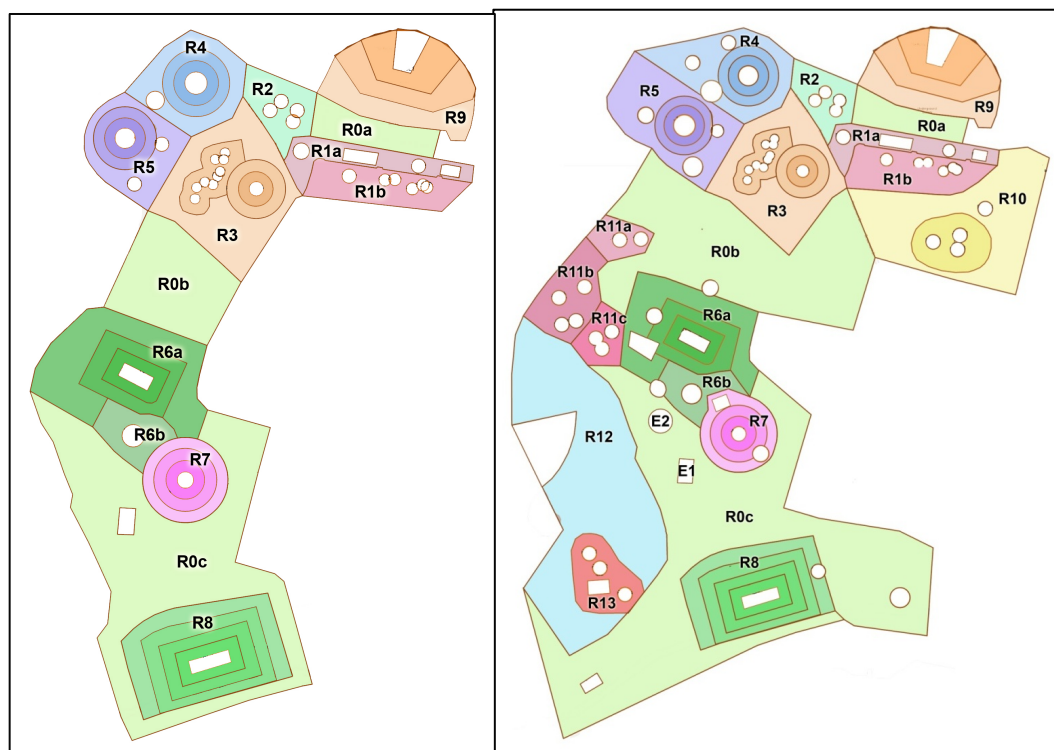


Figure 44: Region map for iteration 3 (left) and 4 (right)

In this iteration a number of advances to the compositional approach were developed and applied as summarised. Manually initiated introduction and coda section was added to the mobile app's UI. An alternative method of signifying arrival at exhibits was realised via distinct generic accents as opposed to bespoke motifs. Those few instances of silence were removed from exhibits in preference for musical treatments across the all. The notion of bridging sections was introduced in R11 to manage regional transitions, where notably on exit the bridge slows the tempo to that of the next adjacent region. Finally, a distinct fourth stage in the trajectory of interaction (TOI) – withdrawal – was added to the treatment of exhibits; in this stage different music was presented when departing an exhibit than was present on the approach stage.

4.6.5 YSP Soundtrack – Study ready version (iteration 5)

This was the final iteration. No new compositional approaches were devised during this iteration, but this stage did witness the realisation of a new region, the re-structuring of several existing regions, further adjustments in response to previous compositional / authoring developments (e.g., withdrawals), changes to the park, and another iteration of pilot testing.

4.6.5.1 Forming and re-forming regions

The majority of restructuring work took place in the *Lower Park* area, principally within regions 7, 12, 13 along with the addition of a new region (14) (see Figure 46, bottom right-hand corner). Region 7 was completely redefined to provide equal *approach* and now *withdrawal* around the two exhibits contained within. An example video of this region can be accessed at: <https://youtu.be/naniX7m2zOs> - time point 29:12 – 31:25. Region 13 was also re-structured to contain a multi-stage *approach* and *withdrawal* section. This region can be heard at the following URL: <https://youtu.be/TYR95rf0QZ4>

4.6.5.2 Re-forming arrival zones around exhibits

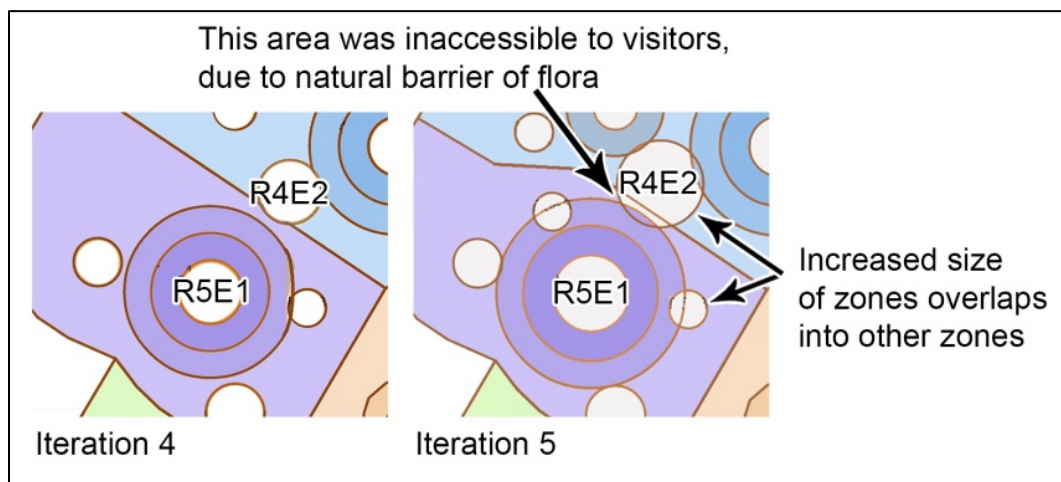


Figure 45: Resizing arrival zones in response to temporary cordons

Due to the winter weather conditions, which included persistent rainfall, the grassland had become increasingly muddy, especially in those areas immediately surrounding the exhibits. During the interim period between visits the YSP grounds keepers had cordoned off areas around a few exhibits particularly affected. Presumably, this was in an effort to preserve the ground by preventing visitors from walking onto it. These temporary cordons were located within the *Gardens*, *Hillside* and *Driveside* areas of the park. This had a direct impact on the placement of some inter-regional zones, principally the arrival zone, as these cordons had significantly reduced, or completely prevented a user from entering and thus triggering the arrival zone. For those affected zones, the corresponding trigger zones were subsequently enlarged so that users could enter and hear the music that accompanied the moment of arrival and the period of engagement. illustrates examples of arrival zone resizing. The left-hand image shows the configuration of the zones in iteration 4 prior to the introduction of the cordons, compared to iteration 5 on the right hand side, which displays the enlarged

zones. These adjustments further underlined the constraints of the physical space and the negotiation of this space between the trigger zones. The enlarged zones now overlapped into other trigger zones. Fortunately, in this instance, there was no direct negative impact on the music's functionality. As the overlapping zones were all *arrival* zones that sounded *arrival* accents, rather than new cells or stems in a different key, for example.

4.6.5.3 *Pilot trial stage 2*

Two other pilot-participants then tested this iteration of the soundtrack. For the most part the experience was well received and was enjoyed by both. One of the two was aware of the soundtrack's functionality prior to testing it, so could predict and understand how the adaptations were unfolding. The second did not know and did not realise over the course of their walk. However, a technical issue, which arose as a result of a scripting error, disrupted their experience – a music cell did not clear on exit from a zone, thus continued to play for an extended duration before they approached the author to enquire. The 'app' was reset and they continued on.

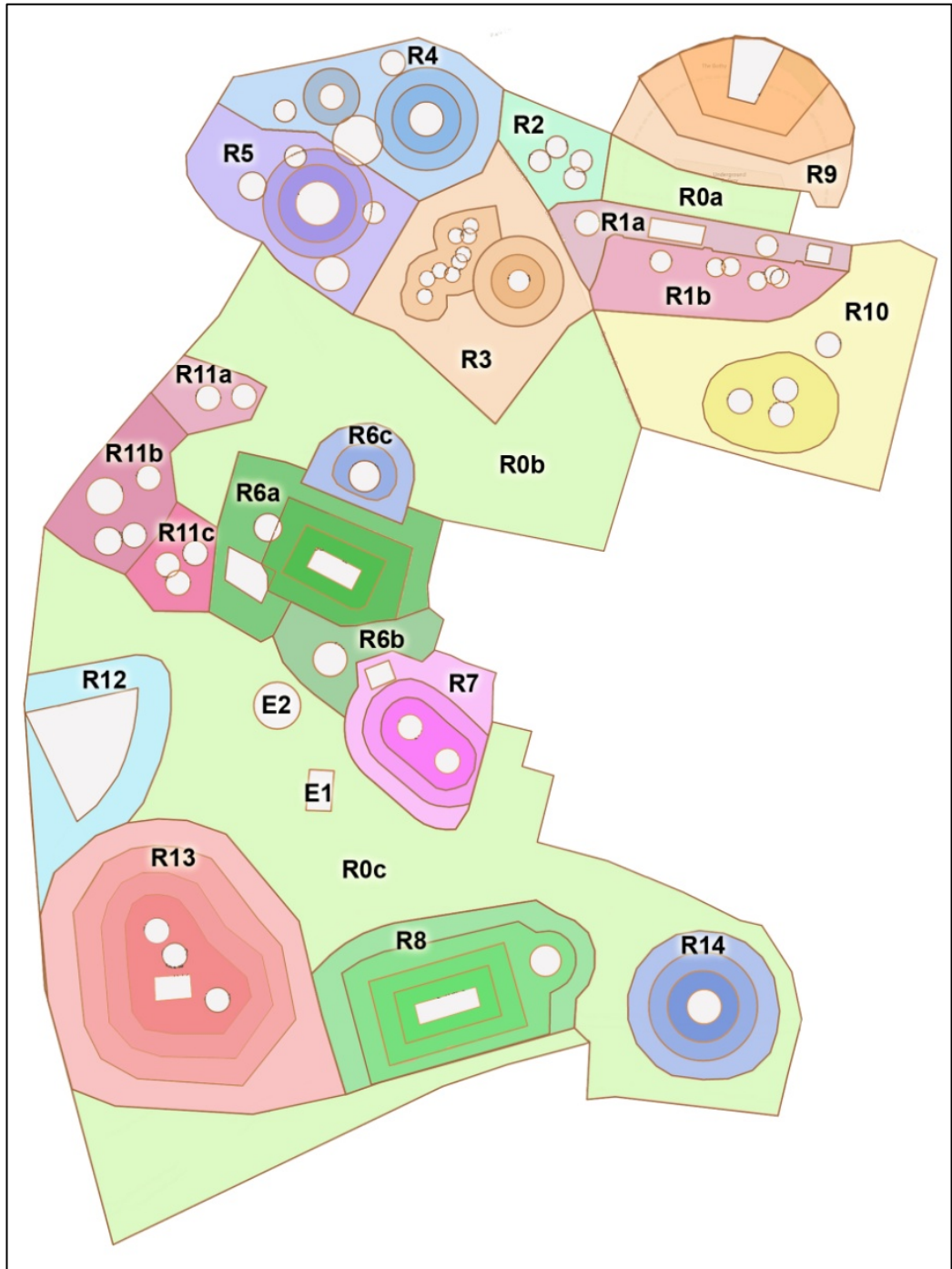


Figure 46: region map for iteration 5

4.7 Findings

The findings as presented here refer back to the objectives as set out in section 4.2. First a brief summary of the resultant soundtrack is presented (objectives 1-5), followed by a reflection from the perspective of the composer regarding this iterative design process (objective 6). A significant in-depth musical analysis, reflection and discussion of this resultant soundtrack is presented in chapter 6, thus the information here serves as more of a summary.

4.7.1 Summary findings of iteration 5

The work contained in this chapter has charted the successful creation of a large-scale adaptive musical soundtrack (objective 1) composed to accompany a visit to the Yorkshire Sculpture Park (YSP) (see Figure 47). The YSP is a large external site that displays many sculpture exhibits and receives a large number of visitors who come for the purposes of exploring the sculpture exhibits. The structure of the park enables flexible exploration over a large scale (objective 2). The adaptive soundtrack was authored using the *AppFurnace* platform, which uses polygon zones and geo-points to trigger playback of media, harnessing a smart phone's location services to track a user GPS coordinates (objective 3). The area of the YSP covered by the soundtrack contained 43 separate sculpture exhibits.

The completed soundtrack and the methods used to devise it were developed over an iterative process that built on the notion of *attachment*, as revealed in chapter 3, in addition to conventions from film and computer game soundtracks (objective 4). The park was sub-divided into a set of physical regions (n.24) (see Figure 47), which became discrete musical scenes (i.e., *regional attachment*). The regions were characterised by different landscaping or areas that housed clusters of exhibits. Each musical scene was composed to a different key centre (in relation to neighbouring regions) and used a different combination of instrumental timbres and thematic material (see Figure 47). Adjacent regions that shared some relationships (e.g., in either their landscaping or exhibits) were termed *associate* regions (n.4), thus their music although still distinct was also related (e.g., thematic, harmonic chord progression, instrumentation). This set of 24 regions defined a global area that continuously presented music. There were no occurrences of music cessation when situated within these regions (i.e., *global attachment*). If these regions were exited, then the music faded to silence, fading back in upon re-entry. Within regions, where physical space permitted, musical adaptations accompanied the process of engaging with exhibits. This was characterised by four distinct stages: *approach*, where the music foreshadowed

arriving at the exhibit, typically realised by increasing the level of musical intensity; *arrival*, which saw a resolution of the musical intensity put into action by the *approach* stage, and also the presentation of a generic accent (stinger) to signify close proximity to the exhibit (i.e., *local attachment*); then came *engagement*, to accompany visitor interaction with an exhibit. Typically the intensity level of the music is reduced to provide 'space' for this interaction; then *withdrawal*, a final adaption to accompany departure from an exhibit. Ten regions contained exhibits that were treated with multi-stage *approach* and *arrivals*, and eight of these contained distinct *withdrawal* stages. Five other exhibits had single stage *approaches* applied to them. The remaining exhibits either had a contrasting musical section surrounding the exhibit, or simply an *arrival* accent. The music in each region was discrete – with the exception of the 'holding music', of a lower intensity, in those areas that did not contain any sculpture exhibits (i.e., R0) (see Figure 47). The soundtrack consisted of a 102 pre-prepared music fragments (cells and stems) to deliver the adaptive functionality listed above. The soundtrack was tested by pilot-participants in preparation for an evaluative user study, as detailed in Chapter 5 (objective 5). A URL to a POV video of this iteration can be accessed at: <https://youtu.be/naniX7m2zOs> - this video contains the majority, but not all of the regions and exhibits.

Not covered in this section, were four exhibits that had non-musical sound design elements played during the engagement stage. These instances are presented and discussed in Chapter 6, section 6.1.1.9.

4.7.2 Composer's reflection on the compositional approach

This section offers a reflection from the perspective of the composer, considering the impact of methodological approach utilized to reveal any pertinent observations that have arisen from its application.

4.7.2.1 Composing with the design methods

The process of structuring the physical environment (i.e., regions, and locations of exhibits) in turn presented a structure for the composition of the soundtrack music. For instance, the formation of physical regions within the park, partitioned the soundtrack into a number of musical sections, where a set of musical relationships were used to differentiate musically between regions. Furthermore, the inclusion of dynamic contours that formed adaptive accompaniments for the *approach*, *arrival*, *engagement* and *withdrawal* from exhibits added further structural detail to individual regions. On the one hand these

mappings between spatial structures and musical structures revealed an understanding of the structure of the environment (i.e., the nature of the user activity with the YSP), and on the other it formed a blueprint that steered the compositional process. From the perspective of the composer, having some of the music's structural attributes defined by a third party source (i.e., the structure of the YSP location) was an effective method to support the compositional process of such a large-scale work.

4.7.2.2 *Impact on compositional approach*

There was a notable adaptation to the composer's typical compositional practice that was revealed over the course of this work. The absence of musical synchronisation – between *cells* or *stems* – in the authoring environment subsequently reduced the emphasis on rhythmic synchronisation within the DAW recording environment. At the beginning the composer would synchronise all musical material to the bars and beats 'grid' in *Cubase* and use the metronome function to stabilise performance timing if instrument parts were recorded live via a MIDI keyboard, with the resultant recordings then being quantised to address significant timing errors. The working assumption was that although stems would not be triggered 'in-time' the coherent approach would nonetheless be to compose the stems as synchronised musical elements. However, as composition continued a noticeable shift away from this practice took place, to be replaced by a general disregard of the 'grid' and instrument parts were played increasingly freely (notably melodic themes, whereas repetitive 'rhythmic' patterns continued to be quantised). On reflection this was a necessary compositional approach to further reduce the absence of 'musical' alignment when the soundtrack was deployed on site.

4.7.3 Reflection on authoring and testing process

4.7.3.1 *App authoring*

The chosen methodology of iterative development impacted on the consistency and coherency of the resultant soundtrack. On the one hand it has enabled for a deep exploration of the work's objectives, which has culminated in a number of resultant techniques. However, the iterative process has understandably resulted in a slightly fragmented soundtrack if viewed as an overarching musical work. As the compositional processes used were in flux, developing over the course of practice. Consequently, musical scenes were composed largely in isolation, with no foreknowledge of the musical direction or content of future scenes, thus they are not as inter-related as they might have been. Composing large-scale musical

forms requires careful management of the music to balance the need for diversity and development (progress and interest), but also and consistency. Nonetheless, this method was appropriate – and necessary – for a first attempt, but a more coherent top-down approach would be interesting to try on future locative experience now that the underlying mappings have been established.

4.7.3.2 *App testing*

Regular visits to the YSP took place throughout the duration of this work to try out iterations as and when they were prepared. On reflection, the majority of these visits were approached as opportunities to *test* rather than *experience* the latest iteration and there is a fundamental distinction between the two. The composer became aware late on in this work that these visits had become a repeated routine: upon arrival a walk around the YSP with the soundtrack accompaniment would ensue and notes would be taken. This would normally take approximately 60 minutes. Following this, any immediate alterations required were undertaken on site, which typically concerned the debugging of JavaScript errors in *AppFurnace* that resulted in audio files not triggering or clearing, minor adjustments to the position of trigger zones, the duration of cross-fades. This necessitated logging into the YSP public WiFi in the restaurant / café area – which was slow and unresponsive – making the changes and updating the ‘app’ hosted on an iPhone, followed by another walk around the park to test the updates. At this point, depending on available time further adjustments and walks may then be made. Consequently, this process became largely one of time management, which subsequently led to walking the same route around the park that covered the area in the shortest possible time. Whilst this approach functioned efficiently as a technical ‘shake-down’ it did not consider matters of the ‘experience’; such as alternative routes, different walking pace, spending longer engaging with exhibits.

Following this realisation, efforts were put in place to vary these walks. However, this was in the latter stages of the soundtrack’s development when pressures to complete the soundtrack and progress forward into the visitor study were persuasive. Consequently, the composer became aware that some musical scenes did not sustain extended listening as effectively as others, if a user were to spend a notable duration in any given region or zone.

4.7.4 Implications of app authoring on soundtrack

4.7.4.1 *Cross-fading cells*

App Furnace uses location-based triggers that are not synchronised to the pulse, or rhythmic placement of notes inherent within the music, but rather at the behest of the trigger zone. Thus, transitions between musical cells are not synchronised to note events such as the ‘down beat’ at the start of a bar – rather cell to cell transitions occur at an arbitrary point in the music. This creates a noticeable glitch, a ‘skipping’ artefact where one cell jumps into another. Cross-fades were used to reduce these glitches. A cross-fade describes the process where sound’s volume is attenuated (from playback db level to 0db), whilst another’s is amplified (from 0db to playback db level) concurrently. Cross-fades of different durations were explored over the design process in an attempt to find an optimum balance between a smooth transition and musical coherency (for instance, if a cross-fade is too long the listener is presented with a noticeable blend of the two cells, which can lead to a moment of cacophony – arguably as disruptive and non-musical as the unsynchronised glitch). The outcome of this testing process found it desirable to have multiple cross-fades of different durations to treat different music.

The general principle follows that the duration of the cross-fade corresponded to the tempo and length of the note values used in the music, i.e., faster tempi or shorter note values employed a shorter cross-fade duration, whereas slower tempi and longer note values afforded longer cross-fades. The type of instrumental timbres used also influenced these duration, for instance cell transitions which contained dense and sustained textures of sound supported longer and thus smoother cross-fades than those with pronounced, stark timbres. The final iteration used 5 different cross-fade durations, which were 0.4 second, 1.0 second, 1.3 seconds, 1.8 seconds and 3.6 seconds.

4.7.4.2 *Cross-fading stems*

With stems, the same challenge applies as detailed in the above. Stems function differently to cells, however, when they are introduced other music is typically already sounding, which partially masks any rhythmical ‘glitch’ as a result of their introduction. Nonetheless, cross-fades were still regularly used but in many instances they did not require long durations. Typically, a cross-fade structure for stems was a short to medium fade-in time (1 sec), but with a longer fade-out time (2.8 sec).

4.7.5 Dealing with change

Responding to changes within the YSP environment was by far the most unexpected and problematic challenge encountered. These changes were characterised by either the removal of sculpture exhibits, repositioning of exhibits, the introduction of new exhibits or the cordoning off of exhibits in response to ground conditions. Over the course of the process charted here (iteration 1-5) 5 exhibits were removed, 15 new exhibits were introduced (some of which were situated in the areas previously occupied by a removed exhibit), 2 were moved to make way for a new exhibit and 5 perimeter fences were introduced to protect the ground surrounding the exhibits. After the first set of changes a YSP curator was consulted to enquire if any further changes were imminently planned, to which they thought not. However, alterations continued to occur. Following another conversion, they explained that the YSP do not have full control over all sculpture exhibits, only those on permanent loan. Others are displayed for an agreed period (touring exhibits) and some are on temporary loan. With this last set – temporary loan – the artist, owner or the former artist's estate reserve the right to remove the exhibits at short notice, which accounted for some of the changes that occurred during this design and development period. Others were as a result of touring exhibits coming to the end of their 'run', which should have been factored into the planning of this work, but was unfortunately missed by the composer.

Obviously adjustments to the soundtrack were required to account for the alterations listed above, as partially illustrated in the preceding iterations. These alterations impacted on all elements of the process, but predominantly on the authoring of the *AppFurnace* trigger zones. For those regions that had exhibits removed and new exhibits introduced (e.g. R7, R5 & R13), all the zones within those regions necessitated alteration, from the outer boundary through to the inner zones that fan out from an exhibit, to the placement of the exhibit's arrival zone. Modifications to a region's outer boundary inevitably impacted on those neighbouring regions that shared boundaries. In some instances the introduction of a new exhibit only necessitated drawing a new arrival zone (e.g., R4, R5, E2 & R9). The movement of an exhibit previously located around the area of R7, prompted the introduction of a new region (i.e., R12). Finally, the introduction of perimeter fences necessitated that the affected arrival zones and corresponding approach zones be enlarged.

The following example regarding Region 4 will illustrate in detail how modifications to the parks' exhibits impacted on both the composition and zone authoring process. In the first iteration, R4 was drawn to encompass a single exhibit, Molecule Man (MM) (see Figure 50). The region was formed by a set of four nested circular zones; the arrival zone at the centre (which housed the exhibit), surrounded by 3 zones that formed a musical *approach* towards the arrival zone (see Figure 48, iteration 1). This region's music was manifest as a series of cells that gradually increased the musical intensity by bringing in an additional layer of music until the arrival zone was reached. A further element of this rising intensity was formed by a harmonic chord progression that ran from the outer zone through to the arrival zone where a modulation to a new key centre was presented.

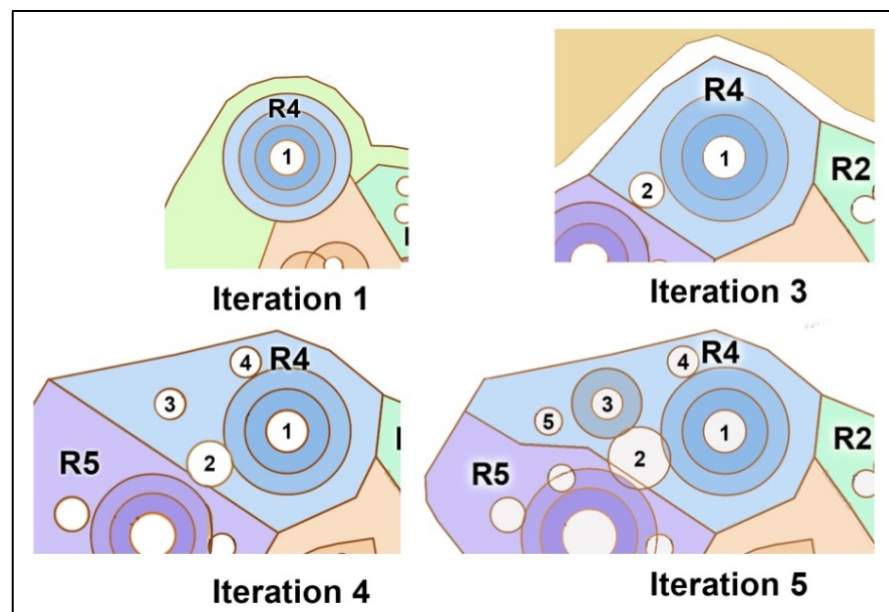


Figure 48: Iterations for Region 4

This regional structure remained unaltered throughout the period that covered the first two iterations. Upon reaching the iteration 3 another exhibit – Riace Figures (RF) by Elisabeth Frink (Figure 49) – was introduced in close proximity to MM. This addition demanded a modification and there appeared to be three options to proceed: first, RF would become an exhibit housed within R4; second, RF becomes part of R5; or third, the formation of a new region specifically to house RF. A decision was taken to include RF into R4 for the following reasons: the formation of a new region was precluded due to the limited physical space available between R4 and R5; most of the area covered by R5 was blocked from the viewpoint of the exhibit, so RF did not ‘feel’ like it was part of that region; conversely, being in direct line of sight of R4’s MM and situated within the same

naturally framed area it thus made sense to incorporate the RF exhibit into R4. In response, the size and shape of R4's boundary was re-formed and enlarged so that it enveloped the exhibit and an arrival zone was placed around its location (see Figure 48, iteration 3).



Figure 50: Molecule Man



Figure 49: Riace Figures

In iteration 4 a further two sculptures were introduced (see Figure 48, iteration 4) and another one in iteration 5 (see Figure 48, iteration 5). As previously described, R4's outer boundary was adjusted and arrival zones defined to account for these additions. By re-defining R4's outer zone to encompass four additional exhibits the functionality of music in this zone (a single stem) took on new meaning. Whereas in iteration 1 the purpose of this stem was the first step of that exhibit's *approach* stage, in iteration 5 it now also functioned as the base stem for four other exhibits musical treatments; the stem was characterised musically by a sustained chord 'pad' in the key of C Major. Exhibits 2 and 4 took advantage of the sustaining texture as an accompaniment layer, thus added a further stem on top which presented melodic themes, thus creating a homophonic texture (i.e., melody and accompaniment). Whereas, exhibit 3 was a 'single stage approach', presenting an intermediary cell which then modulated the music to the key of in its arrival zone. And finally, exhibit 5 just had an arrival accent triggered in its zone. Region 4, with all these exhibits can be heard at the following URL: <https://youtu.be/naniX7m2zOs> - the approach to Exhibit 1 is at 07:36, with the withdrawal stage finishing at 09:05. Exhibit 4 time points are 09:05 – 09:45, Exhibit 2 is heard between 10:08 – 10:43, and finally the Exhibit 5 accent is presented 11:29.

This single example illustrates the complexity of coping with changes to the structure of the locative experience.

4.8 Conclusions

This work resulted in the composition and spatial authoring of a large-scale locative soundtrack for a cultural visiting site, which adapts automatically based on GPS positioning. The iterative creation of this soundtrack has revealed the need for a fine balance between the requirements of the physical space and the composition of the music. A number of techniques were tried, tested and refined over the course of the composition and authoring process that have contributed to the final version of the soundtrack.

A set of mappings between musical structures and spatial structures that allowed for the composition of this soundtrack were iteratively developed. These mappings, from the composer's perspective have been considered an effective means of guiding the compositional process, as they informed choices of key, harmony and orchestration. From the spatial perspective these musical mappings accompanied significant assemblies in the natural or built environment, in addition to visitor interaction with points of interest (i.e., the exploration of the sculpture exhibits). However, significant physical space is required for these interactions to unfold musically, which was not always possible. The structure of the park and placement of exhibits is not uniform and consequently not all exhibits could be treated with the same musical mappings. This necessitated a compromised approach, which resulted in several variations to the mappings. The defining of trigger zones is particularly challenging when clusters of exhibits are placed in close proximity.

The piloting process revealed that it is important for visitors to understand when and where the soundtrack experience begins, rather than playback being initiated by an unseen trigger zone, as this introduces a degree of uncertainty for the user. Consequently, the beginning and ending of the soundtrack is manually controlled, thus giving the user control over entry and exit from the experience.

Unforeseen alterations to the structure of the YSP, mainly to the exhibits had a significant impact on the soundtrack, as it forced further composition and the reconfiguration of the authored trigger zones.

The absence of note event synchronisation (i.e., cells and stems triggering in 'musical time') during the composition process gradually altered the approach that the composer took to creating the music in a digital workstation (DAW).

Thus, the composition of musical layers was increasingly viewed texturally, rather than contrapuntally.

With the exception of a small number of pilot-participants, this work has been developed and evaluated purely from the composer's perspective. As noted previously, a reflective musical analysis is detailed in chapter 6, which returns to and discusses this work with a view to distilling the findings and drawing out some compositional guidelines. However, before that process this final iteration of the soundtrack was experienced by a group of visitors to the YSP, as charted in the following chapter.

Chapter 5 - A walk in the park

5.1 Introduction

The work contained in this chapter charts the deployment of the Yorkshire Sculpture Park (YSP) soundtrack application to investigate how it was experienced by a group of visitors. Twenty-two visitors explored the park alone whilst listening to the adaptive soundtrack and then recounted their experience.

The findings reveal that this musically accompanied cultural visiting experience was notably different to a typical, non-musically accompanied visit. A number of broad and reoccurring themes were reported that construct a vivid picture of the experience, which seemingly emerge from the integration of the adaptive soundtrack into this activity.

Structurally, this chapter first details the study design, which is then followed by a presentation of the findings, from which a set of conclusions is drawn.

Throughout this chapter the following abbreviations are used:

YSP = Yorkshire Sculpture Park

P = Participant (e.g., P11)

R = Region (e.g., R2)

E = Exhibit (e.g., R2E1 = Sculpture exhibit 1 situated in Region 2)

5.2 Study design

The study design was motivated by the following objectives:

1. To capture the visitors' individual experiences in response to the musically accompanied cultural visit.
 - a. How does the presence of music affect visitor engagement and their process of attending to the cultural visiting activity; does it converge or disrupt it?
 - b. Does the presence of music affect visitors' walking behaviour?
 - c. Does the presence of music affect the visitors' experience?
 - d. How does the integration of music effect their aesthetic interpretation of the overarching experience?

2. To investigate whether the structural approaches applied in the composition and authoring of the soundtrack form a lucid musical accompaniment, from the visitors' perspective (i.e., audio visual congruence – the alignment of musical structures (events) to the physical structure of the YSP).
3. To investigate the robustness of the technical infrastructure (i.e., *AppFurnace*, *AppFurnace Player* and GPS) on the delivery of a soundtrack accompaniment.

5.2.1 Walking Task

The study consisted of listening to the adaptive soundtrack whilst walking around the YSP. The participants' were informed that aim of the study was to observe how music influences the experience of a visit to the YSP. The music was played via the *AppFurnace* mobile application installed on a supplied iPhone 4s and a pair of Sennheiser SD-25 closed cup headphones.

All the participants were shadowed, from a distance of approximately 20-40 metres, by the author, to observe their on-task behaviours. The author wanted them to feel comfortable and free to roam wherever they wanted, without any impression that the author was 'on their shoulder' (Preece, Sharp, and Rogers 2015). In a similar vein to study 1 (Chapter 3), the participants were not informed about the adaptive functionality of the soundtrack application. This non-disclosure did not intend to deliberately misinform the participants, but rather, it was done so as to frame the study in a manner that would permit the visitors to experience the soundtrack accompanied walk in the most naturalistic way possible, on their own terms, to interpret what they experienced on face value. Oppositely, disclosure of the system's dynamic functionality would have – potentially – directed undue interest to the mechanics of the soundtrack, leading to a skewed interpretation of the experience.

The participants were shown a map of the park and informed that they could walk wherever they wished, but were told that the study was primarily interested in the exploration of the marked area (covered by the soundtrack) (see Figure 51). This explanation was also part of the non-disclosure, to strongly encourage them to remain within the soundtrack treated area, but without revealing why.

Prior to the walk the participants were taken through the following pre-task briefing: each participant was informed about the nature of the task and the related research; what the task involved; the types and methods of data capture; the anticipated duration; and that they were free to withdraw from the study at

any point, upon which their data would not be included in the analysis and subsequently deleted. They signed a consent form and were given a participant number, which became associated with their data to enable post-study anonymisation. They were then given the iPhone and accompanying headphones and shown how to operate the 'app'. The author outlined the area of the park on the map that was of interest to this study and then informed them that:

- 1 You are to walk around and explore the park and the sculpture exhibits. The iPhone will play music as you walk around. Once you have started music playback you will not need to start or stop the music, it will just play. When you decide to conclude your walk press the 'stop music' button on the user interface. There may be some periods of silence, but that does not necessarily denote a problem. However, if you feel at any point that there is a technical fault, please indicate this to the investigator.
- 2 It is your choice where you go and how long you take. However, if you have not finished within approximately 80 minutes the investigator may halt your walk.
- 3 You are encouraged to wear the headphones and listen to the music throughout the full duration of the study, but you are free to stop listening whenever you like.
- 4 When you decide to finish your walk, please return to either the start location or indicate to the investigator that you would like to stop.
- 5 Post-task, the investigator will ask you some questions about your walk.

All the participants commenced their walks from the same location, which was situated at the bottom of the steps that lead down from the entrance to the visitors centre (Figure 51).

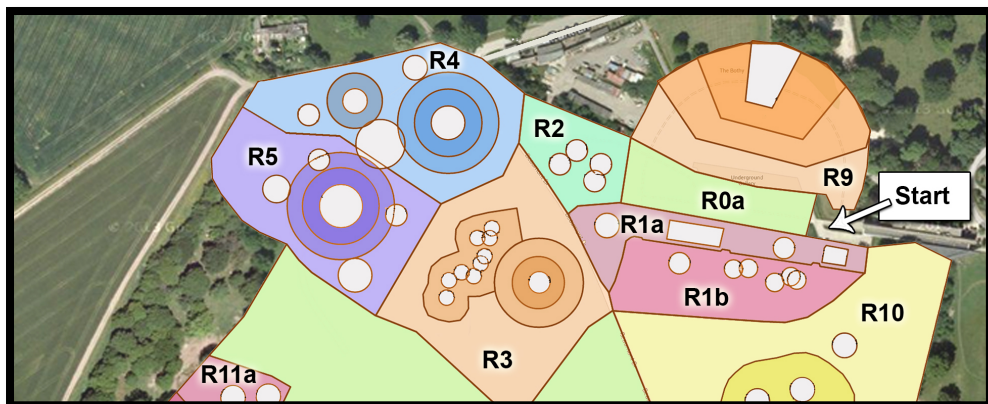


Figure 51: Area of park covered by soundtrack

5.2.2 Participants

Twenty-two participants completed the study between December 2013 and February 2014. There was an even split of eleven females and eleven males. Their age range spanned 10 – 65 years, with seventeen participants aged above 40. Three were in their late twenty's and the final two participants were aged 10 and 14 years respectfully. Due to their young age, the latter two participants (brother and sister) accompanied each other during their walks. Three (P11, P14 and P15) had previously visited Yorkshire Sculpture Park (YSP), two being regular visitors (P14 and P15). Participant 14 had attended Bretton Hall College as a student (ex-higher education college situated in the centre of YSP). All the participants were invited to attend the park for the purposes of undertaking the study. Six of the participants were current members of the National Trust and regularly engage in walking experiences. The participant demographic broadly reflected the typical cross-section of YSP visitors, as surveyed by the YSP. Three of the twenty-two participants (P11, P14 and P21) had either received some degree of musical training (P14 and P21) or were active musicians (P11). Six participants revealed that they typically listen to music whilst out walking (P1, P3, P4, P8, P11 and P13). Examples of their listening behaviour commonly centred on walking journeys such as commutes to work, university or walking the dog (P1, P3 P4, and P11), or less common, specific contexts such as when on holiday (P13).

5.2.3 Data capture

The study captured a selection of data types as listed below:

GPS capture of walking routes: a GPS tracking application (*GPS Tracks*) installed on the iPhone 4s tracked the participants movements around the study space. The resultant data was exported as GPX files from the iPhones, which when processed with GPS Visualizer²⁰ to illustrate the participant's start and end locations, in addition to their walking route, pace and duration.

Field notes (Dictaphone / and video): the author recorded field notes onto a Dictaphone and a video camera was used to film the participants' on-task behaviour.

Post task interviews: after completion of the walk semi-structured interviews were recorded on a Dictaphone. In the first instance the participants were asked

²⁰ <http://www.gpsvisualizer.com> - an online utility for processing GPS data

to talk freely about their experience and to discuss anything they wanted to. The author then posed questions intended to further explore a topic raised by the participant or to lead the discussion onto themes not yet covered, such as:

- Where was your attention during the walk – were you focused on your thoughts, the exhibits and parklands or the music?
- Talk to me about the music you heard?
 - How did the music fit against the exhibits and the parkland - Did you notice changes in the music - Did the music stop at any point during your walk?
- Which was your favourite exhibit?
- How did you feel being alone and wearing headphones?
- Talk me through the route you took (a large scale map of the park with images showing most of the exhibits was used as a tool for the participants to refer to)
- Is there anything else that you like to add?

5.3 Findings

The findings from these walks are now presented. Data is drawn from the post-walk transcripts – where a thematic analysis was undertaken to expose any pertinent themes – and from the *AppFurnace* and GPS tracking ‘app’ logs. First, those participants who encountered technical issues are discussed (objective 3). Following this, sections on visitor engagement (objective 1a), walking behaviour and interaction (objective 1b and 2), the visitor experience (objective 1c) and visitor’s interpretation of the experience (objective 1d) are presented. Maps that illustrate participant routes around the park can be accessed from the following URL: <http://wp.me/P4iEzp-67>

5.3.1 Technical issues encountered

Before presenting the main findings a brief statement regarding the technical issues encountered are first detailed. Five of the twenty-two participants experienced some technical issues, which appeared to impact on their walking experience. For instance, a music file did not clear when P11 exited R6c (see Figure 46). This file continued to loop round, playing continuously in combination with other music files from other regions subsequently entered, until they eventually terminated their walk. It was clear from the post interview discussion that this had an adverse effect on the second half of P11’s experience.

"There was one piece of music that I found really annoying [...] I couldn't get rid of it, so I felt like I almost wanted to take the headphones off at that point. I was hoping at some point this was going to change, but it didn't".

The other four participants also experienced a 'stuck' music file (P3, P6, P10 & P22). All occurred upon exiting the main soundtrack area and venturing outside of the study area into the *County Park* (area to the right-hand of the study area, see Figure 51). The music should have faded to a silence at this point, but a previously unrevealed error in the *AppFurnace* JavaScript caused the music file for R0c to loop continuously after exiting the boundary on that side of the park. Interestingly, this error appeared to extend the walking duration for three of these participants (P3, P6 & P10), who continued to explore outside of the study area for an extended period of time, presumably as the music continued to play. Conversely, this technical issue shortened P22's walk. It occurred very early in their walk, before they had explored many regions and been exposed to many musical adaptations. This participant spent about 20-25 minutes walking around the *Country Park* area listening to the 'stuck' file, upon which they removed their headphones and ended their walk:

"The first track was fine I could cope with that, it was sort of classical music [R1a and R1b]. The second track from what I remember was a little more discordant [R0 in Country Park area]"

Although they do not mention the repetitive nature of the latter 'stuck' music, they did indicate that they thought, 'if this is what it's going to be like all the time, then I don't want to listen to this.'

In contrast, P10 when discussing the later stages of their walk (during the 'stuck' music in the *County Park* area) explained that:

"I was a bit unsure of where I was or was the actual music saying to me we're kind of coming towards the end and this was the ending [...] whereas at the beginning I remember there being lots of different styles, tempos things like that".

P10 spent approximately 55 minutes in the 'adaptive study area' of the YSP, prior to exiting into the *County Park* section (i.e., 'stuck' loop – see Figure 46), and continued to walk for a further 25 minutes before making their way back to the YSP visitor centre. Their quote does not suggest they had any issue with the repetitive nature of the 'looping' music at the end of their walk. The main distinction between P10 and P22 interpretations appear to be as a result of their

respective points of exposure. Participant 10, as with P6, had extensively explored the study area and thus had been exposed to many different musical adaptations prior to the 'stuck' music file, upon which they then chose to interpret the repetitive music as the experience coming to an end; whereas P22 encountered the repeating extract at a very early stage in their walk (after 12 minutes) which ultimately led to shortened walk.

Participant 7 described a single moment when the music stopped temporarily, only to restart soon after, stating, *"I thought it was going to [stop] at one point but then it started again"*. An analysis of their walking route reveals this moment. Figure 52 illustrates their walking route breaching the outer boundary on the border between R2 and R0a, which accounts for their description.

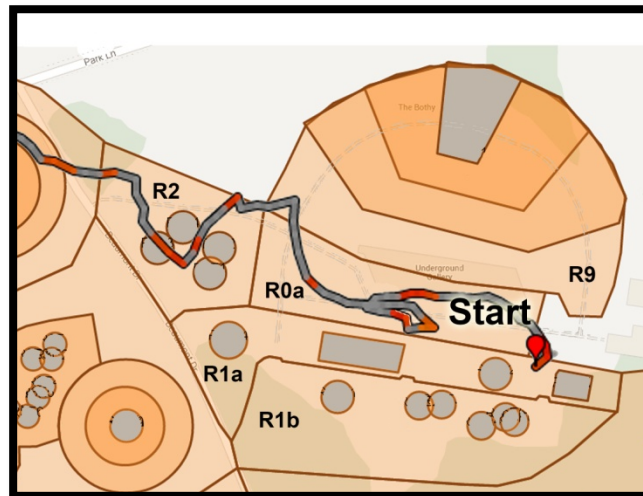


Figure 52: Participant 7 moment of silence

No other technical issues were reported. These participants are not excluded from the findings, but rather they will be drawn on, as these unforeseen errors have in turn revealed some interesting issues about the experience, which will be described in the forthcoming.

5.3.2 Visitor engagement

5.3.2.1 General thoughts

Participants were asked to talk generally about their experience. The overwhelming majority of participants (n. 21) described it as a positive and enjoyable one. Only P22, as a result of technical issues noted above expressed dissatisfaction. Typical participant comments were: *"It was just lovely, lovely experience walking around"* (P16); *"I loved it, I'd do that all day. I think it was really amazing with the music"* (P3).

"I stood next to group of people looking at the statue. There was four of them and me, with headphones on, and I stood and just felt 'I've got something you haven't got' and I thought they were missing out. It was just the total experience of it I think. I've got this beautiful music going on which enhanced the whole experience" (P21).

Five reported that the soundtrack blended into the whole experience, *"the whole thing seemed an experience, the music, the sculptures, where I was, everything it all seemed to be part of that experience" (P7).*

Other statements revealed that the soundtrack changed the nature of the experience for some:

"Ok, my immediate first impression was that this is enhancing and adding to the experience" (P15); "The overwhelming thing for me was how it made it a different experience, I am so shocked, really, really shocked because it made it more than just being a visual thing, it really did become a – I can't explain it – It was almost like going to a show [...] it was an experience that I would do again because I ended up having a different take on my usual visit to Yorkshire Sculpture Park" (P14).

Participant 14, throughout their interview, discussed how different this soundtrack experience was compared to their normal visits to the YSP. This participant, as acknowledged in section 5.2.2, attended college at Bretton Hall and has been a frequent visitor to the park for over 25 years. Evidently, P14 was well placed to offer an informed comparison between a walk with, and without, the soundtrack accompaniment.

Others mentioned that the inclusion of the music soundtrack made the exhibits more engaging and enjoyable, even if a participant was not particularly interested in that style of art, *"I would say that I am not into sculpture but I found that the music calmed myself down and enhanced the way that I saw things" (P20).*

A deeper discussion on the impact of music on visual interpretation is presented in section 5.3.5.2.

5.3.2.2 Thoughts about the music

The participant group responded very positively to the music heard. Only P22 expressed a dislike of the music, which resulted in their prompt withdrawal from the task. Generally, the music was described using positive terminology such as

“beautiful”, “relaxed”, “calm” and “emotional”, but also neutral terms for example “samey” and “non-specific”. These descriptions in all likelihood refer to the music’s general ambient, textural style rather than as a result of the soundtrack’s adaptive functionality. The following quotes expose how a couple of the participants perceived the music related to their personal tastes or prior experience. One participant (P11), a musician, stated that:

“When it gets more kind of minimalist, you are in danger of you know, the kind of health spa experience, if you aren’t careful you are not far away from having pan pipes and running water which has massively become a cliché in health spas”.

Whereas P19 noted that: *“I very often go to Ragdale Hall [a health spa]. I could feel that that’s the sort of music I would listen to there”.*

Some others discussed the appropriateness of the soundtrack’s musical style for this type of setting, *“did the music suit the style if the sculptures? Yes, I was going to ask you that, who decided to partner the music with this location, because I think it does. You wouldn’t want to go round with Led Zeppelin in your ear, would you!”* (P6).

Overall, the music was perceived as appropriate for the setting and relatively neutral, and enjoyable to listen to.

5.3.2.3 Attention during walk

The participants were asked where their attention was during the walk. Nineteen out of the Twenty-two participants reported that their focus was firmly placed on the on visual stimuli of the exhibits and parkland. The comments below describe some of the typical responses, *“when you look at the statues [...] the music just blends into the background”* (P9); *“it wasn’t the whole focus, I was able to appreciate everything else. It wasn’t a distraction either, the music. It wasn’t a deterrent or distraction”* (P18).

Only P11 felt that certain segments of music commanded too much attention, drawing it away from the visual stimuli. They noted that the more abstract music allowed them to focus on the sculptures and parkland, whereas those musical sections with strong melodic themes demanded their attention. Finally, P10 was outlier on this theme being the only one who spoke at length about being lost in thoughts and reminiscing during the walk:

“First of all it was a really interesting experience for me given that I know this place inside out, having been to college here. So immediately I put the

music on and I started walking out, well I was in floods of tears because it just brought everything back but I think it heightened it because it was the very moody music and I think it made that even more strong”.

This participant clearly has strong historical and emotional connections with the YSP. On the one hand it is understandable why this participant reminisced for extended periods, but on the hand the strength of their reaction is intriguing. This participant did not state that emotional reactions such as the one described here were in anyway typical of previous visits.

5.3.2.4 Participant understanding of the playback system

Participants, prior to the study, were not informed about any aspect of the soundtrack’s functionality and were deliberately not questioned about it post-study. On the whole they did not express a desire to understand or even question how the playback system operated. All of the participants, when asked, reported hearing changes in the music at different times, for instance P6 and P7 acknowledged musical evolutions, but their apparent consideration over their answers also illustrates how the music had blended into the background:

“The music did change at times, I know it did. Sometimes the same piece lasted for ages, but I did notice it did change I don’t know particularly when” (P7); Yes [the music did change], but with that type of music you do notice it changing, but you’re not sort of, what shall we say, it’s in your ear and because you’re looking at the sculpture and reading you’re not concentrating on the music, it’s just sort of there all of the time” (P6).

The music presented in the regions in the top half of the park (R1/2/3/4/5/9/10) was generally reported as being quite similar, which may account for some indistinct recollections of musical adaptations. P8 observed the music becoming more distinct at later points in their walk (i.e., when in the *lower park area*):

“To start with it seemed more non-specific music, just mood music kind of and then towards the end I seemed to notice the music a bit more perhaps, but I don’t think I noticed it to start with particularly” (P8).

The author also acknowledges that the music in the top half of the park was of broadly similar style and a greater variation of music was presented in those regions located in the lower half of the park. This was not a deliberate action, but

rather as a result of the order that music was composed and allocated to regions during the design and development process (see Chapter 4).

Some interview comments inferred an assumption that it was a fixed linear soundtrack. For instance, P10 when discussing a musical example stated, *“It was at the beginning of the recording”*. The following quote from P18 implies a recognition that a musical change appeared orchestrated, as it occurred at seemingly the right moment, but they could not understand how this was brought about, *“like in the bit where there were more coloured sculptures you think has this been set intentionally [changes in the music] but then not every person is going to take the same route, so you can’t say that?”* (P18).

Four participants stated that they assumed GPS, or some other positioning technology was used to trigger changes in the music (P3, P4, P11, and P15). P15, commented that, *“I noticed that there were clearly geographical changes that happened, I then felt I had to check that out and so I left one area, heard the music, went back in and did a bit of that, which I thought ‘oh that was interesting”*.



Figure 53: *Everything is Connected* exhibit.

The quote above describes P15 engaging in a process of zone boundary testing, so as to determine whether their observations of geographically triggered changes were correct. Participant 15 described this occurrence in the area that suggested the transition between R11c and R6a, which is confirmed by their GPS traces. They go on to speculate that this realisation may have enhanced their experience further: *“Appreciating that that was the case made me appreciate the*

experience perhaps a bit more, and that's when I thought 'oh God this is a marketable thing' and I could see how this would work".

In addition to P15, P12 also engaged in boundary testing. This took place at the *Everything is Connected* exhibit (E1) (see Figure 53 **Error! Reference source not found.**).

The music presented during the *engagement* phase at this exhibit contained elements of 'sound design', such as sounds of electrical sparking, a 'dial-up' modem connecting and typing at a computer keyboard. Thus, these elements contrasted the soundtrack's predominately musical underscore (example video available at - <https://youtu.be/ytwCeFMXqsc>). The following quote from P12 describes 'testing' the zone boundary at this exhibit:

"Because I walked up to it and noticed, like, it had changed. I noticed that straight away and then I walked away and it stopped, and I sort of wondered if I walked back would it start again and it did. So that was sort of, like, a little bit of an experiment" (P12).

Following this observation this participant went on to report that they then proceeded to look out for other musical changes upon arriving at exhibits, stating that sometimes they thought there was a difference and sometimes they could not tell. This participant, who was aged 14, did not offer, or enquire as to how these musical changes were being brought about. These two instances impact on the data presented in the following section on regions visited, specifically 'repeat visits' (see Figure 56). The author is unable to speculate how many repeat visits may be accounted for by zone boundary testing. However, as only P12 and P15 discussed this in their post-walk interviews, it is speculatively considered to be only a few isolated instances.

Above and beyond the four who reported an assumption that GPS (or a similar method) was used to control the music along with P12 who was observed testing out a trigger zone, the majority (n.17) offered no direct statement or enquiry about the function of the music playback. Whilst not conclusive, one would assume that if more had been aware of its functionality, this would have been revealed during the post-task interviews. Speculatively, therefore, it appears that the majority of participants assumed a fixed musical recording.

5.3.3 Walking behaviour and interaction

The findings now move on to present details of participants walking behaviour, drawing on observations and system logs to reveal what happened.

5.3.3.1 *Navigating the park*

The majority of the participants ventured into and through a large proportion of the area covered by the soundtrack. However, P1, P2, P5 & P9, stayed in the top half of the park (Gardens, Hillside & Driveside areas), seemingly unaware or uncertain whether other areas existed and how to access them. The route through from the top half of the YSP to the *Lower Park* and *Lakeside* areas was not immediately clear or well signposted. During the study's piloting process, three of the pilot-participants also remained in the top half of the park, assuming they had discovered all there was to see. It was anticipated, therefore, that this might also happen in the visitor study. Thus, during the pre-study briefing participants were supplied with a map of the park and the investigator explained how to navigate through to the lower half. However, the post study interviews revealed this was still unclear for some, including those who did find their way through.

5.3.3.2 *Walk duration*

Figure 54 illustrates the participants' walking durations, as drawn from their GPS walking traces. The mean duration for the participant group was 1:00:55 (hours, minutes and seconds), with a range of 1:11:36 between the shortest (00:26:44) and longest (1:38:20) walks. Whilst there was no particular expectation on how long the participants' would walk for, the design and piloting process revealed that approximately one hour was required to cover the majority of the study area – should one choose to – which was similarly reflected here. Those participants who stayed just in the top half of the park (P1, P2, P5, P7, P9, P10 and P22) typically walked for a shorter duration, with the exception of P10.

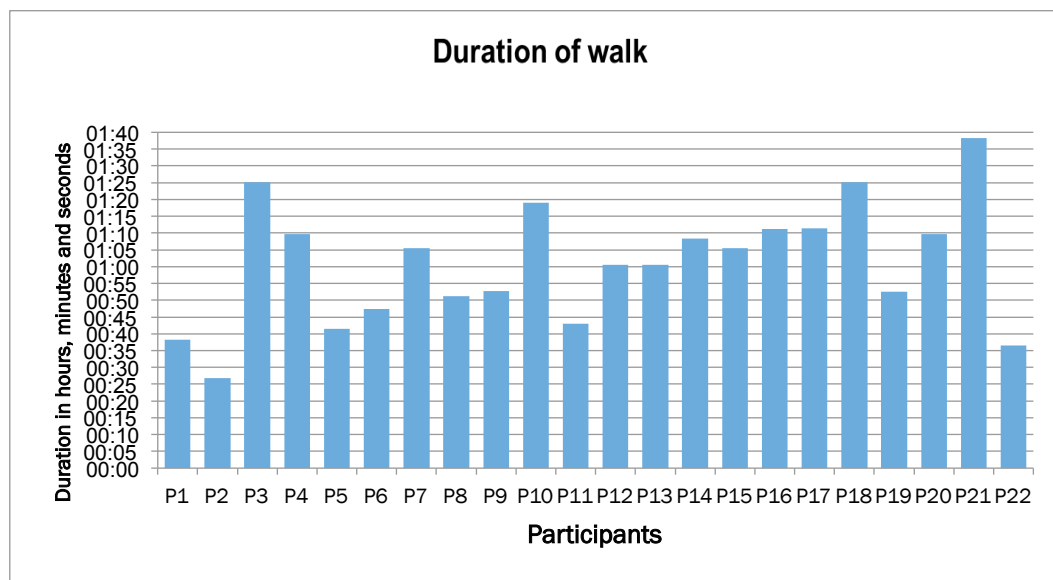


Figure 54: Duration of walking tasks

Some participants reported that the music extended the duration of their walk, “*I wouldn’t have walked on my own for as long as I did without the music*” (P15), whereas P18 and P19 stated that they really enjoyed the experience, but disclosed that had this not been a ‘study’ they may have chosen to stop sooner than they did.

The post-walk interviews noted that eleven participants suggested the music affected their walking behaviour in some way. Seven of these speculated that the music slowed down their walking pace: “*So I think had I not had the music on I perhaps would have moved around more quickly maybe*” (P8) and “*I would say it probably made me walk around at a slower pace*” (P10). Slow and moderate tempi were used throughout (60 – 84bpm), with the exception of the music in R11, which contained strong rhythmic syncopation at a faster tempo. This contrasting shift of musical tempo was reported by five, “*But the music was obviously getting quicker anyway so you almost felt like you could skip through that bit*” (P18).

Finally, two others (P11 and P15) disclosed that they, on occasion, noted a pull to synchronise their walking pace to the music’s tempo:

“There was a pace to the music that I felt I wanted to get my walking into the rhythm of it and it was just slightly frustratingly too slow and I found myself walking much slower than I wanted, but I’d have felt uncomfortable going any quicker because the music was so compelling, I felt like I wanted to get my gait in with it” (P15).

All of the statements presented here infer the music’s tempi responsible for affecting the intensity of participants’ physical momentum.

5.3.3.3 Distance Covered

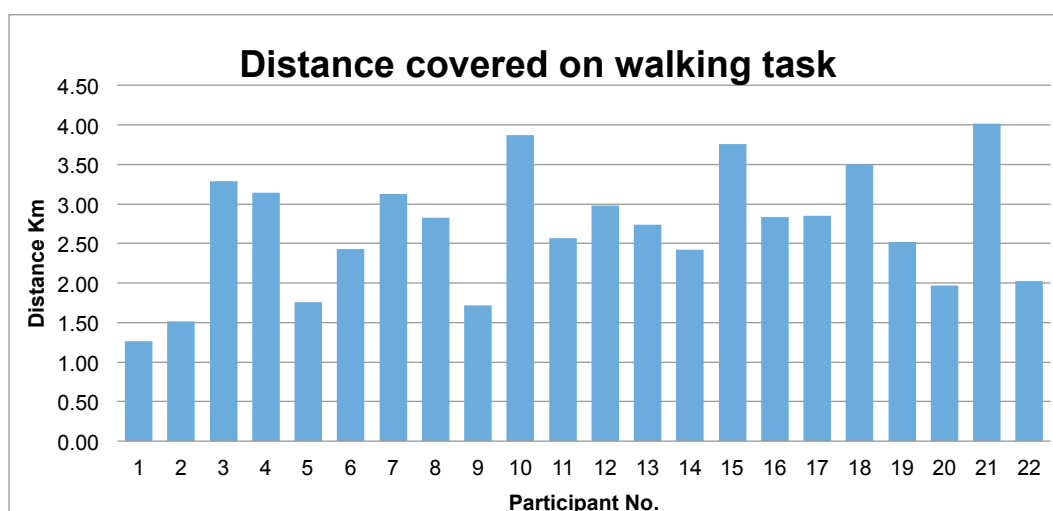


Figure 55: distance covered on walking task

presents the distance participants' travelled during their walking task. A mean distance of 2.69 kilometres was recorded, with a range of 2.3km between the shortest (1.26km) and the longest (4.02km). The impact of the activity (visit to a cultural visiting site) on the participants walking behaviour becomes apparent when comparing task durations and distance, as the discriminating factor between the two do not just concern differences of walking pace, but also time spent engaging with exhibits and the artefacts in the parkland; this may have included periods of being stationary. An illustrating example concerns the comparison of P14 and P15. Both of these participants walked for a similar duration (P14 = 01:08:00 and P15 = 01:05:00). However, P14 covered only 2.42km in comparison to P15's 3.76km. The post-task interview revealed the reason for this divergence as P14 stated that, "*I just sat on the benches in front of the mansion. I must have sat there for probably 35 minutes*".

5.3.3.4 Interaction with zonal structure

This section details a summary of how the participants' walking routes interacted with the YSP soundtrack structure. This is segmented into three sections: transition into (and out from) *regions*, interaction with *approaches*, *arrivals*, *engagements* and *withdrawals*.

Regions

An overview of the *regions* visited by the participants is detailed in Figure 56.

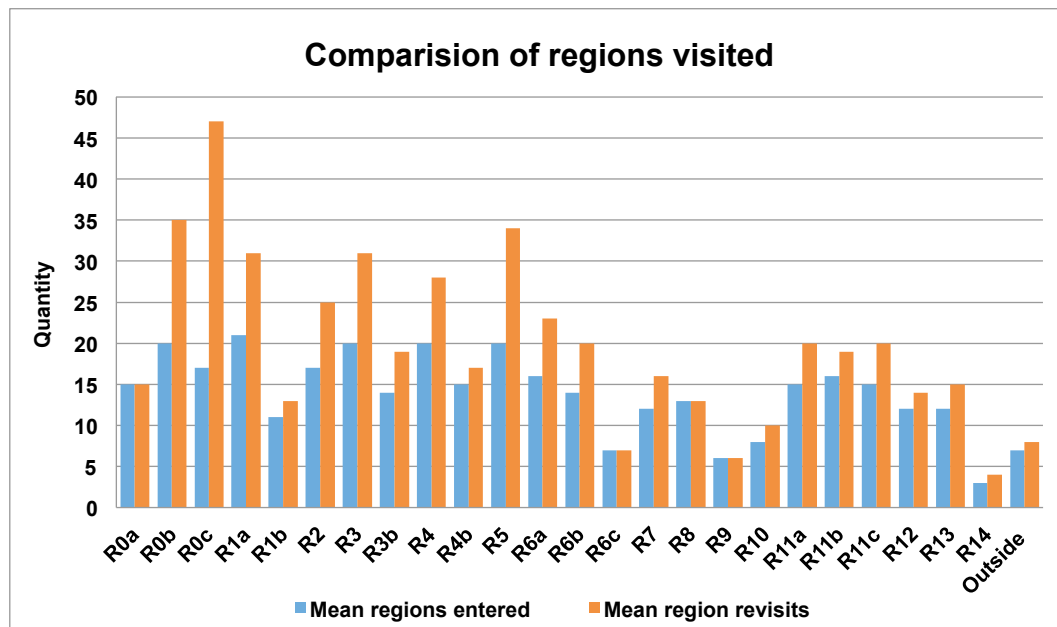


Figure 56: Regions visited

This chart presents two data series. The first (blue bars) represents the popularity of a region (the maximum would be 22 i.e., a visit by all 22 participants). The second data series (orange bars) illustrates the number of repeat visits to a region. Unsurprisingly, repeat visits to the holding music regions of R0b and R0c were common, as transition through these regions was necessitated by any participant who journeyed to the lower areas of the park (see Figure 51). Consequently, most participants would journey through this region at least twice (once on the route down and then again on their return). Regions R1a, R3, R4 were visited by almost all and also witnessed the greatest number of repeat visits of those regions which contained exhibits. Their close proximity to the start location accounts for this regularity, as the majority of participants' outward and return journeys took a trajectory through these regions. Furthermore, five participants (P1, P2, P5, P7 and P22) remained in the top half of the park for the full duration of their walks, which also contributes to the roll-off in the number of visits to those regions in the lower half of the park (see Figure 51 and Figure 56). Some regions, such as R6c, R9, R10, R14 who received very few visits were not as visually identifiable as others in the park, meaning that tree cover, fencing or other boundaries masked their locations.

The data illustrated in outlines the number of regional transitions made by each participant during their walk. A regional transition denotes the act of crossing a zone boundary from one region into an adjacent region. The coloured segments in the chart () illustrate how many of these regional transitions were as a result of repeat visits into the same region. In compiling this chart only distinct revisits

were included, meaning that participants' had entered and left the region, only returning to it after a notable period of time, thus any rapid, successive re-triggers that would appear to be as a result of GPS error or participants walking along a 'seam' between two regions were discounted.

All bar one of the participants (n.21) re-visited previously explored regions. However, the frequency at which participants traversed into and out from one of the 'holding regions' (R0a, Rob, Roc) skews this data (Figure 56).

An association between distance walked and the number of regions transitioned would be anticipated, and that is largely observed (comparison of and), with the notable exception of P3, P7, P10 and P22. As discussed in section 5.3.1 these participants exited the outer region of the soundtrack area, where the sound file continued to loop indefinitely, resulting in their continued walking, which skewed their relationship between distance covered and regional transitions made.

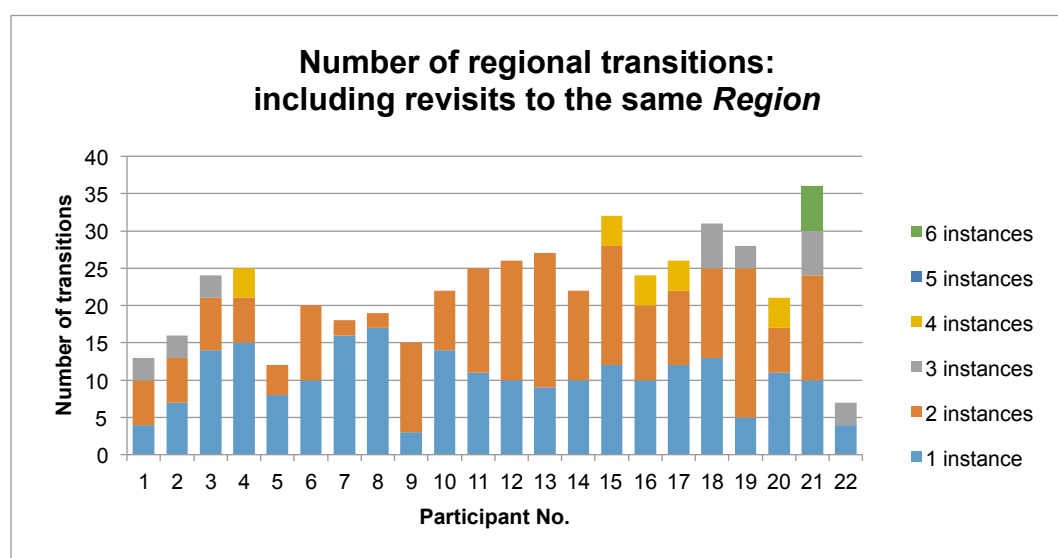


Figure 57: Number of Regional Transitions.

Only a single participant (P14, a trained musician) hinted at hearing musical repetition (i.e., repeat visiting), suggesting that some musical themes (melodic or rhythmic motifs) were used multiple times:

“I was aware when you moved into a different sort of style and I was aware of it moving into a different style but then there would be moment where you’d have a bit from before and there were themes, for me, it seemed as though there were themes rolling over” (P10).

There were two other exceptions to this, which are discussed in section 5.3.2.4.

In considering why repeated musical extracts were not so readily observed, several factors may be pertinent: first, the reported predominance of 'samey' mood music may have made it difficult to distinguish between the regions; second, the soundtrack blended into the background of the experience for some, thus acting as a secondary stimulus; and third, the possibility that the soundtrack was viewed as a fixed recording, thus any heard repetition would have evidently been predetermined and thus of no particular interest.

Participant 16 described hearing a regional transition that prompted them to focus on the exhibits contained at that location.

"I don't know if it just coincidence or what, but going through the walkway to begin with it was really nice and calm and then when I came to a piece that was different the music seemed to change [...] the music made me more aware of what I was looking at basically" (P16).

The following examples were presented by a group of participants who had predicted that musical changes were most likely triggered by GPS (P3, P4, P11 and P15), but nonetheless would not have known the rationale used to structure them. For instance, P11 noted that, *"The whole experience of walking round is complete with change, change in scenery, change in sculptures and the music seemed to reflect that quite well"*. Participant 15 draws a connection between the YSP experience and display media experiences, in this instance a computer game:

"There are places where you are doing a video game, Tomb Raider, one of those where you are in an environment and you might enter a new bit and there is an evocative bit of music that goes with it and that has a bit of a 'ooh' feeling to it".

Some others also described the soundtrack experience as similar to an audio / visual media experience, such as a film, documentary or performance. In addition to noticing aligned changes between music and the environment, the following from P4 describes the aesthetic appropriateness of a transition between regions, which took place when exiting the *Sculpture Trail* (R11b) into an open field area (R0b); a distinct change of landscape, *"that was lovely, the music changed just right actually. Just as it went from this quite dense, almost enclosed area to open up and the strings or whatever it was burst out"*. They clearly enjoyed the moment, and they then went on to discuss how regional transitions prompted them to be aware of new exhibits:

“I was quite aware of it [changes in the music] because it seemed to go with areas of sculptures actually [...] it made me aware to look out for a new, another sort of area of sculptures. This must be a new area”.

Similarly to the above, this following example (P3) describes the music’s role as one of framing the physical area, thus communicating entry into a new environment and to be aware of new sculpture exhibits. When asked to clarify how they determined what a new area was they responded:

“It seemed to be [hearing changes in the music] almost in time with me noticing a new area. So, I’d see some sculptures in the distance and would consciously notice the music changing. So it was almost together” (P3).

Furthermore, P3 noted the design of regional structure in the soundtrack app, *“I certainly didn’t notice any music change while I was standing still or close to a group, or in a group of statues, it was always in a transitional period”*. It was this observation that was fundamental in their identification that this was an adaptive soundtrack, rather than a fixed playlist of music.

There is a body of evidence that shows the musical regions were noted and were deemed fitting for walking transitions in the park. Some assumed these to be coincidences, whilst others predicted GPS adaptations. This theme will be revisited in the discussion in Chapter 7.

Approaches

The focus is now shifted onto participants’ walking interactions within the regions themselves, specifically with the *approach stage*. *Approaches* were set in-between the outer boundary of a region and an exhibit’s innermost zone (i.e., *arrival zone*). Only those *approaches* with two or more stages are included here (termed *multi-stage approaches*) (see section 4.6.1.3). The rationale for this was to focus on those *approaches* that contained multiple steps of rising musical intensity, hence those that delivered a substantial musical evolution over the course of their passage.

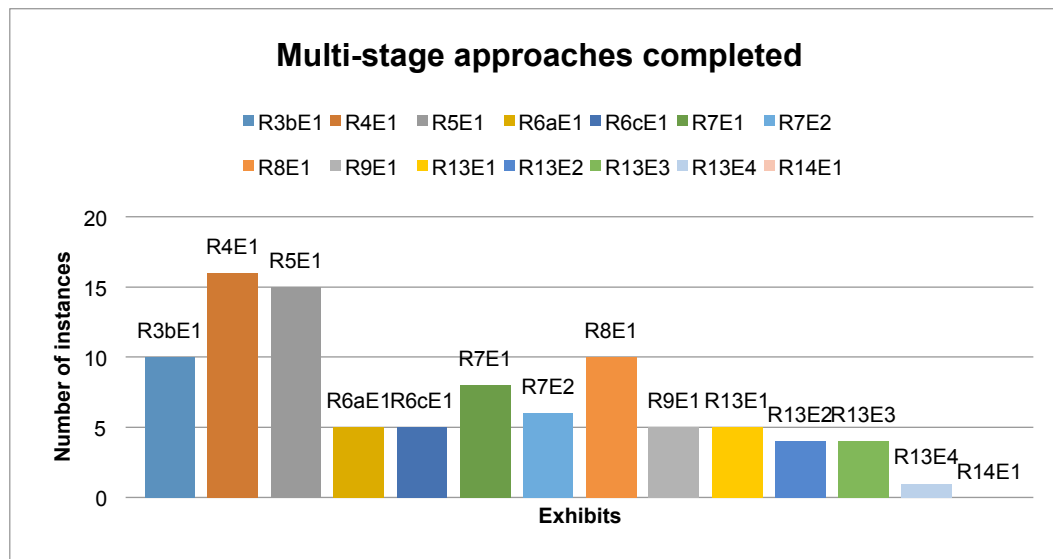


Figure 58: Multi-stage approaches completed

There were ten exhibits treated with multi-stage approaches: R3b1, R4E1, R5E1, R6aE1, R6cE1, R7E1/2, R8E1/2, R12E1/2/3/4 and R14E1. displays the number of instances participants' progressed through each of these ten multi-stage approaches, from the outer region through all approach zones and into the *arrival* zone.

Unsurprisingly, this data – broadly – reflects participants interactions with regions (see Figure 56), in that those regions situated in the top half of the park (R3, R4 and R5) observed the largest number of instances where participants journeyed through multi-stage approaches, followed by a roll-off in numbers for those contained in the lower half of the park. Notably, R3bE1, R4E1 and R8E1 are particularly prominent exhibits due to their large size and placement in open parkland (i.e., can be seen from a distance and from several vantage points), which may also account for the high number of visits. Conversely, half of the participant group did not venture into R13 even though it was very prominent (large mill stones set in an open field. See Figure 59). Being situated in the bottom right-hand corner of the park there was little to explore beyond that location, which may explain why so many of the visitors decided not to journey over to that area.



Figure 59: Exhibits in Region 13

Of the eleven participants that did walk into R13, six transitioned through all *approach* stages and entered one or more of the *arrival* zones contained within that region (Figure 59). Whereas the remaining participants walked through the region and some of the approach zones, but did not deliberately approach the exhibits to within a close proximity (i.e. entered the arrival zone), but rather walked through their general area.

The post-walk interviews revealed only three participants acknowledged *approaches*, two of these directly: “well, obviously it changed as you approached certain exhibits” (P5); “it felt to me that the closer you were to a sculpture there was more going on in the music and as you drifted away the music calmed down a bit, or a fewer instruments” (P3).

Although noting these changes they did not offer any descriptions of these *approaches* having a direct impact on their walking experience. In this final example, P11 did not directly highlight *approaches*, but rather they described an example of how the music worked, or rather did not work in relation to the *Molecule Man* exhibit they approached in R4:

“I was walking towards that ‘Molecule Man’ and at one point the music got quite sinister which I thought was good. I thought the music was going to enhance that and then it kind of didn’t, it kind of went away and got kind of quite dreamy. To me it felt like it should be a little bit more, a bit darker” (P11).

The music in this set of approach zones was discussed in section 4.6.4.3 and can be viewed at <https://youtu.be/R6ac1hKksy4> - R4 is entered at 00:34. The outer zone of R4 sounded a C Major chord. The next *approach* zone shifted the chord harmony to the mediant chord (3rd degree) in the key of C Major (E minor). This major to minor transition are often interpreted as 'dark' or 'sad' and would appear to correspond to P11's statement of, "*at one point the music got quite sinister*". Upon moving into the next *approach* zone the harmony shifts once again, this time to the chord of A Major, a transitional, chord which prepares the modulation of key to the D Major used in the arrival zone (see map). The movement back to a major chord harmony followed by the V-I cadence which leads into the key of D Major at the *arrival* zone very much alters the 'mood' of the music; thus it becomes much brighter, reflecting P11's comment, "*it kind of went away and got kind of quite dreamy*". Although the music did not evolve as expected, or hoped for P11, their description nonetheless corresponds neatly to the intended function of *approaches*; to prepare the viewer by foreshadowing the impending moment of arrival and engagement with the exhibit. Given that all participants traversed through approaches, the lack of awareness is interesting.

Arrivals

details the total number of sculpture exhibits deliberately approached and viewed by participants. The blue section of the column indicates the number of *approaches* that resulted in entry into the *arrival* zone, upon which the presentation of the *arrival* accent, plus any other adaptation to the music was presented. The orange segments in the chart indicate those exhibits that were deliberately approached, but where the participants stopped short of entering the arrival zone; consequently not hearing any *arrival* accent or *engagement* treatment. The majority (83.14%) of participant approaches and engagements with the exhibits were done so in close proximity to the sculptures – inside the *arrival* / *engagement* zones. This indicates two factors: first, that these participants interacted with the sculpture exhibits in a similar way as those visitors observed as part of the orientation and observation work which preceded and informed the design of this soundtrack; and second, the general coverage (diameter / size) of the arrival zones were appropriate.

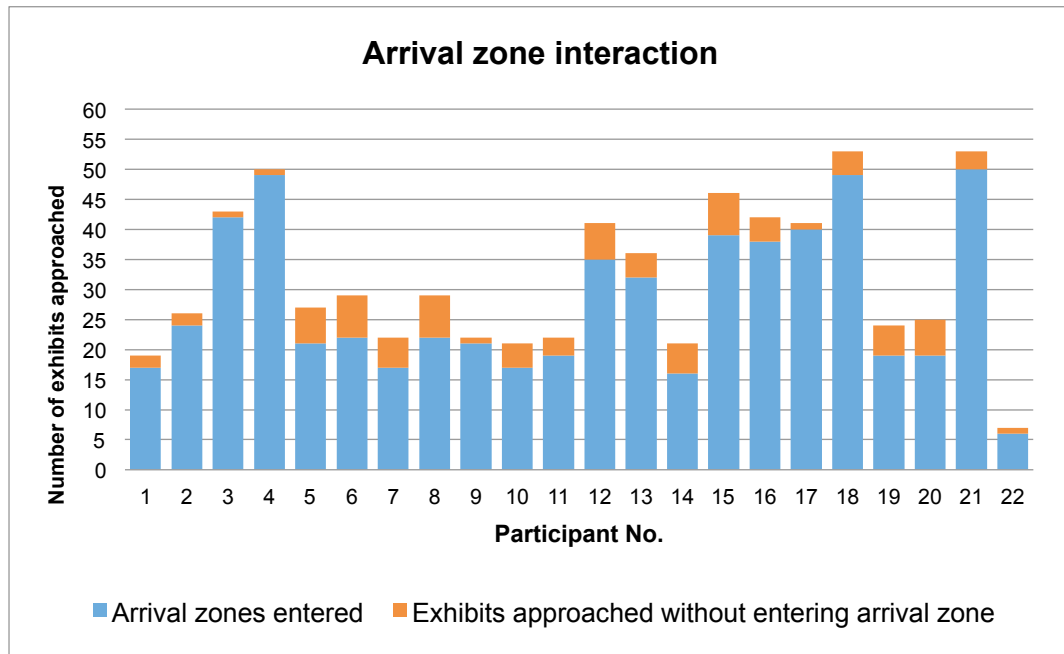


Figure 60: Arrival zone interaction per participant

The first data series displays (blue columns) an aggregation of arrival zones entries for each participant. As described with entries into regions, this data also includes repeat visits to *arrival* zones, but not those as a result of any undesired re-triggering of sound files (GPS error or participant hovering on a seam). Thus, this data indicates the number of occasions a participant was presented with an *arrival* accent, or specific *arrival* or *engagement* music.

The rationale for determining what constitutes a ‘deliberate’ approach to an exhibit is as follows: maps of participants routes, charted from the GPX files, were combined with maps of the zone boundaries to reveal how participant paths moved up to, into, through and out of zones. The author manually examined these to reveal noticeable paths that led towards an *arrival* zone, but stopped short of entry. Additionally, the *AppFurnace* log files were used to confirm whether an *arrival* zone had been entered, as a manually compiled map with the GPS traces may not accurately determine entry by sight alone. Furthermore, walking pace data also drawn from the GPX files revealed when participants stopped or slowed significantly from their normal walking pace at the point of reaching these locations. Collectively this combination of data sources supported a ‘best guess’ verification as to whether a participant had intentionally arrived at an exhibit they wished to view – meaning the distinction between a navigated trajectory up to an exhibit as opposed to a meandering walk passed an exhibit. Figure 61 present’s two examples of ‘deliberate’ *approaches* towards an exhibit. The left-hand image shows P21 walk into and through the

first two stages of that exhibit's *approach*. When the colouring of their route turns from grey (grey refers to a mean walking pace over 2.5kph) to red (illustrates mean walking pace under 1kph) the participant slows, or stops. Finally they withdraw from the exhibit on a different heading. The second example on the right shows a similar event. Participant 6 approaches to the edge of the arrival zone, again slows or stops before walking away on a different trajectory.

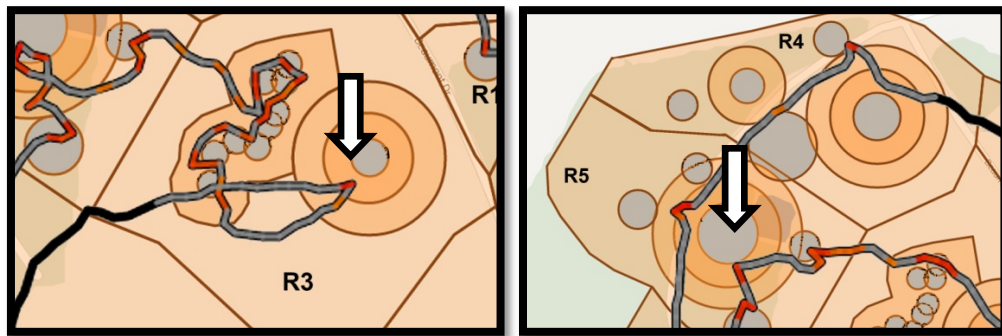


Figure 61: Viewing exhibits from outside of the arrival zone

By comparing the data presented in and that contained in a high-level understanding of participant behaviour is revealed; specifically, those participants who focused more on close quarter engagement with the exhibits, in contrast to those who did not. The following examples illustrate this distinction. The extract below from P21's route shows a deliberate path to take in the majority of sculptures (). The red markings on the route indicate a walking pace below 1kph, orange between 1-2.5kph and grey above 2.5kph. It is clear how their walking pace slows, or stops, when in close proximity to exhibits.

Conversely, P19 explored much of the same area of the park as did P21 above, but did not approach the exhibits as closely or slow their walking pace as frequently when near to them (Figure 63).

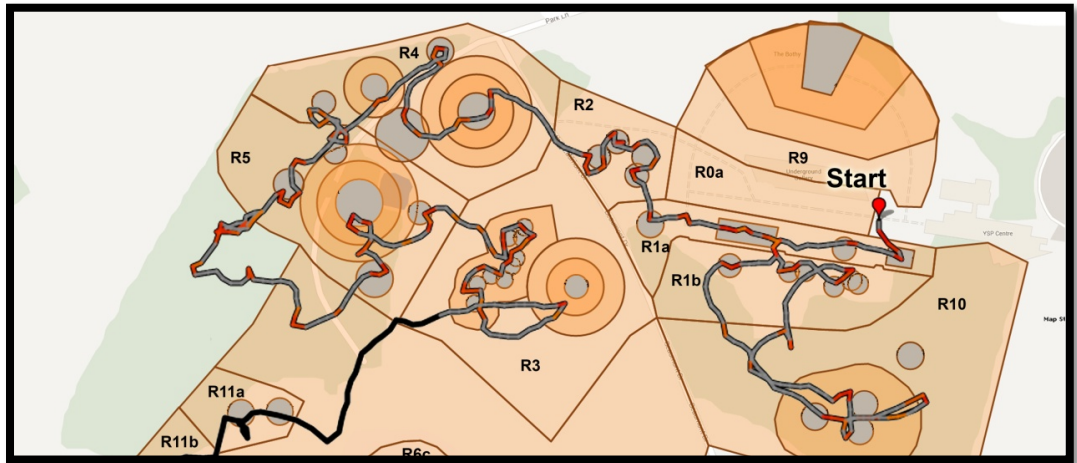


Figure 62: Participant 21

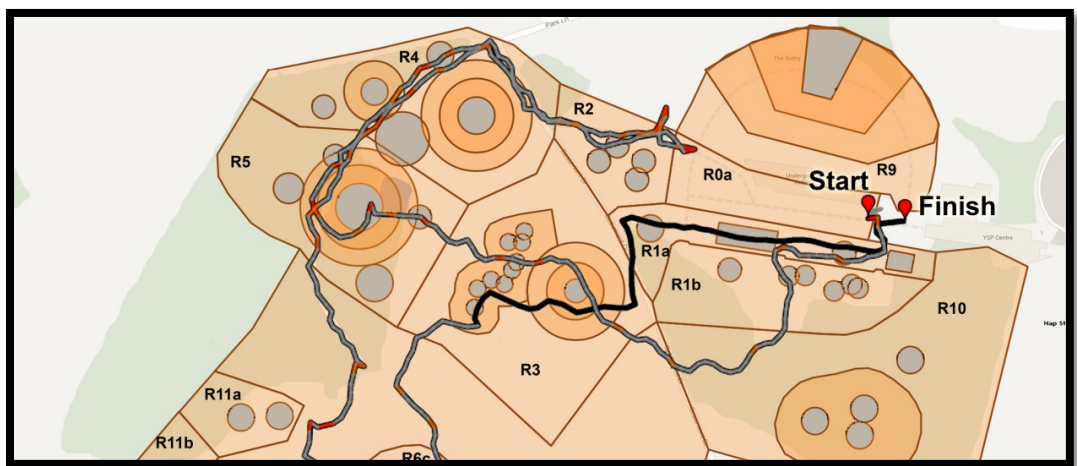


Figure 63: Participant 19

Although P19 would have viewed many of the same exhibits as P21, their soundtrack experience was notably different as fewer exhibits were *approached*, so consequently fewer *arrival* zones were entered, which led to a lower level of musical adaption across their walk. Rather than intending to draw any conclusions here, this example serves to highlight different behaviours in this type of setting. Analysis of the participants' walking traces reveal that the majority of the participants' engaged in deliberate *approaches* and *arrivals* (n.15), whereas a smaller number (n.7) walked through the same areas, but engaged in fewer *approaches* and *arrivals*. A further example of visitor behaviour concerns P14 who walked for a long duration (68 minutes), but they did not approach the sculptures as frequently as most other participants, the reason was their familiarity with the park and its exhibits, being a regular visitor, "I know this park extremely well and I am very, very familiar with so many of the sculptures".

In turning to the interview transcripts there are no descriptions that directly state a perceived impression of *arrival*. Eight participants' acknowledged hearing

multiple instances of the ‘chime’ *arrival* accent. Four of these eight did not attribute any function to these accents, or even question their presence, but rather they asserted that they seemed to be musical events that were out of place: “I remember the first time it happened it made me jump” (P10), and “it was just quite a contrast [...] it would be like ‘oh, where did that come from, what was that about?’” (P19). Three perceived that the accents signalled something, but were not sure what: “I thought they signified changes and the music didn’t change. So I expected it to and it didn’t” (P11). This example appears to suggest an interpretation of the arrival accents consistent with their intention, but they did not connect the accent to any physical artefact. Why these participants did not form a connection between the accents and their proximity to the exhibits is interesting.

Participant 4 – who predicted a GPS triggered ‘app’ – was the sole visitor who interpreted the function of the accents correctly, stating that they sounded whenever they were in close proximity to a sculpture. Nonetheless, they offered no assessment of the purpose of the accents, or an opinion on what impact, if any, they had on their experience. Only participant 16 proposed an interpretation closely related to the intended function of the *arrival* accents:

“It seemed to be when I got to a more different type of sculpture, whether it was coincidence or not there was like a ping in the music, you’d got to look at it more carefully, look at the sculpture more carefully [...] just remind yourself to look at something more intensely” (P16).

The accents were largely ineffective at signalling *arrival* for the majority.

Engagements

This section considers the *engagement* stage, when participants were interacting in close proximity to the exhibits. Just under half (n.19) of the exhibits (n.43) were treated with an *engagement* stage (an adaptation to the music distinct from the regional music surrounding the exhibit). Predictably, it was those engagements stages that were treated with non-musical sound design elements that prompted discussion. For instance, P19 and P21 both acknowledged the ‘middle-eastern’ style chanting/bells incorporated into the engagement phase of the Buddha exhibit in R5 (Figure 64):

“There was like a colourful Buddha. (Laughs)...I think you were planning it, you got some remote control that changes the music! The music went on just one note, like a drone and I just felt really peaceful, as if he was doing his “ooommm”. And I just felt like I wanted to stop there” (p21).



Figure 64: Buddha exhibit in Region 5

This quote clearly notes an enjoyment of the connection between the music and the exhibit, although they are a little puzzled as to how that music could just happen to sound at that specific point in their walk; a further supposition of the majorities assumption of a fixed linear soundtrack. Another interesting example reported by P18, who commented on hearing talking voices when viewing the ‘Molecule Man’ exhibit in R4 (see Figure 65). Embedded in the musical texture of this exhibit’s engagement music was a sound sample of spoken conversation: *“In the background you could almost sense that there was a conversation going on, you could almost hear voices talking to each other”* (P18).

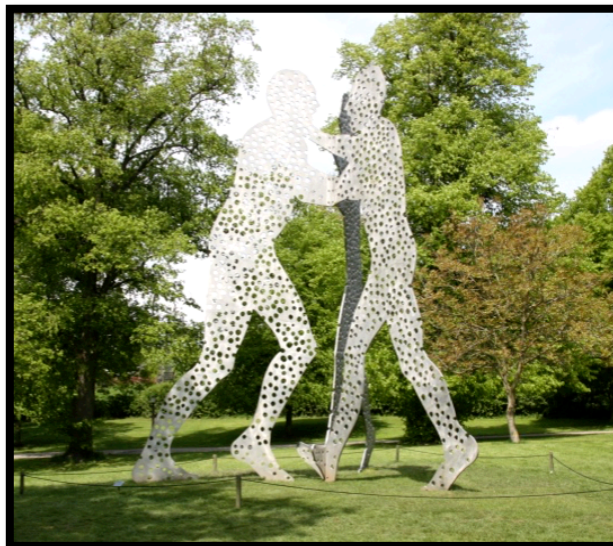


Figure 65: Molecule Man in Region 4

Markedly, P18 then surmises that they imagined these voices, rather than actually hearing them: “*You know when I could almost sense those voices in the left ear and the music still playing and I’m thinking, am I letting myself think that because that is what I want to hear*” (P18).

In all probability this participant was not assuming an adaptive system but a fixed soundtrack, which led them to speculate that this sound effect, with its direct connection to the sculpture (i.e., men facing each other in dialogue), would not just happen to play at that precise moment, and was therefore dismissed as a subconscious imagining. Whatever the rationale this is an interesting interaction and observation.

All of these *engagement* examples refer to non-musical elements, which appeared readily perceptible and thus noteworthy. Furthermore, these examples all illustrate a sense of enjoyment, wonder and pleasure from the apparently serendipitous events. Conversely, there were no reported references to those *engagement* stages with purely musical adaptations, such as the introduction of new musical material, a lowering of musical intensity or changes of key.

Withdrawals

The final stage of the *trajectory of interaction* was the *withdrawal* stage. Only six exhibits in the YSP soundtrack were treated with a *withdrawal*. The post-task interviews, alongside the field notes, revealed no evidence that those participants’ who visited those exhibits acknowledged a different musical treatment when departing from the arrival zone. This is not surprising given the emerging deduction that the majority appeared unaware of the mobile applications adaptive functionality. Thus, any musical shifts would not have been attributed to spatial agency, but rather the pre-determined course of a linear soundtrack.

Silence and global boundary

Seven participants’ reported occurrences of silence. Participants 3, 5, 8, 10, 18 & 21 all ventured outside the global boundary on a single occasion. For Participants 3, 5, 10, 18 and 21 this location was to the outside of R5 (see Figure 51), and for P8 it was R2. The author witnessed these events and observed a similar response from most: they stopped briefly and then turned round to get the author’s attention. The author then approached the participant, who then removed, or pulled the headphones to one side and stated that the music had stopped. The author suggested that they continue on with whatever they were doing and

hopefully the music will begin to play again. After a little more exploration all of these participants re-entered the global boundary, signalled to the author that ‘all was ok’ and continued on their walk. Participant 3, however, interpreted the music stopping differently, as they discussed afterwards:

“The only time the music really changed my direction was when it stopped [...] That to me was a trigger that I have gone out from where I should have be, I don’t know if that’s right or not”.

The final participant (P14) who reported experiencing silence, occurred for them in the *Lower Park* area, near to the Bretton Hall. It appears that this may have coincided with this participant sitting down on a bench in-front of the hall for a period of time, which was very close to the edge of the global boundary, as they discuss in section 5.3.3.3 (p.155).

“I did have an issue about 40 minutes in when it stopped, this was when I was down in front of the mansion and I tried hard to get it back on again to the point where I thought ‘I’m giving up with this’. Then I carried on walking on and I thought ‘no I liked listening to the music when I was walking’ so I had another go and I can’t remember what I did now but it came back on”.

Across the board these examples highlight the presentation of silence as unexpected and undesirable. All who experienced silence wanted to re-discover the music playback, which will be discussed further in Chapter 7.

Beginnings and Endings

The beginning and ending of the soundtrack were both manually triggered. The author guided all participants to initiate the introduction section upon commencing their walks. But, in stark contrast none of the participants activated the manually triggered *Coda* section to conclude their walk. The possible rationales for this disparity are as follows:

- First, during the pre-walk briefing, the user interface controls (UI) were explained to the participants. However, the explanation for the *introduction* and *coda* buttons informed that, “*this button starts the soundtrack, and this other button ends the soundtrack*”. Thus, it would be understandable to presume participants considered the two UI buttons to afford the same functionality as *start / stop* buttons on a hardware or software media player, rather than them instigating playback of a specific musical material; an inference which

may further suggest, or corroborate that the participants' were largely unaware that it was a dynamic playback system.

- Second, concerns expectations of user interface (UI) interaction. Apart from commencing music playback at the start of their study walks, the mobile application did not require any further user interaction with the UI until the conclusion of their walk where the *coda* section could be manually triggered. It would, then, seem unrealistic to expect users to remember, or even to consider it necessary to engage with this interaction.

It appears that *beginnings* and *endings*, if different to the functionality of the rest of the application requires further thought and design.

5.3.3.5 Further observations

Other notable behaviours observed during the study are as follows. The majority of participants sought out the exhibits' information plaques, which contained descriptions of the exhibit and artist. In this setting these plaques were often situated a short distance from the exhibits (not next to them), which on occasion required the participants to search the surrounding area in order to locate them. Generally, when participants approached the exhibits, they would seek out the information plaques first before moving closer to the exhibit to view it, "*I like to know what I am looking at really to get some background information*" (P9). The placement or importance of these plaques was not considered during the design and authoring process. Therefore, many of these plaques were positioned just outside the arrival zone for the related exhibit, meaning that the *arrival* accent and *engagement* music would not yet have triggered when participants reached these locations. It appeared, via the field observations, that the moment of *arrival* at the information plaque represented the start of engagement with the exhibit; hence this activity should have been addressed in the *trajectory of interaction*.

As witnessed during early visits to the YSP to observe visitor behaviours, these participants also typically walked from exhibit to exhibit across the grass, rather than using the pathways. However, as this study was undertaken across the months of December, January and February and accordingly there had been, and continued to be, a great deal of rainfall, much of the grassed areas (particularly those 'well-trodden' areas directly surrounding the exhibits) were very muddy and slippery in places. These environmental conditions did result in a number of instances of participants clearly altering their headings so as to avoid this challenging terrain, some of these alterations resulted in greater use of the pathways than had been previously observed. Nonetheless, the muddy

conditions during the study did not seem to adversely affect the navigation or exploration of the park for the majority of this participant group.

5.3.4 The visitors' experience

In this section interview transcripts are used to illustrate the experiential aspects the soundtrack experience.

5.3.4.1 Wearing headphones

Prior to the walks, when issuing headphones (closed cup variety), the author observed a tendency for participants to remark (jokingly) about their size, or pull a face that may have expressed uncertainty, embarrassment or concern about having to wear them publically. When discussed post-walk those prior feelings of unease had dissipated. For instance, P18 stated, *"I was quite surprised that I didn't feel as self-conscious as I would normally do. You think I'm walking around with headphones on and nobody really takes any notice"*. Whereas P7, when asked whether they felt vulnerable being cut off from the ambient sound around them, stated, *"No, not at all. I suppose it wasn't like being on busy road or street or anything, but still there are people around you, [but] no"*. Another (P17) mentioned that during their walk that they found themselves turning their head regularly to look behind themselves. They felt this was not as a result of feeling vulnerable, but rather an acknowledgement that could not use on ambient sound to understand what was happening behind them, so were looking regularly.

It appears that the YSP, being free from large numbers of people, traffic and complex navigational routes provided a safe environment for the participants to roam whilst wearing headphones, as they did not feel hampered by the masked ambient sound. However, this study took place over the winter months when there were fewer visitors than at other times of the year. This raises a question as to whether these participants would have felt differently if amongst a denser visitor population of visitors.

5.3.4.2 Walking alone

Although all participants completed the study on their own, many arrived for the study in groups (e.g., with partners, family or friends). Nine participants chose to discuss this solitary walking experience during their interviews. For them it was unusual to visit a cultural visiting site such as the YSP unaccompanied, as it is typically a social activity. Some speculated that they would not have walked for as long on their own if they had been without the musical accompaniment,

whereas others were surprised at how much they enjoyed the solitary experience: *"I don't think I would have been as relaxed if I hadn't been listening to the music, especially walking round on my own"* (P7); and *"I think maybe you would not feel that self-consciousness having the music to immerse yourself in"* (P5).

The quotes above reveal that the music may have defused potential feelings of self-consciousness and isolation for some. The following from P16 and P7 suggested that the enforced isolation enhanced their experience: *"I think if I'd have come on my own I'd have just kind of wandered round, you know, taken it in but"* (P16); and *"I really enjoyed the experience, just the sort of walking round, and enjoyed having the headphones on, which I would never [...] I'm not particularly good at walking, I like to share things"* (P7).

5.3.4.3 Impact of environmental conditions

As previously stated this study was undertaken over the winter months and on the majority of the days that the study took place the weather conditions were unfavourable, comprising of a mixture of rain and cold temperatures. As noted, the grassland was extremely muddy in some areas, especially those areas adjacent to the exhibits. Thus, the potential for this to adversely impact the participant experience was a concern prior to the study's commencement. Eight participants noted with surprise, how unyielding they were to the weather conditions, citing the musical accompaniment as the reason:

"I noticed lots of other people walking back because it was raining and I didn't actually feel the need to hurry. [...] I wasn't that aware of the rain as I might have been perhaps. I think it made it a much more immersive" (P5).

"And even when it started to rain and my fingers got quite cold, I thought normally I would look at the weather I think, "oh I'll call it a day", but no, the music, because it made me feel so relaxed I just pulled my hood up and carried on and just enjoyed it" (P7).

The implication appearing to be that the music – perhaps in partnership with the donning of headphones – diminished or distracted these participants from the physical impact of the weather conditions.

5.3.5 Visitor interpretation

The findings now present feedback drawn from the interview transcripts regarding the participants' perception of the music and its specific impact on the experience.

5.3.5.1 *The soundtrack as a focuser and prolonger of attention*

An interesting theme revealed by fifteen participants refers to a perceived desire or ability to focus on visual features and artefacts such as the exhibits and surrounding parkland. They also considered that this extended the duration that they spent engaged with visual stimuli:

"Yes, it [music] slowed you and it made you concentrate more on what you were looking at than if you had done it without it. Whereas normally, especially on a wet day, would rush around saying ok that looks alright, that looks alright and on the next" (P6); "I'd stop and think a little bit more, probably study a bit more" (P10); "It [music] made me curious. I noticed that from the beginning, I felt that I wanted to keep looking" (P21).

Whilst the above quotes infer that the music focused participants' attention on the exhibits and the surrounding environment. Others described a 'cutting off' of the outside world, which may suggest that the act of listening to the music via headphones was the important matter in aiding their focus: *"Having the music on I felt cocooned and I could shut everybody else out and concentrate on what I was doing, I really enjoyed the experience" (P7).* Whereas some acknowledged the solitary nature of the experience as a key factor in their seemingly enhanced ability to focus:

"If I'd been with someone and talking to them, and therefore perhaps not enjoying the walk experience as much, or you've got people wandering by chattering I'd find myself listening and therefore again unfocused. So I think it developed focus" (P17).

"I think I probably dwelt longer on the sculpture than I would have done in a different situation. I deliberately said in a different situation because I don't know if it was the music because I have never been here on my own before and this was an experience that I did on my own. That also was a big factor in the experience and I think, you know, if I have an experience like this at a park or gallery or something like that and I do it on my own, I probably would spend more time focusing on the content, if you like, than I

would if I did it as a family or with someone else, but I definitely found that I was focusing more than normal on the content, on the sculptures” (P11).

In addition to the soundtrack masking external distractions, four participants suggested that the soundtrack also masked their inner thoughts and dialogue:

“What I was surprised about was that I’d got so much time on my own, listening to a piece of music I thought it would make me think of work, things at home and it didn’t. I didn’t really have any thoughts about me at all” (P19).

A significant proportion of the participants expressed a heightened ability to focus on visual elements in the park for prolonged periods, which further enhanced their overarching experience. It appears that a combination of the music, headphones and the enforced solitude removed both external and internal distractions, leaving the way clear to concentrate on the YSP and its exhibits.

5.3.5.2 Interpretation of visual objects through a musical lens

During their post-walk interviews the participants spoke about the effect of the music soundtrack on their interpretation of visual artefacts such as the sculpture exhibits or parkland scenery, which is now detailed. This topic is divided into three separate themes: first, the formation of connections between musical events and visual or physical elements contained with YSP; second, the music’s influence on participants’ aesthetic interpretation of the exhibits; and third, how the music shaped participants’ emotional states.

There were some reports of moments when the music matched the visual attributes of the landscape and the exhibits. Some of these moments were general, such as: *“Walking around sometimes it [music] was very relative to what I was listening to as to what I was looking at” (p10);* and *“it just seemed to fit where I was at the time. Sometimes it didn’t, but it didn’t matter. And sometimes the music seemed to coincide with what I was looking at, or coincide better” (p21).*

Whereas others were more specific, describing moments of serendipity, *“there was this moment at the beginning standing in the middle of like, [...] a group of sculptures and the wind came past and blew all these yellow leaves past and the music was really atmospheric and it was just really beautiful, yeah. It made a hell of a difference” (P3).*

P14, in particular, went beyond general descriptions, divulging some detailed examples of serendipitous connections between the musical events and visual stimuli:

“There was a tree with the light coming through from behind ... was reflected onto the water and the ducks had swum past ... it was making the most beautiful patterns on the river. Just at the point that, whether it was a xylophone or what it was, it was doing that repeated pattern ... if it hadn’t got the xylophone pattern sort of rippling away, repeating and rippling, and the reflections on the water were very uniformed as well and I just thought ‘ooh, ooh’ ... that was a new experience anyway” (p14).

P14 describes the melodic and rhythmic contour of a xylophone ostinato figure contained within R13’s music and connected it to the ripple patterns they were concurrently viewing in the water. A further example also from P14 shows a similar process:

“Those clay pipes, I was very aware that it was absolutely a happy accident that the melody was rising and falling in a repetitive way and then there were all those clay pipes rising and falling and repeating away, and again I wasn’t looking, I feel sure I wasn’t looking for it, it was just there” (referring to a location within R11c).

As with the previous example, P14 once again formed a connection between patterns in the music and patterns in the physical environment. Participant 14 describes these connections as a *“happy accident”*, stressing they were presented to them, rather than sought after, *“no I wasn’t looking for a connection they just sort of appeared to me”*. Others formed connections between the colours and luminosity of the sculptures and different musical states, such P16:

“It seemed to be that it was quite a calming music to the ones that were in a group and then there were visual ones - that’s when I noticed it [change in music]. I certainly liked the Buddha and the octopus, the bright ones mainly. Whether that was because some of the sculptures were blending in with the landscape, you know the lighter ones seemed to be a bit more dynamic [music]” (P16).

The exhibits referred to in the above quote – located in R11 – are covered in brightly coloured mosaic. As described in section 4.6.4.2, the music in this region was distinct in that its tempo significantly faster than music in other regions.

Participant 16 appeared to form two associations, the first between “visual, brighter” objects and “dynamic” (faster) music, and the second being those exhibits “blending in with the landscape” and the “calmer” (slower) music.

As acknowledged there was a general consensus that the addition of the soundtrack enhanced the viewing experience. A few participants discussed this in more depth:

“If I preferred the music it seemed to kind of enhance my enjoyment of the statues [...] the change in music did change I think your feelings to what you were looking at, well with me, certainly with me” (p9);

“I found walking around looking at sculptures the music had quite a lot of influence I think on how I viewed the sculptures [...] these brass pieces (R1a and R1b), I don’t like in actual fact, I enjoyed them more because of the music. I’ve seen them before and I’ve read the description but I just think they’re just lumps of brass, and therefore the music in a way made them feel a little bit more special” (P11).

Not all participants, however, believed that the music affected their interpretation of the exhibits. For instance, P3 declared that, *“It didn’t change how I interpreted the sculptures necessarily. It just made me more engaged and more likely to interpret them, rather than ‘that’s kind of nice, just move on’”*.

The quote above refers back to the increased degree of focus that the majority experienced as a result of the music soundtrack, with this participant explaining that the music encouraged them to consider and form interpretations, rather than being led to an interpretation by the music.

There were also comments about emotional interpretations and shifting emotional states during the walk. Some of these were general and unspecific such as *“I do think I have been through a range of emotions today”* (P19) and also the example discussed in section 5.3.2.3 concerning P14 who whilst reminiscing of their college days at the park experienced a strong emotional reaction. Two participants both described feelings of unease whilst viewing exhibits in R4 (see Figure 66), *“The three men with the white faces [...] the music became a little bit darker and it made me want to move on from there”* (P10). Participant 2 described a stronger response to the same combination of exhibits and music in R4 (see Figure 66):

There is one section where the music was quite foreboding, and it actually quite spooked me, that combined with the figures. That whole area I felt with

the music promoted me to think 'oh they're religious icons, or tribal things' or something that made me emotionally engage with them in a way that I wasn't with the other pieces. I've never had that kind of experience before and it got to the point where I was thinking 'I really need to get away from that section now.' (P2).



Figure 66: Exhibits in Region 4

5.4 Conclusions

The findings from this study are not discussed at this stage, rather they are summarised in this conclusion and then returned to in Chapter 7 where an extensive discussion on the themes arising here is undertaken. A summary of the key findings is now presented, which refer back to the objectives as outlined in the study design section; they are partitioned into experiential themes and technical themes.

5.4.1 Experiential Themes

The music contained in the soundtrack was widely enjoyed and was felt appropriate for the setting (objective 1a). The music did not unduly distract or draw participants' attention away from the process of exploring, observing and interacting with the parkland and exhibits, but rather they reported an increased perception of focus on these attributes (objective 1d). Rather than functioning as an accompaniment, for many the music was felt to permeate the physical and visual experience to the degree that it became fully integrated, and this made for a uniquely satisfying activity, quite different from a typical cultural visiting experience (objective 2).

Of particular interest and a finding not anticipated, was the apparent implication that the soundtrack was a fixed linear recording as opposed to an adaptive

soundtrack. This finding presents a challenge to pick apart and identify the value, effectiveness and the on-going implications of this style of adaptive compositional approach. On the one hand this discovery could imply that a fixed, linear playlist would also have offered a similarly deep experience for the visitor. But on the other, the outcome that an adaptive soundtrack, devoid of rhythmical synchronising that used crude and often error prone positioning technology (GPS) delivered a musical accompaniment largely considered fixed (implying fluid and smooth) is promising (objective 2 and 3).

This visitor study has revealed a number of interesting experiential themes not anticipated. One of the challenges of this line of research is the enforced solitary nature of mobile music listening, which by design is not a social activity. By placing mobile listening into a setting that is typically social, such as cultural visiting this challenge is further compounded. However, participants described their solitary experience with the music as an engaging one, almost as though the music acted as a surrogate companion (objective 1c). Furthermore, there were reduced feelings of self-consciousness and of being content to spend an extended period on their own. Finally, a sense of detachment from the weather conditions was also noted in response to the music (objective 1c). Altogether, this could be summarised as the soundtrack imparting a general sense of comfort and security.

Universally the participants perceived that the soundtrack enhanced their appreciation of the YSP landscape and artefacts (objective 1d). The relaxed nature of the music mostly slowed down participants walking pace, and they felt more inclined to spend longer observing and interacting with the exhibits, than they would have done otherwise (objective 1b). This was also partly facilitated by a perceived ability to focus deeply on the exhibits and other visual attributes. Finally, the music affected participants' perception and interpretation of visual attributes. Predominantly its effect was a subtle and enhancing one that was readily accepted. For some the music increased their enjoyment of the exhibits, whilst others found the combination of music and visual imagery provoked strong emotional reactions. For a few, connections between apparently coordinated musical and physical attributes were presented, and some experienced moments of serendipity.

5.4.2 Technical Themes

The location of and participant interaction with, the artist/exhibit information plaques played an important part in engaging with exhibits. This was not

considered in the soundtrack design and consequently, many of these information signs were located outside of the arrival zones.

The manually operated triggering of musical elements (i.e., the *introduction*, but particularly the *coda*) needs reassessing, as no participants initiated the *coda* section. This may be partly due to the nature of the user study, that the author was shadowing the participants (although from a distance), thus when concluding the walk, they turned to the author rather than the smart phone's user interface. The adaptive structure of the soundtrack was largely successful, in that it created a fundamentally fluid musical experience that was largely glitch free from the user perspective (objective 3).

Turning attention towards the authoring process, the size of the arrival zones, were for the most part appropriate, as the majority of the participants' interactions with exhibits resulted in them entering the arrival zone (objective 3). Five participants encountered technical issues, which were all as a result of script errors in the *AppFurnace* 'app'. All of these errors resulted in an audio file continuing to loop indefinitely, rather than clearing upon exit from their related zone. This disrupted the walk for two of the participants, but interestingly did not disrupt, but rather extended the walk for the other three (objective 3).

This study represents the conclusion of the research activities contained within this thesis. From here on in the findings are discussed in relation to prior literature to distil a generalizable understanding of them. This in turn then feeds into the formation of a framework of guidelines for composing locative soundtracks presented in Chapter 8.

Chapter 6 - Compositional analysis

6.1 Composing the soundtrack

This chapter is presented from the voice of the composer as they undertake a reflective musical analysis of the YSP soundtrack. This analysis brings in supporting literature from the field of music theory to either clarify common practice or highlight new approaches. This analysis covers – in part – the principal research question: *Can a relationship between musical structure and spatial experience be formed, which informs and guides the composition of effective soundtracks that respond to and drive the spatial experience?*

For the purposes of understanding the contribution and implications of the musical features, which were mapped onto spatial features in the YSP, each is discussed in isolation, although there is understandably some overlap at times. The musical features have been classified by the composer as: *form; key centres, harmony and mode; timbres and textures, metre; tempo; rhythm; phrases, themes, and melodies; musical dynamics and intensifications; and lastly non-musical sounds.* Following the discussion on individual features the composer considers matters of musical style and the bearing this had on the adaptive compositional approached utilized here.

6.1.1 Application of musical features

6.1.1.1 Form

First we consider matters of form – the structure of the soundtrack. This discussion results from a reflective analysis of the soundtrack which observed that traditional formal structures – meaning those typically used in the composition of absolute, fixed, linear music – were also present in this fluid non-linear setting, which on first viewing would not seem either relevant or feasible. The composer did not seek to deliberately apply conventional ‘forms’, but they are typically considered in the composer’s normal practice, and thus have subconsciously assimilated into the composition of this soundtrack.

As detailed the soundtrack was structured around a set of musical scenes (i.e., regions), which were mapped onto the naturally occurring and built environment of the YSP. Figure 67 illustrates a map of these regions. In this

illustration the region labels have been renamed to a set of characters (e.g., A-B-C-D) for the purposes of this discussion, to use the established labelling structure of musical sections. For the purpose of describing the high-level structure of the soundtrack, the regions have been stripped of their *approach* and *arrival* zones and also associate regions have been folded into one high-level region.

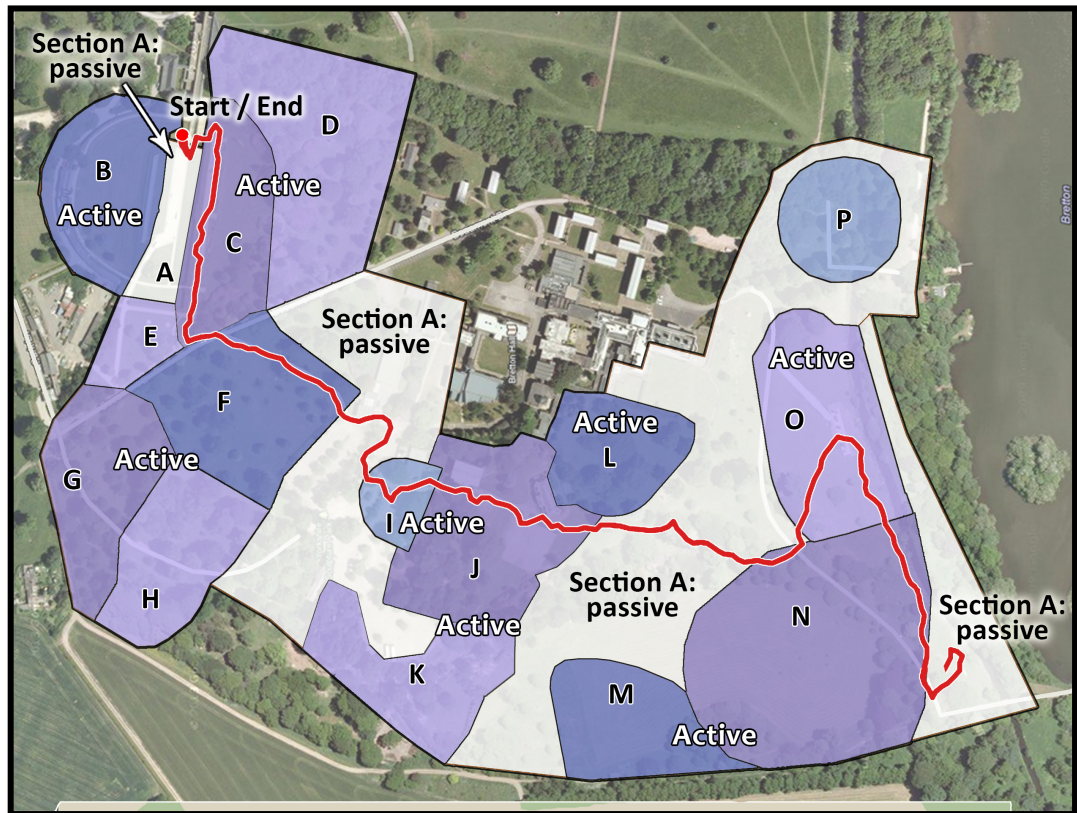


Figure 67: Structure of the soundtracks' scenes

This 'patchwork' construction of adjoined regions, readily characterize *sectional* forms (Stein 1979), i.e., discrete musical sections presented in sequence, which – depending on the type of formal structure used – have some form of relationship to each other. This relationship might be of harmonic, metre, or thematic variation. Figure 67 also illustrates a participant's walking route through the park (i.e., red line), which specifies how their particular trajectory intersects through the regions. Initially, their route could be described as *chain form* (i.e., A-B-C-D-E), a sequence of unique sections (Stein 1979). However, on further investigation a different view can be taken. This participant's route took them through those regions labelled 'A' on four separate occasions at different points in the park. *Region A's* were deemed holding 'passive' regions, as they were not populated with exhibits, but rather represented areas of the park to be traversed through in order to access other populated 'active' regions. Each occurrence of a *Region A* was accompanied with the same music, which consisted of a sustained chord pad

with a sparse and distant piano motif playing a simple octave theme. The presentation of the same music in these regions was deliberately tendered to communicate a user's on-going presence in the soundtrack experience, but that their current location was not near to any points of interest. What this describes is a partition of the YSP visitor experience into two high-level states – either in a 'passive' state (i.e., not in an area of interest) or in an 'active' state (i.e., in an area of interest). Whilst this is a very simplistic view of the YSP visitor experience and one that takes a particular reading of it, it does nonetheless, neatly describe the highest structural level of the soundtrack: in a 'passive' musical scene or in an 'active' musical scene. If we return to our visitor's route through the park (Figure 67) we can see that their time spent in active regions is punctuated by periods in passive regions (R0). Thus, rather than the sequential *chain* form noted above, another sectional form appears as illustrated by this alternating passive / active structure, that of *Rondo Form* (Stein 1979). *Rondo* is typically characterised by an initial section (A), termed the *refrain*, which is presented at the outset and repeats alternately, typically without repetition or development. Interleaved by each repeat is a contrasting section (termed an *episode*, i.e., sections B, C, D), composed in a different key to the stated tonic key of the *refrain* and with different thematic material (Stein 1979). Thus the structure of *Rondo* composition can be described as 'A-B-A-C-A-D-A' (depending on the number of episodes used). It is this alternate repetition of the refrain (A) with its 'home' key centre and thematic material that gives the formal structure of *Rondo* its integrity. Turning back to the YSP soundtrack, the 'passive' region A signify the *refrain* (key of E Minor) and those contrasting 'active' regions describe the *episodes*, which were all composed to different a key centre and contained unique thematic material. Moreover, the soundtrack's manually initiated *introduction* and *coda* sections were also variations of the 'passive' region A, which bookended the soundtrack. Thus the refrain ('A') is stated at the introduction and at the ending of the soundtrack, as would be expected of a *Rondo* structure. Figure 68 describes the participant's route as illustrated in Figure 67 from the perspective of instances spent in 'active' or 'passive' regions, which then reveals the *Rondo* structure. The characters on top correspond to the region labels in Figure 67.

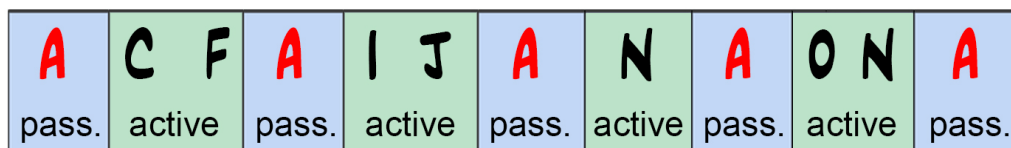


Figure 68: Rondo Form

Evidently, there is a significant temporal skew when viewing the structure of the soundtrack in this way. The participants spend the vast majority of their time in ‘active’ regions and these passive regions were typically periods of a shorter duration. However, this example does not seek to suggest that the application of a *Rondo* form in locative setting is a balanced structure (temporally) from the listener’s perceptive, but rather it is the relationships between the sections that can be used to guide the compositional process.

Whereas the above example considers musical regions as the high-level form of the soundtrack, the following examples concern the application of traditional musical forms, within the regions themselves, thus at a lower-level. This example refers to an area in the YSP called the Sculpture trail (Region K in Figure 67, but also termed R11a, b, & c). The trail is a snaking walkway with sculptures situated on areas of grass to the side of the path. The Sculpture Trail was partitioned into three associate regions during the design process to introduce some musical variation along its length. The music composed for the three associate regions were all based on the same material – the metre was in triple time (3/4), with an ostinato bass line, which was accompanied by further thematic material written in compound time (4/4) which constructs a polyrhythmic counterpoint. The principal different between each associate region is that the music is transposed into a different key centre (E minor, B minor, and F# minor). These characteristics are typical of a *Chaconne*, a baroque dance form (Stein 1979) (see Figure 69). A *Chaconne* is a combination of sectional forms and developmental form, where variation is realized via shifts of the tonal centre (Stein 1979). A POV video of this music can be accessed at <https://youtu.be/naniX7m2zOs>



Figure 69: Excerpt from *Region K*

Finally, all of those regions treated with a ‘trajectory of interaction’ (TOI) are essentially structured around *ternary* form (i.e., A-B-A1), three-part structure: *approach* (A), *arrival* and *engage* (B) and *withdraw* (A1) stages. Most forms can be tracked back to *tripartition*, “the affinity and correlation of the flanking parts will

always be felt as against the middle part, the bearer of intensification, plot, contrast" (Toch 1958, 163).

The YSP soundtrack with its regional structure defined by unique combinations of key, texture, timbre and thematic material is essentially a sequence of transition points between contrasting musical sections, i.e., points of arrival and moments of contrast. To this end it neatly reflects both Toch's (1958) and Ratner's (1983) views on musical form being constructed around these moments of contrast and points of arrival. Portions of the soundtrack have been described using the language of traditional musical 'forms'. The rationale for doing this here is to highlight two matters: first the flexibility of the compositional approach developed here, and second, an opportunity for compositional guidance. By flexibility the author reminds the reader that the work of this thesis has largely sought to find common ground between those traditional, typical, commonplace compositional practices and the unique disposition of locative experiences. Meaning, that the more one can relate and transfer normative processes from conventional compositional practice into a new setting, the easier it will be for the majority to gracefully engage with it. Whether experienced composers use musical 'forms' in their practice is immaterial, what is important is that their currency is largely understood, and thus provides a common footing. On the second point – compositional guidance – there is an option to use traditional musical forms to steer compositional choices, such as the relationships between sections within a form (i.e., associate regions, or the TOI). Take the example of *Region K*, for instance. These three associate regions could have been treated in a multitude of ways, but if a composer looks towards an established formal structure, like in this instance a *Chaconne*, then a musical template of triple metre, ostinato bass, variation achieved via the modulation of key is instantly presented. In a context where a composer may be working to time constraints, or has already composed a substantial body of music and is looking for creative stimulation, these 'forms' can offer ready direction.

To summarise, this analysis has shown that traditional musical 'forms' – as drawn from linear, absolute music – have some purchase in this non-linear setting. Traditional forms were functioning on a high-level experiential structure (i.e., passive vs. active areas) and also at a low-level, within the regions (*active regions*). Whilst the relationship between the spatial / experiential structure of the sculpture park setting and musical forms have been made apparent, we have not accounted for temporal matters, i.e., accounting for the duration any phrase

or section of musical sounds for. This issue is discussed alongside that of the application of theme and melody in section 6.1.1.7.

6.1.1.2 Key centres, harmony and mode

The application of harmony was manifest in two forms in the YSP soundtrack: first, to create a rich harmonic landscape across the regions, which is realised upon transitions into and out of adjacent regions and second, within the regions themselves so as to form a harmonic trajectory that accompanies visitors interaction in, through and out of engagement with exhibits. Harmonic motion was initially explored in Study 1 (Chapter 3), which demonstrated some (light) purchase in defining regions, i.e., *regional attachment*. This formed the blueprint that was taken forward and explored in greater depth in the YSP soundtrack.

Regional transitions

The utilization of key centres developed over the course of this work as one of the means of differentiating between neighbouring regions. Thus, a transition from one region to another is accompanied by a modulation in key. This reflects normal practice in many styles of western tonal music, where key changes are typically utilized in the introduction of new sections of 'pop' songs or in classical forms such as Sonata and Symphony where they are one of the main structural devices (e.g., the *development* section of Sonata form modulating to the dominant key of the tonic key presented in the *exposition* - (Ratner 1970)). Whilst the YSP soundtrack utilized different key centres as a means to characterise each region, this characterisation is realised via the tonal relationships experienced upon transition between adjacent regions as opposed to an inward focus on the 'best' key for the desired mood of any particular region²¹.

The organisation of these key centre relationships presented a challenge, due in part to both the number of regions (n.22) and their nonlinear structure (i.e., not sequential). Inevitably a number of key centre repetitions would be necessitated given the number of regions. Moreover, as the majority of regions shared a border with multiple other regions (not always a one to one mapping), the key

²¹ Many composers and musicologists believe that different keys express different emotional qualities, and composers typically chose their key based on the desired mood for any particular composition. By and large keys with sharps are considered brighter than keys with flats, which are perceived as more solemn or sad. However, studies have largely contradicted this pervasive assumption, such as Powell and Dibben's study (2005).

centre relationships between clusters of adjacent regions required careful management, to permit a pleasing modulation of key from one region into (potentially) multiple other regions (a one to many mapping). Music theorists often refer to the diagrammatic *circle of fifths* to illustrate the potency of harmonic connections between the 12 chromatic notes and their related harmonies (Kennedy and Kennedy 2004).

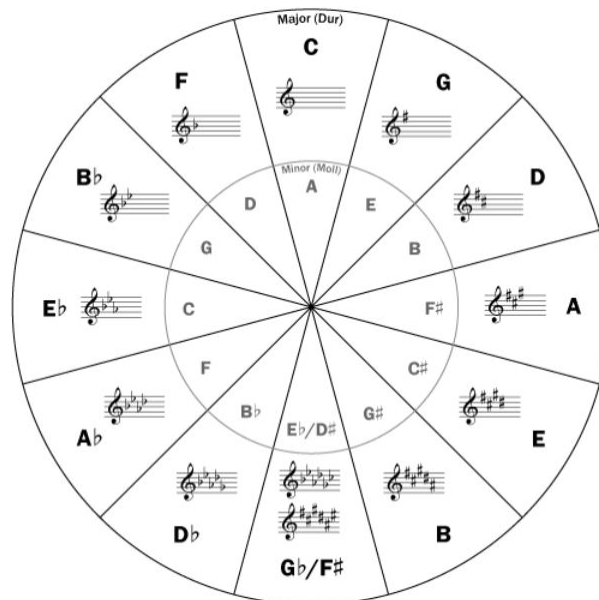


Figure 70: Circle of Fifths²²

Neighbouring key centres on the circle are characterised by the strongest harmonic relationship, which weakens the further apart on the circle the keys are placed. Thus strong modulations of key would be from the major to the relative minor (e.g., C Major > A minor), or an anticlockwise motion to the sub-dominant (e.g., C Major > F Major or F Major's relative minor = D minor) or a clockwise motion to the dominant key (e.g., C Major > G Major, or G Major's relative minor = E minor).

Limiting the scope of tonal relationships in the YSP soundtrack was considered, but deemed a weak option, as this approach would have required many repetitions of the same key centres across regions, limiting the opportunity to explore more expansive harmonic differentiation. There was, however, a desire to establish some form of global key structure, but the iterative design process challenged this as regions were progressively added, re-formed and sometimes

²² Image sourced from <http://www.world-of-songwriting.com/circle-of-fifths.html>

removed. Thus, it was not feasible – in the early stages – to predict the number of regions and the boundary relationships between them to plan a global key centre structure. Consequently, these key centre relationships also developed in an incremental fashion, which led, somewhat inevitably, to some weak – or undesired (from the perspective of the composer) – modulations of key at transition points (e.g., R6b > R7, R12 > R13, R13 > R8 and R1a > R0). Some finished music was revisited and subsequently transposed to different key centres in an effort to form stronger relationships between some regions, but this was not realistic across the soundtrack as a whole.

The second challenge for the creation of these tonal relationships came as a result of all the regional modulations being *unprepared*. A *prepared modulation* involves the modulation of key over a period of time via the presentation of bridging harmonic content, which steers the music from one key centre into another through a series of related harmonic shifts. One characteristic of the YSP zonal structure is the abrupt transition between regions (i.e., *unprepared*). The beauty of prepared modulations is that this bridging harmonic content permits for modulations to very remote key centres²³, should they be desired. However, the constraints of the authoring system dictated *unprepared modulations*. For the most part strong modulations of a 4th (subdominant) or 5th (dominant), or relative major / minor were preferred throughout (see Figure 47 for an annotated map with regional key centres).

Intra-regional harmony

Focus is now turned to the use of harmonic movement within the regions. Adaptive harmonic progression was used in some *approach* and *withdrawal* zones and transitions into *arrival* zones. The regions that used harmonic motion as an adaptive feature were R4, R6c, R7, R13 and R14, which all contained multi-stage approaches. In these cases each successive entry into an *approach* zone triggered a shift in the music's underlying chord harmony. These harmonic progressions essentially formed prepared modulations of key from the outer zone of a region into an *arrival* zone. For instance, in R13, a modulation of key from D Major (outer region) to D minor at arrival was presented (i.e., D Major > G major (subdominant) > E minor (relative minor) > A minor (minor subdominant) and finally to D minor (minor subdominant)) (see Figure 47).

²³ Remote key centres: those keys that have a distant harmonic relationship with the current key, i.e., those at the opposing end of the Circle of Fifths.

There were sixteen instances of a key centre modulation to mark entry into *arrival* zones. Eleven of these were unprepared modulations that all utilized strong tonal relationships that were either to the relative major / minor (R3, R4 (E2), R5, R6a (E3)), dominant (R6a (E1), R11b, R12) or sub-dominant (R6b).

A final note considers the application of mode, which was not investigated as a tool in this work (i.e., deliberate adaptations to major or minor keys), which may have been made manifest by choosing to place minor or major key modulations at particular exhibits on the basis of desired mood and emotional context. Rather, application of mode was purely a creative choice for the composer. A largely even split between major and minor modes was used (by accident, not design). The utilization of mode as an adaptive feature represents an area for future work.

6.1.1.3 *Timbres and textures*

Timbre was used throughout to paint each region with its own tonal colour, thus to mark the transition between neighbouring regions. This was envisioned from the outset of the YSP soundtrack, in reply to the impact of timbre in the preceding study, which signposted towards the notion of *regional attachment*. The music in each region was, for the most part, formed from a collection of instruments or synthesised sounds (voices), rather than a single voice. Consequently, this discussion, in essence, refers to the construction of musical textures as formed by a combination of discrete timbres.

It was challenging to create an individual musical texture of distinction and clarity for 22 regions, as there were two competing intentions at play. On the one hand was the aim for a distinct texture in each region, and on the other hand the desire for a unified whole, a soundtrack of scenes (regions) that sounded like they were part of the same overarching composition. Commonly, one of the core methods of creating musical unity across musical sections is the maintenance of instrumentation. The composer did not plan the apportionment of timbres to regions in advance of the compositional work, for similar reasons as key centres discussed above; these treatments unfolded over an iterative process. Hence, the composer began composition with the simple intention that each region was to be of a unique timbral formation. It transpired fairly early in the process that it would not be possible to treat all the regions with a unique timbral quality, simply because of the substantial number of timbres this would have necessitated. The textures formed in the early regions were largely a result of an impulsive construction, but as composition ensued more attention was necessitated to tackle this large-scale task. Dubnov et al. (1997) propose that

musical textures are essentially formed by a combination of *frequency*, *time* and *intensity*. These will be used to illustrate the methods applied here. A general palette of timbres was progressively gathered, which were used as a base set of colours. Central to this palette were acoustic piano, electric piano (e.g., Fender Rhodes / Wurlitzer), orchestral string section (Violin, Viola, Cello, Double Bass), woodwind section (Bassoon, Clarinet, Oboe, Flute) and French Horns, several synthesizer pads (textural patches with long sustain and decay portions), and several synthesized patches used for melodic themes (short sustain and decay portions). This palette was then complimented by a number of other, lesser-used timbres. By having a set of core instrumental colours, a degree of uniformity and semblance of style could be maintained across regions. Textural variation was thus attained by the inner organisation of timbral parameters; meaning the role each parameter would take in the texture. *Frequency*: refers to the register of the instrumental voice. Simply, whether the timbre was a bass, tenor, alto or soprano voice. *Time*: refers to two different attributes. The first attribute relates to the rhythmic construction of the voice, i.e., its horizontal construction. For instance, slow time might describe a bass line presenting a melodic line formed on whole (breve) and half notes (minim), whereas a fast time could be a sixteen-note (semi-quaver) ostinato pattern or a syncopated counterpoint. The second attribute of time refers to the construction of textures as a result of *approach* zones. These regional textures were not static objects, rather they often unfolded over time, as each timbral parameter was typically introduced in succession as a visitor walked through the *approach* zones. Consequently, variation could be achieved via the order in which these instrumental voices were announced. If we consider that the main intention was to present contrasting regions, then this distinction is interrogated most at the moment of transition, the period of exposure to the new region. Once the new musical section has established itself as 'new' in the mind of the listener then any subsequent development of the music is related to the current texture rather than the preceding one.

Intensity: intensity could refer to the global intensity of a texture, as formed from its constituent parts, but here it is used to describe the intensity of individual voices, specifically the prominence or balance they may have within a construction of texture. Matters of *frequency* and *time* could also shape the individual intensity of a voice. For instance, a bass line in the lower frequency register playing slow moving whole (breve) or half notes (minim) is unlikely to be as inherently prominent as a mid / high range melody playing an eight note (crochet) pattern, assuming all other matters of balance are equal. However, intensity concerns the accumulation of many attributes, such as the balance of

respective volumes, the articulation of the voice, the timbre used (e.g., a timbre with a percussive attack vs. a legato string line), its rhythmic construction (*time*) and pitch range (*frequency*).

Essentially the process of forming unique regional textures, textures that develop over the course of a region (i.e., through *approach zones*) concerns matters of orchestration – how the individual instruments are used collectively to form an arrangement. As a final note, there are a range of established textural types, formed from a combination of *frequency*, *time* and *intensity*, such as monophonic (single voice), homophonic (melody and accompaniment), polyphonic / contrapuntal (multiple lines), and homorhythmic / chordal.

A couple of examples are now presented to illustrate the formation of distinct textures. Figure 71, from Region 1a shows a light homophonic texture formed from 3 instrument voices. The melody is presented by the Cello's thus the prominent *frequency* is in a lower register. The accompaniment uses long note values (breves, semi-breves, and minims); the pizzicato bass line uses shorter notes values, but this is a stylistic matter, their placement is every two beats (i.e., minim length).

Figure 71: Region 1a

Figure 72: Region 13

Whereas the music from region 13 as detailed in Figure 72 is a thicker texture (more voices). The Cello is used again, as in the example above, but here its role has changed, as it presents a sustained pedal point in the bass register. The ostinato pattern played by the Electric piano is a prominent voice (e.g., high-mid range register, forte dynamic marking, rhythmic intensity). Whereas in Figure 71 the strings played a sustained chordal accompaniment (in a tenor / alto register), this role has been given to a synthziser pad timbre, but in a lower register (bass), and the strings are playing complementary octaves in a soprano register.

These techniques are common currency in arrangement and orchestration of music. The purpose of this discussion point was to highlight how these methods were employed to form mappings between the musical and spatial features.

6.1.1.4 Metre

Metre was not utilized as a dynamic component within this soundtrack (e.g., no triggered adaptations to metre were employed), and it was not widely explored from a compositional perspective. The large majority of the music was composed in common time (4/4), the exception being found in R6c (3/4) and R11 a, b & c, where a polyrhythmic approach was used.

6.1.1.5 Tempo

Tempo, or variation of tempo, was not a musical feature chosen to adapt here, with one exception (i.e., the bridging section used in region 11 that slows the tempo upon exit. See section 4.6.4.2). However, as discussed in detail in section 7.2.3 matters of pulse were influential on the visitors walking behaviour noted during the study.

Had tempo been an adaptive musical feature explored here, then it may have been realised by gradual advancements or declines in tempo as visitors approached or withdrew from the sculptures. This would represent yet another method of increasing or decreasing musical intensity. However, given the zone based authoring infrastructure, these advancements would have been stepwise progressions rather than a linear contour. The composer considered this undesirable, considering the regular stepped alterations of tempo within a region's music as disruptive and unmusical, thus they were not perused.

The application of the 'ritardando bridge' on exit in R11 appeared effective. Consequently, the notion of bridging sections may represent an effective means to better manage extra-regional transitions in general, whether to enable the

modification of tempo, or to permit prepared modulations of key, or graduated modifications of orchestration and texture. Although not explored in great deal, bridging sections appear to be a valuable currency in managing transitions between regions.

6.1.1.6 *Rhythm*

Rhythm, as a self-contained musical feature is considered somewhat of an oddity in this context. Whilst matters of ‘rhythm’ typically hold a similar billing to those of melody and harmony in the discussion of music theory, when considering rhythm in the context of the YSP soundtrack, what does ‘rhythm’ actually mean? Scheirer (1998) notes that an understanding of rhythm is largely instinctive, but problematic to express. According to Handel, “the *experience of rhythm involves movement, regularity, grouping, and yet accentuation and differentiation*” (Handel 1993), whereas the Concise Oxford Dictionary of Music states that “*Rhythm (in the full sense of the word) covers everything pertaining to the time aspect of music as distinct from the aspect of pitch*” (Kennedy and Kennedy 2004). These definitions class rhythm as concerned with temporal qualities, the packaging and presentation of melodic content into units of time. Thus, it seems that rhythm is integral to the musical note, motif, phrase, theme, melody, section and movement. So how would one isolate rhythm and use it as an adaptive feature in its own right? The author notes that this discussion would probably be better placed considering ‘rhythmic’ features, such as syncopation, metre, accents and tempo, rather than rhythm as an overarching concept, of which some isolated example were used in this work, i.e., increasing the rhythmic complexity of stems during *approaches*; the bridging section that slowed the tempo noted in the above section’ and of course the *arrival* accents. Nevertheless, matters of rhythm deserve a more thorough exposition than they have received in this thesis, as without question there are a host of opportunities that have not been addressed by this particular cut through the concept of mapping musical features to spatial features. For instance, Ambient Addition (Vawter 2006) took a largely rhythmic approach to creating a ‘live’ soundtrack which sampled everyday sounds in the environment and playing them back to a defined rhythmic pattern.

6.1.1.7 *Phrases, themes, and melodies*

Melody and melodic adaptations were not widely utilized as an adaptive feature, and the composer did not place the creation of expansive or elaborate melodies at the forefront of the compositional process. This rationale was guided at the outset by the known constraints of the *AppFurnce* authoring platform (absence of note

event synchronisation). However, another (related) contributory factor became increasingly evident as the composition and testing process ensued: what can be described here as matters concerning the placement of linear fixed 'musical time' musical fragments into the nonlinear fluid 'experience time' of the locative experience. This latter point is not reserved for the creation of melodic or thematic content, but rather it was revealed, or given a focus (for the composer) when working with these features.

Melodies are generally deemed the principal element of musical interest – the tune that people hum – and as such they are conspicuous. Melodies have a shape; a start, middle and an end, and are typically constructed from a series of shorter phrases. Once heard and established in the mind of listener their familiarity breeds an expectation of how further presentation of thematic material will unfold (Meyer 1956). A simple example can be typically seen in popular music where the sections of songs are typically formed from regular even groupings of measures (e.g., 16 bar verses and choruses) and these sections are often further reducible to a sequence of even phrases (e.g., 4 x 4 bar phrases). The listener, through historic exposure to music learns and thus predicts (expects), where these sectional changes are likely to unfold (Meyer 1956). In linear recordings or performances, the composer / performer has a large degree of flexibility regards 'musical time' (e.g. length of a phrase, melody, section, composition in relation to the chosen tempo), and musical time operates independently of any other temporal constraint. Composers of media soundtracks, however, do have temporal constraints, as musical time is required to synchronise with the 'visual time' of the footage. *"The music's starts stops, swell and retreats, and specific instrumentation and textures are carefully crafted to fulfil specific dramatic functions"* (Davis 2010, 89). Wingstedt et al. (2010) stresses the temporal function of media soundtracks for establishing continuity and defining form. Nonetheless, once composed they are still fixed structures. Locative media experiences, on the other hand are non-linear and fluid as a user's movement through time and space cannot be predicted. In this sense a locative soundtrack can be viewed as most similar to an interactive soundtrack in a computer game, where the temporal matters of gameplay are equally fluid. In computer game settings the same techniques of horizontal re-sequencing and vertical layering (Phillips 2014) that have been applied here are commonly used to create fluid interactions. The key difference in the YSP soundtrack is the absence of note event synchronisation with the *AppFurnace* platform. Consequently, in the YSP soundtrack the presentation of phrases, themes and melodies did not necessarily unfold to their completion – with their balanced structures of even groupings of measures – but

rather participant transitions into and out from zones ('experience time') dictated what proportion of a phrase or theme was heard. This in turn weakened the formal structure of the soundtrack and risked disrupting musical coherence. Once more, we are discussing matters of 'form' and the matters of form in this locative musical experience was structured around the physical environment. Rueb's extensive work on locative sound experiences has led to their definition of 'landscape' as being a combination of 'space-time' (Rueb 2014b), and Behrendt (2012) observes that historically locative and mobile experiences are discussed with a focus on location as a predominately physical manifestation at the expense of temporal matters. Ultimately, this point of discussion acknowledges that adaptive musical soundtracks for locative experiences need to consider their formal structured from both spatial and temporal perspectives.

Returning to the YSP musical features, the discussion will now investigate a range of compensatory methods used to reduce the impact of indeterminate 'experience time' on the unfolding of 'fixed time' musical cells and stems.

For instance, there was a tendency for the composer to create short themes that were typically 1, 2 or 4 bars in length (Figure 73 and Figure 74). The intention was to enable any particular phrase or musical statement to unfold quickly and then repeat, in an effort to encourage listener familiarisation in the event of a transitory duration in any region or zone, thus some opportunity for the music's thematic material to be established before moving on. Variations to the melodic contour of these themes were often composed rather than verbatim repeats, to integrate a degree of evolution so as to sustain interest should a participant remain in a region for an extended duration.

Figure 73: example of 4 bar melody from region 1a

In addition to their largely short duration, the composition of themes also showed some consistency in the type of timbre and performance method. Typically, themes were sustained timbres articulated with legato to create smooth, flowing contours with limited dynamic stress. They were typically

constructed around simple interval contours, with scarce elaboration, employing predominately long note values, complimentary to the sustained legato articulation (see Figure 73). String ensembles or synthesized sound sources were commonly used, and in those instances where a more percussive timbres were utilized (e.g., electric or acoustic piano) the instrument was treated with various production treatments such as reverberation and digital delay to place some (virtual) distance between the sound and the listener. Furthermore, equalisation, specifically low-pass filters or the parametric reduction of high frequencies to soften the attack of the sounds was also widely utilized.

Specific approaches to the orchestration of musical material were also taken, namely the placement of melodic themes in a lower register, below other accompaniment. This aimed to reduce their prominence in the musical texture (see Figure 73). Those melodic statements placed in the upper registers were largely formed from shorter note values phrases, but were often ostinato patterns, which had a more textural function.

The musical score fragment consists of two staves. The top staff is for Piano, with a treble and bass clef, and a key signature of one sharp (F#). The tempo is marked as quarter note = 40, freely. The Piano part starts with a mezzo-piano (mp) dynamic. The bottom staff is for Synth Pad, also with a treble and bass clef, and a key signature of one sharp (F#). The Synth Pad part provides a harmonic background with sustained chords in both hands.

Figure 74: A fragment from *Region 14*

Another approach experimented with in the latter stages of the soundtrack's development was a 'fragmented' pseudo-improvised approach to melodic material. This intended to disrupt the listener's expectation of a regulated phrase structure. An effective example can be seen in R14, whose thematic material constituted a simple 1 bar motif (e.g., short phrase lengths), which was then repeated with some form of variation upon every repeat (Figure 74). Twenty-four variations of this motif were prepared and placed in sequence. Figure 74 details just the first *approach* zone in this region, of which four subsequent version of increasing texture – all with 24 variants of the theme – were created for each successive *approach* zone. Although the musical score fragment contained in Figure 74 suggests that these motifs were repeated every bar with the same rhythmic values, they were in fact performed with abundant rubato (i.e., flexible timing), so as to increase the perception of a rhythmically free, improvised

performance. It was intended that this would disrupt the expectation of regular cyclic phrases, which would in turn support the transition into and out from this region at any temporal point.

Turning toward interactive soundtracks for computer games, composers have also wrestled with the requirements that the music be both *short-term reactive* and sensitive to *unchanged continuance* of the gameplay (Berndt 2009). Composers of computer game scores have long understood that strong musical statements pose issues when dealing with repetition (Marks 2001). Berndt et al.'s (2012) survey on the scope of variation techniques used in interactive computer game scores, which seek to address these requirements, list *structural diffusion* (to reduce, blend or blur prominent structural markers, of which they also suggest the avoidance of "memorable melodic features", which are "*the strongest catchers of attention*" (p.2)); *sequential variance*; *polyphonic variance*; *generative variance* (of which embellishment and improvisation are a part); and *performative variance* as the principal means by which to exercise musical variation. There is evidently parallel between these techniques and those applied in the YSP soundtrack described above.

The approaches described here concern some emerging methods in managing divergence between fixed 'musical time' and fluid 'experience time'. They do not attempt to remove this issue, but rather they concern the following: expeditious unfolding of thematic material so as to enable participants to experience individual selections of music in their full form before the next subsequent transition; the reduction of prominent melodic themes to reduce the impact of 'mid-point' transitions; and some variation techniques to defuse the impression of regimented musical structure, to permit easy exit but also offer musical evolution in response to extended listening.

6.1.1.8 Musical dynamics and intensifications

Musical dynamics were exclusively utilized as an adaptive feature, and no other deliberate contrast of dynamics were applied outside of these instances. The treatment of dynamics can be separated into three classes: *dynamic levels*, *dynamic events* and *dynamic contours*.

Dynamic levels refer to the overall musical intensity and / or loudness of a given region. The levels used in the YSP soundtrack can be nominally labelled as Level 1 (L1), Level 2 (L2) and Level 3 (L3), with L1 representing the lowest dynamic level and L3 the greatest. The 'passive' holding regions (R0a, b & c), which

contained no sculpture exhibits were composed as L1 regions. The ‘active’ regions containing sculpture exhibits were all L2 at their outset, thus any transition between ‘active’ regions did not result in prominent shifts in dynamic level. Any *approach* zones situated in a region were classed as L3, areas of greatest dynamic intensity, and finally, those *engagement* zones at the centre of *approaches* that were treated with a dynamic reduction, were also composed to L1. Whilst largely nominal, this simple classification guided the dynamic trajectory of the soundtrack, where the level of musical intensity reflects the users trajectory of engagement with points of interest / artefacts situated within the space.

Dynamic events refer to the abrupt, or unprepared, introduction of musical material that contrasts any concurrently sounding musical content by way of its articulation or amplitude level. In practice *dynamic events* were characterized by the *arrival accents*: those motifs (in early iterations) or single note chimes (later iterations) that symbolized a participant’s arrival at an exhibit.

Dynamic contours denote the graduated alteration of the dynamic level, or intensification of a musical voice or group of musical voices; namely those *approaches* towards exhibits where the musical intensity was heightened to foreshadow the moment of arrival. Some *dynamic contours* were also found in those short transitions from the *arrival* climax to a lower dynamic level during the subsequent engagement phase (e.g., R4E1). The terms ‘graduated’ and ‘contour’ are generous, as in reality the trigger zone functionality of *AppFurnace* resulted in step-wise intensifications rather than a linear growth or decay.

6.1.1.9 Non-musical sounds

Non-musical sounds, which are described here as ‘sound design elements’, were used in four locales in the park. These tests cases intended to present a deliberate contrast to the absolute music presented throughout the remainder of the soundtrack. The four examples were all integrated into an *engagement* phase, to accompany an exhibit (R4E1, R5E1, R6bE1 and E1).

The four exhibits were largely chosen at random, although they readily suggested the association of sounds for their accompaniment (e.g., Tibetan chanting and percussion for the mosaic Buddha (R5), voices talking for the ‘Molecule Man’ (R4) and digital and analogue communication sounds for the ‘Everything is Connected’ exhibit (E1)). Elements of music were also presented into all examples, thus the sound design attributes were incorporated into the musical texture (Dubnov, Tishby, and Cohen 1997). Given that the engagement

stages largely aimed to reduce the dynamic level of the music – to provide space for engagement with the exhibits – the musical attributes were typically comprised of sustaining ‘pads’ such as a string ensemble or synthesized textures, which presented little musical activity.

These moments of ‘sound design’ promoted a different type of listening experience to the non-diegetic music presented elsewhere. Sonnenschein describes “*stylized ambiances*” in film soundtracks, the use of sound(s) that can fall midway between diegetic and non-diegetic that are “*charged with emotional content*” (Sonnenschein 2001, 154). The sound design elements used in the YSP soundtrack would appear to be stylised ambiances, which promote *referential* listening (Sonnenschein 2001). Whilst the listener would be aware that the sounds are not emanating from the exhibits, thus not diegetic, nonetheless the connection or association between object and sound is apparent. Considering non-musical sounds in this setting from the viewpoint of Wingstedt et al.’s six narrative functions of media music, would class *referential* listening as an *informative* function (2010). Entry into and exit out from interaction with these sound design treated zones may necessitated a switch from *casual* listening (Chion, Gorbman, and Murch 1994) to *referential* listening (Sonnenschein 2001). This switch can also be described in terms of gestalt psychology, namely the concept of *figure and ground* (Tsur 2009; Sonnenschein 2001; Schafer 1993). It describes humans’ ability to make sense of stimuli, such as the objects around them, how certain objects will be *ground* (meaning they are perceived but not directly attended to, they are situated in the background) and others the *figure* (the object or stimuli that is currently being attended to). Arguably, with the YSP soundtrack the connection between the sound design and the sculptures draws attention to the sound design elements (i.e., *figure*), whereas the musical elements within the texture occupy the *ground*. The deliberate encouragement of *referential* listening has been charted in other locative musical experiences, for instance in the site-specific musical album, *Listen to the Light* by Bluebrain, where in one locale in Central Park, a merry-go-round is accompanied by the sounds of horses (Geere 2015). A further discussion about the implication of these examples in from the perspective of the study visitors is presented in section 7.3.4 and 7.2.7.

6.1.2 Matters of style

So far the discussion has presented the various musical features as independent articles detached from the music they were used to compose (YSP soundtrack), meaning that any discussion on the application of harmony, melody or timbre for

instance cannot be held completely independently from the style of the composed music, as style “*results from a series of choices made within some set of constraints*” (Meyer 1989), i.e., the learned constraints of the style. Style cannot be removed from the compositional processes utilized, just as the compositional processes cannot be discussed without ultimately discussing musical style. This is a thorny issue and one that cannot be explored fully in this thesis. Nonetheless, it needs to be noted that the compositional guidelines developed and applied here have allowed the composer to produce a soundtrack to their chosen style, so the choice of style has also – in part – facilitated the development of these compositional guidelines.

So, on the one hand, the author stated at the outset of this thesis that this compositional work was firmly rooted in the western diatonic system, which immediately framed or constrained the outcome of the resultant guidelines. Moving beyond this point of departure, the composer’s intention was to work towards revealing some mappings between locative experiences and the core musical features of the diatonic system (e.g., melody, harmony, rhythm, timbre and dynamics) and this was a deliberate decision as those core musical features are pervasive in all diatonic, tonal music. Thus, by grounding this thesis’s investigation into these functional features, the author would be best placed to develop a set of guidelines with the utmost scope for transferability and scalability across multiple tonal styles.

On the other hand, it is clear that some of the approaches exposed from this research investigation are somewhat rooted in the style that the soundtrack was composed in. For instance section 6.1.1.7 noted how the soundtrack’s thematic material was composed using predominately ‘legato phrasing of simple themes, with a general emphasis on texture rather elaborate melodies’. Evidently, these possess a strong stylistic sheen that may not be suitable for other types of locative experiences. Moreover, the choice of tempi and musical dynamics exert a significant bearing on how the music is going to sound, and whilst slow tempi and restrained dynamics (for the most part) were appropriate for this setting, again, they may not fit other settings and activities.

There are no ‘guidelines’ as such to be revealed from this particular issue, but rather an important observation that the application of these methods (as charted in Chapter 8) need to be weighed against the desired stylistic concerns of the locative soundtrack, as tensions between the two may arise and consequently require attention.

6.1.3 Summary

This discussion section has reflected upon the application of musical components as adaptive features from the composer's perspective and some on supporting literature. A detailed summary or conclusions are not going to be presented here, as this work will be returned to in Chapter 8, which presents a framework of guidelines for composing locative soundtracks.

This musical analysis has displayed a rich picture of music to spatial mappings that has encompassed most of the musical features of the western tonal system. This details the complexity of integration between the methods utilized in the composition of the YSP soundtrack music and the spatial structure of the locative setting. Some conventions from music theory, such as the application of traditional 'forms' – normally reserved for fixed, absolute music – have proven valuable in both the spatial and musical structure of this adaptive soundtrack. A core element of these music to spatial mappings concern detailed arrangements of key centres, chord progressions, and the structure of musical textures that have enabled musical evolution and differentiation, but also relationships that spread across the soundtrack as a whole. Nonetheless, the iterative method of this work has challenged these relationships, but now the principles for those mappings are in place, a top-down approach can be used in future settings. One of the unique challenges of placed sound experiences is the placement of fixed musical structures into a fluid non-linear experience. Some methods were outlined to reduce the impact of 'breaking' these fixed structures when deployed.

This chapter has presented an analysis of the YSP soundtrack from the composer's perspective. This is now followed by a discussion on the visitor study of the YSP soundtrack experience.

Chapter 7 - The user experience

7.1 Introduction

The discussion now turns its attention to the Yorkshire Sculpture Park (YSP) user study, to pick apart and distil an understanding of the nature of their experience. Accordingly, this discussion covers three of the sub-research questions: *'what would be the experiential bearing on the user experience of such soundtracks that adapt and respond to their exploration of a physical space'*; *'what are the implications of the physical environment on the development of guidelines for composing locative soundtrack experiences'*; and *'what are the implications for a framework of guidelines for composing locative soundtracks as mediated through the chosen technology?'*

The structure of the 'user experience' is presented in three sections. The first, explores the participants general experience of the musically accompanied visit to the YSP. The second stage turns the attention to the reported or observed affect of the soundtrack's adaptive structure on the user experience, considering issues such as beginnings and endings, and interpretation of silence. The third considers the bearing of the technical infrastructure on the participant experience. The discussion draws on prior literature from a range of disciplines, to cast some light on the themes under discussion. In contrast to the preceding chapter, which focused on the composer's perspective via the field of music theory, in this discussion we hear the authors voice from an HCI perspective.

Karageorghis and Terry (2008) who have investigated the affect of music in various sports and exercise settings have noted 'internal' factors, where a specific musical feature(s) is directly responsible for exerting an influence (e.g., tempo, vigour, volume); and 'external' factors which arise from an interpretive user perspective (e.g., historical associations, personal preferences). These terms will be adopted here to highlight and elucidate connections between the users' experience and the soundtrack (C. I. Karageorghis and Terry 2008).

7.2 Key experiential themes

In Chapter 5 a set of seven distinct experiential themes were reported by the YSP study participants, which are now discussed.

7.2.1 Accompanied solitude

The structure of the YSP study meant that participants undertook the walk alone (with the one exception of the brother and sister as discussed in Chapter 5). Being a solitary experience this walk stood in contrast to the typical cultural visiting experience, which are largely social activities (Falk 2009; Tolmie et al. 2014). Although now out-dated, the last Ipsos Mori poll of UK museums and gallery's (1999) noted only 16% of visitors visited alone ('Ipsos MORI | Poll | Popularity Of UK Museums' 1999). This is further validated by the Yorkshire Sculpture Park Visitor Survey (April 2013 to March 2014), which stated 96% of visitors to the park were part of a social group. In light of these norms it was not surprising that the YSP participants' readily discussed how unusual it was for them to engage in this activity alone. Consequently, it was interesting to note that they then went on to discuss – with some degree of surprise – their lone experiences in a predominately positive manner, postulating that the music was the primary factor for their ease. Prior research on music listening, especially in mobile contexts (M. Bull 2001; Michael Bull 2005; Michael Bull 2006; Heye and Lamont 2010; Herbert 2012; Herbert 2013; DeNora 1999) has observed music to exert a dissociative function on the listener, proposing that the music withdraws the listener from their immediate reality. Bull (2006) goes on to argue that these lone experiences are nonetheless still social experiences, as the formation of a personalised soundworld creates a form of accompanied solitude, in which users feel empowered, in control and self-sufficient. The iPod, in effect, 'warms up' the spaces of mobile habitation for users who transform the site of their experience into a form of 'sanctuary' (Herbert 2012), thus reducing feelings of isolation. This has also been noted in nursing practice, where a reduction in feelings of isolation – via listening to music – reduced hospital patients perception of pain and discomfort (McCaffrey and Locsin 2002; Maslar 1986). This notion of accompanied solitude was palpable from the YSP participants' comments. None expressed feelings of self-conscious or vulnerability that can often be associated with feelings of isolation. This finding cannot be attributed to any musical feature, but rather it is as a result of being immersed in a 'sound-bubble' of music via headphones, and as such it can be classed an 'external' factor.

7.2.2 Comfort

The next theme under discussion – *comfort* – refers to participant reports of detachment from the often unpleasant weather conditions which accompanied the study; the music appeared to have masked or diverted the participants' attention away from the effects of physical conditions. Prior research from the

field of music therapy, in particular music as analgesia may help explain this finding. Much of this work argues that ‘music analgesia’ functions by the ‘gate theory’ of pain relief. Explained simply, a stimuli (e.g., listening to music, watching TV, undertaking a cognitive workload task) distracts attention away from the body’s pain receptors, resulting in a reduction of pain or discomfort. The ‘gate theory’ acknowledges that many different stimuli can promote this distractive function (J. A. Finlay et al. 2014), some of which are considered active distractors (e.g., computer games, mental arithmetic, muscle relaxation techniques) and others passive (e.g., music listening, watching television). Some studies have shown that active distractors are typically more efficient, positing the argument against music analgesia’s value (Dahlquist et al. 2007), although Wikens (2008) notes that multi-sensory workloads distract effectively, whether they are a combination of passive, or passive and active stimuli. A notable observation in many of these studies is that preferred music – as chosen by the patient – works significantly better than unknown supplied music (Bernatzky et al. 2011; Mitchell, MacDonald, and Brodie 2006; Siedlecki 2005). Other research notes that music listening is thought to release endorphins, a known pain reliever and mood regulator (McCaffrey and Locsin 2002). Furthermore, Maslar’s (1986) survey of the music-pain relief literature also pointed to music’s known ability to regulate mood, reduce feelings of isolation, and provoke emotional states through music’s association with past experiences, which in turn have been shown to reduce pain (as noted above in 7.2.1). A further study (?) where one group of patients listened to music on headphones and a control group just rested, but also wore the headphones, found that both groups reported similar feelings of pain reduction, speculating that the masking of ambient noise also assisted in the promotion of comfort. This highlights the role of headphones into the YSP experience. Gunn and Hall (2008) argue that headphones act as a comforter stems back to when babies are immersed in the mother’s womb surrounded in an envelope of sound and repetitive rhythms. Consequently, the donning of headphones or earbuds recreates this sense of security and immersion. The final example represents an interesting exploration into whether specific musical features might have an active role in promoting ‘music analgesia’. Finlay et al., (Katherine A. Finlay et al. 2015; Katherine Anne Finlay 2009) noted that music is a “heterogeneous” form and thus it is too simplistic to suggest that music can act as an analgesic in all its forms (which may in part relate to those studies which concluded that a patients preferred music is significantly more effective at enacting pain reduction). Consequently, they conducted a study over a 5 day period on post-operative patients, which used a

number of pieces of music that contained differing levels of ‘harmonicity’ (i.e., levels of consonance) and ‘rhythmicity’ (i.e., degree of rhythmic consistency). Although the results were not entirely conclusive the study did reveal that those who listened to only music with a higher level of ‘harmonicity’ and ‘rhythmicity’ showed reduced levels of cortisol (which creates stress and can thus be an indicator of pain) on the first day post-op compared to those who listened to lower levels of ‘harmonicity’ and ‘rhythmicity’ (Katherine A. Finlay et al. 2015). Although this work is in its infancy, it will be interesting to see its development.

Clearly, this body of work represents a very different context and setting from the YSP participants reports of ‘feeling comfortable’ in the face of what is clearly very mild discomfort (e.g., cold temperatures and rain). Nonetheless, there appears to have been some form of mild ‘music analgesia’ at play in the YSP study. In all likelihood this observation was as result of mood regulation and distraction by the music presented via headphones. What is not clear is whether this affect can be deliberately composed for, although there is some emerging evidence that harmonic consonance and rhythmic regularity may be effective. In this sense the role of music as a comforter is possibly due to both ‘internal’ (consonance and rhythmic regularity) and ‘external’ factors (mood regulator, prior associations and emotional responses).

7.2.3 Abatement with occasional advancement

The YSP participants perceived that the music effected their walking pace and behaviour, specifically that they walked slower than they would normally expect at this type of setting. We know that music and notably tempo can impact on humans physical movements (Styns et al. 2007; C. I. Karageorghis, Terry, and Lane 1999; C. I. Karageorghis and Terry 2008; Leman et al. 2013; Edworthy and Waring 2006). The synchronisation of physical actions to musical tempo is termed as entrainment (Clayton, Sager, and Will 2005; Leman 2012), where two or more rhythmical activities interact and “lock” together (in this case the *music* and the physical act of *walking*). However, in the case of walking and music, Leman *et al.* (2013) argue that musical ‘vigour’ also effects walking speed. This assertion arose from a study where 18 mixed aged and gender participants walked – in synchronisation – along to 52 different musical excerpts all at the same tempo of 130bpm. They observed that different musical features (e.g., rhythmical stress, ostinato cycles vs. relaxed rhythmical placement and melodic structure: i.e., level of musical ‘vigour’) entrained the participants stride length, which in turn altered their walking speed, even though they were synchronised

to the same tempo (timing). However, a similar study (Styns et al. 2007) did not conclude any significant difference between stimuli. Karageorghis and Terry (2008) whilst investigating the impact of differing musical tempi on exercise routines, noted a correlation for the preference for musical tempi and the level of physical intensity exerted, for instance, slow tempi were preferred for minimal to moderate intensity of activity.

Humans tend to synchronise physical actions such as walking to a small tempo band around 120bpm, (Styns et al. 2007) and the slower or faster the tempo gets the more difficulty people have in matching it. The tempo range utilized in the soundtrack was 66 – 82bpm (beats per minute) – in the *adagio* / *adagietto* range (using traditional Italian terminology) – considerably slower than the average walking pace of 117bpm (Murray, Drought, and Kory 1964). This contrast was noted by one of the participants, *“there was a pace to the music that I felt I wanted to get my walking into the rhythm of it and it was just slightly frustratingly too slow”*.

The music in Regions 11a, b & c, were the one example, which used a noticeably faster tempo (106bpm). The tempo, or perceived vigour of the music in region 11 (a, b & c) was reported by a number of YSP participants. There is a parallel to be drawn here with a study of static cyclists which noted that the introduction of music of a faster tempo – after many slow tempo pieces – produced an ergogenic effect, a perceived sense of ‘motivation’ (Szabo, Small, and Leigh 1999). Szabo et al.’s description accurately reflects those at the YSP who upon entering region 11 felt that, *“the music was obviously getting quicker anyway so you almost felt like you could skip through that bit”*.

In *Study 1: Follow the music*, matters of walking pace and tempo also were also observed, notably with Composition 3 (120bpm), where the participants walked significantly faster during that study condition. This walking pace data in study 1 was presented as statistically, drawn from the GPS traces captured on the GPS mapping app running in the background of the mobile phone. Conversely, in the YSP study the walking pace findings are anecdotal, and no statistical calculations have been conducted to verify this. The rationale for this tact concerns the difference in the study activities. In study 1, the task did not involve any deliberate engagement with any other artefact of physical structure, as it was conducted in empty field and just concerned the act of walking. Whereas in the YSP study the activity of exploring the sculpture park was saturated with starts, stops, artefacts, physical objects and distinct changes to be negotiated in the physical environment, which precluded any statistical analysis of walking pace.

It appears apparent that the tempo of the soundtrack's music impacted – to some degree – on the participants' general walking speed, although as mentioned above it was not possible to calculate its precise influence. This finding, in line with prior literature, reveals that tempo choice in locative experiences may not be only a matter for compositional endeavour, but can also be used to influence user activity. For instance, one could imagine a locative experience where users may be encouraged to pass through a particular region faster via the presentation of music at a fast tempo. Tempo functions as an 'internal' factor, as users response to a musical feature.

7.2.4 Attention and focus

Teri Rueb, whilst discussing her locative sound experience work notes that *"the sound overlay in each work brings attention to the physical and social contours of the natural and built environment"* (Rueb 2014b, 241), whereas (Behrendt 2013) observes that walking and listening to music are both temporal activities that when combined via a locative media experience function by *"connecting us strongly to the physical landscape around us"* (p.28).

Participants reported that the music facilitated them to focus more intently on the sculpture exhibits and artefacts, and for longer durations than they thought they would otherwise. Some speculated this to be a result of the headphones masking external ambient noise, or as a result of being unaccompanied and free from normal social interactions, which cause distractions. The former is suggestive of both Bull's (2006) and DeNora's (1999) assertions that music listeners often use their music to mask ambient sounds. Some of the YSP participants also reported a masking of internal dialogue as well as external ambient sound, which is equally reflected by Bull (2006) and also Herbert's diary studies of music listening experiences, which noted the *"reduction of intensity of thought or internal dialogue"* as one of three primary factors for musically mediated absorption (Herbert 2012, 51). Moreover, a *"change of sensory awareness"*, represents another factor for absorption of which 'sharpened' attention can be an attribute (Herbert 2012, 51). Whilst audio masking and solitude both appear to be credible reasons for developing a more attuned perception of focus, other prior research of background music in the workplace or schools may also suggest that the music itself may have contributed to this 'focusing' effect (Burleson, Center, and Reeves 1989; Uhrbrock 1961). Hallam et al.'s (2002) study of school aged children noted that calmer, softer music increased concentration and task performance, whereas louder, more vibrant and aggressive music had a detrimental effect. Similarly

reflected in DeNora's (1999) interviews which noted that people deliberately chose unfamiliar instrumental music to accompany work or study tasks for the "*purpose of gaining focus*" (DeNora 1999, 43). Finally, a study of young males that resulted in an enhancement of memory and attention capacities whilst listening to music, also observed a lowering of their susceptibility to external distractions (Morton, Kershner, and Siegel 1990). Other accordant research hypothesize that music listening causes arousal, which subsequently increases a listener's facility for cognitive processing, which in turn enhances their memory and attention (Cohen 1990).

The breadth of this literature informs this discussion point in the following ways: first, the musical soundtrack would appear responsible for this experiential theme; secondly, the music delivered via headphones masked external and – for some – internal distractions; third, the style of the music (i.e., instrumental, mostly calm, melodic (i.e., tonal)) facilitated a sharpening of participants attention on to the artefacts and landscape; and finally the lone experience may have also had a contributory effect. In relation to this last point, an ethnographic study of group behaviour at cultural visiting sites noted that group dynamics often disrupt or prevent some group members from being able to invest the time and attention to the artworks as they may wish to, feeling the need to 'keep up' with other group members (Tolmie et al. 2014). This observation was alluded to by one YSP participant, who made mention to the fact that he had not been to a cultural visiting setting without friends or family before and thus was not sure whether to apportion their observation of increased focus to the music or the fact that he was 'set free' to explore at his own pace and in his own time.

7.2.5 Enhancement and interpretation

For some participants the music also enhanced their appreciation of the exhibits and surrounding parkland. We turn again to prior work from psychomusicology, sociology and film music studies, which may assist in picking apart this theme. Bulls work with iPod users also references music-visual enhancement, stating that the music is deliberately used by iPod users to both 'astheticise' their environment and to improve the quality of their experience, often turning mundane activities – such as commuting – into more pleasurable ones via self-curated soundtracks of private meaning (Michael Bull 2006; Heye and Lamont 2010). Herbert's proposition that listening to music can also result in an enhanced sensory receptiveness to colours, materials and sounds, in addition to a heightened attention (as discussed above in 7.2.4) (Herbert 2012). These examples

appear to refer to the concept of 'spreading activation' (Cohen 1990) and 'conceptual resonance', meaning that the YSP participants enjoyment of the music transferred onto and affected their perception of the exhibits and surrounding parkland (Sirius and Clarke 1994). One participant in Region 3 mentioned particularly liking the music in that region and therefore the sculptures as well, as the music reminded him of a song by the Band, *A Mortal Coil* that he liked when he was younger. Whereas, another participant noted that the music made some sculptures they did not like "*feel more special*". Clearly, music-visual enhancement accounts, in part, for the established use of musical soundtracks in films and video games, and seemingly in the way people 'shape' their environment during every day iPod listening, and this is an affect we have equally observed in the YSP study.

To 'pick apart' whether internal or external musical factors account for this phenomenon there is a need to consider first and foremost the interpretation of the music by the listener. In order for 'spreading activation' to take place the musical accompaniment must be congruent and this congruency is in part formed by associationism (Cohen 1990). Thus, one reading may suggest that the YSP soundtrack felt fitting and congruent for the YSP activity as the soundtrack's musical style (nu-classical / electronica) is also commonly utilized in nature documentaries. Thus the music was appropriately associated, which in turn permitted the process of 'spreading activation' to occur. This analysis would suggest that 'external' musical factors were at play. Nonetheless, the role of the composer was to compose music appropriate for the activity, which was made manifest by deliberate choices of harmony, melody, timbre, orchestration and dynamics, i.e., 'internal' musical elements.

Consequently, careful choice of musical style is required to deliver a soundtrack that can be 'associated' by the majority. The potential danger here would be for the composer to 'play safe', to produce music that is innocuous, to dilute creative compositional choices down into the lowest common denominators and into the realm of muzak²⁴ and those musical clichés sometimes found in media soundtracks. There is some evidence that the YSP soundtrack was interpreted as such. For instance, two participants referenced an association with the music they

²⁴ Muzak was a company that produced background music for the service and retail industry, and the brand name quickly become synonymous with light, ineffectual 'elevator music'. Muzak is now owned by Mood Media. <http://www.moodmedia.co.uk/>

heard, but had opposing opinions. Participant 11, speaking with negative connotations stated, “if you aren’t careful you are not far away from having pan pipes and running water which has massively become a cliché in health spas” (P11), whereas P19, speaking about how relaxing the YSP experience was, mentioned, “I very often go to Ragdale Hall [a health spa]. I could feel that that’s the sort of music I would listen to there”. Interestingly, this brings another factor into play, which is the one of musical preference. Neither of the two participants’ appeared to suggest their stated musical association (health spa music) was incongruent for the setting, but rather they differed on whether the music was to their taste or not. The nature of individual musical preferences is beyond the scope of this thesis, but this example serves as a timely reminder that music and musical tastes evoke strong opinions for many.

7.2.6 Emotional responses

This next theme – emotional responses – follows on directly from the previous in that much of the same literature relates, particularly that of associationism. A small number of the participants’ reported having strong emotional reactions to the experience. As discussed in Chapter 2 music and human’s regulation of mood and emotional responses are closely interlinked (Scherer and Zentner 2001; Juslin and Västfjäll 2008; Juslin 2011; Juslin and Sloboda 2001; DeNora 1999; DeNora 1986; Michael Bull 2006; Baumgartner, Esslen, and Jäncke 2006; Cohen 2001). A number of studies (often questionnaire or diary studies) have concluded that music listeners have stronger emotional responses to music they self-select as opposed to random or unknown samples (Sloboda, O’Neill, and Ivaldi 2001). Whereas some, such as (Liljeström, Juslin, and Västfjäll 2013) contended these emotional responses are further enhanced when the experience is shared, specifically when in social situations. These observations are at odds with the set-up of the YSP musically accompanied walk, being a solitary experience with unknown music. However, Liljeström, Juslin, and Västfjäll go on to note that emotional responses to music occur as a result of complex interactions between the listener, music and situation, each of which may involve a range of contributing factors (Liljeström, Juslin, and Västfjäll 2013). Juslin et al. (2008) who captured music listening experiences and analysed them in relation to their context noted that when listening to music in solitary settings listeners showed a tendency to reported feelings of “*calm-contentment, nostalgia-longing, and sadness-melancholy*” (Juslin et al. 2008, 678). This on face value reflects many of the YSP participants’ reported experience. There were those who felt calm and relaxed, which would appear to be Juslin’s (2013) *contagion* in action, to the participant

(who attended college at the park) who cried during the study, possibly *episodic memory* (Juslin 2013). The examples presented here from the literature typically concern the study of emotions when the music listening is the primary activity, thus do not necessarily consider the impact of other concurrent activities. The following example concerns a neurophysiological study where music of differing moods was played in conjunction with viewing photographs of faces that presented different moods and emotions. The study found that those which were congruent (i.e., sad music with sad facial expression for instance) resulted in significantly strong emotional reactions for the participants, which were not present if the photographs were viewed without the music or with incongruent music (Baumgartner et al. 2006).

7.2.7 Serendipity

A number of participants were open to the formation of chance connections between the soundtrack and physical artefacts and parkland – moments of serendipity. Austin (2003), in presenting a working definition of serendipity describes it as ‘happy accidents’ which result from seemingly unconnected events that nonetheless require *synchronicity* between two or more modes, or stimuli for serendipitous formation (Liestman 1992). Some of the YSP serendipitous moments were actually orchestrated, as they resulted from the soundtrack’s adaptive design (unknown to the participants), such as the application of culturally related sound design at the Buddha exhibit, or musical transition upon entering a new region (these represent internal factors, directly related to musical transition and events). Whereas, others were truly serendipitous as they were personal to the participant. Moments of serendipity have been noted in other locative musical experiences such as *Sonic City* (Gaye and Holmquist 2004) and *Riot! 1893* (Reid, Hull, et al. 2005). Notably, those few participants who correctly perceived the adaptive functionality of the soundtrack also experienced moments of serendipity. This last point reveals an interesting observation. One of the principal guiding foci of this locative work has been media soundtracks. The author is not aware of any literature that discusses the presence of serendipity as a result of media soundtracks, but yet it has been observed in this soundtrack accompanied locative experience. Presumably, when people watch a film or play a computer game they know that the music has been deliberately composed for the media, thus what is witnessed is not accidental. So why were there moments of serendipity for those who perceived the adaptive nature of the YSP soundtrack, who understood that it was predetermined? Speculatively, an answer could be found in the novelty of the experience. Even

with an understanding of the YSP soundtrack being adaptive, these participants may not have been able to predict how these adaptations would unfold; put simply, the language and conventions of locative soundtracks are not yet established in the same way as media soundtracks are, with all their common conventions and clichés.

7.2.8 The convergence of experiential themes

The seven themes discussed above collectively suggest that the soundtrack was instrumental in facilitating the largely immersive experience the participants described. A range of research from the fields of music therapy, music psychology and music sociology have been used to illuminate on the role of the soundtrack's music in shaping this experience. Although these themes have been presented in turn, many evidently converge due to the same or similar phenomena that music enacts on humans' physical and emotion experience.

Although acknowledged in several of these themes, Michel Bull's writing on personal stereo use in mobile settings deserves further exposition, as it illuminates the nature of music listening in locative contexts, so offers a relevant link to the YSP soundtrack. Bull (Michael Bull 2006), proposes a set of nine control tactics that users either deliberately apply or gain from listening to their personal stereos in urban environments, which are: (1) to mask external sounds; (2) create a sense of specialness formed from the self-curated and concealed soundtrack; (3) 'aestheticise' the location by overlaying a 'film' like soundtrack; (4) to transport the listener out of the urban environment and into a self-contained virtual environment of private meaning; (5) to remove feelings of seclusion; (6) uncluttered their cognitive processes; (7) the music in combination with headphones represents a "do not disturb" sign; (8) improving the quality of time; and finally (9) music can add vigour to physical activity.

With the exception of number 7 and 4, the YSP study similarly noted all of these 'control' tactics in action. The term 'control', as used by Bull, does not seem too appropriate in the case of the YSP study, as participants were not in control of the music and it is with this point that a distinct contrast between Bull's observations and the YSP study comes to the fore. Central to Bull's observations is *personal control* – principally that users' create their "sound bubbles" from carefully choosing and controlling their 'own' musical soundtracks. This is at odds with the YSP study, where the participants had no control over the choice of music. The theme of control runs throughout much the literature used in this discussion. For instance DeNora's (1999) noted that people choose music as a vehicle to

mediate their “*feeling[s], motivation, desire[s], comportment, action style, energy*”, similarly by Heye and Lamont (2010). Evidently, this body of work purports to understand the world as it is, either through in depth interviews or diary studies, and as such they are not concerned with comparisons (i.e., comparing experiences as mediated through chosen music vs. unknown music). Thus, it is problematic to attempt to make a direct comparison between the experiences of general everyday music listening and the YSP study. A more nuanced view on this point is required, such as that seen in the literature on ‘music analgesia’, which notes that all music can promote analgesic benefits, but they are heightened when patients listen to preferred music (Bernatzky et al. 2011; Mitchell, MacDonald, and Brodie 2006; Siedlecki 2005).

In sum, what appears to be revealed here is that the YSP experience concurred with a body of literature that has studied the experiential benefits of music listening in relation to a variety of contexts. Of particular note is that the YSP participants did not require personal management of their musical soundtracks to benefit from some of the ‘control’ methods Bull presents (2006). Participants were still able to carve out their own sense of space, address feelings of isolation – enforced by the study, not of their own volition – block out external and internal clutter, and ‘asthetise’ their environment. Which in turn, reveals that these experiential attributes typically manifest by personal control, can also be experienced by an orchestrated non-personalised activity.

7.3 Impact of the soundtrack’s structural design

This section peers a little deeper into participants either reported or observed behavioural responses to the soundtrack’s adaptations, to consider their impact on the user experience. All the soundtrack’s adaptations are essentially signposts for moments within the experience, whether they are a transition from one area to another (regions), or *approach* or *arrival* at an exhibit, or entering or exiting the experience. Thus, to reference against Wingsdt’s et al.’s (Wingstedt, Brändström, and Berg 2010; Wingstedt 2008) six narrative functions of music in media, all the adaptations discussed here are *guiding* functions.

7.3.1 Beginnings and endings

We discuss how the beginnings and endings of the YSP was managed, with a particular note that no participants activated the manually operated coda section. A discussion about this issue is now presented.

During the pre-walk briefing, the UI controls were explained. However, the explanation for the *introduction* and *coda* buttons informed participants that, “*this button starts the soundtrack, and this other button ends the soundtrack*”. On reflection, it would be understandable to presume that the participants considered the two UI buttons to afford the same functionality as *Start / Stop* on a hardware or software media player, rather than them instigating playback of a specific musical sections. Moreover, an issue of expected UI interaction may also be relevant. Apart from commencing music playback at the start of their study walks, the system did not require any further interaction from the users until the conclusion of their walk, where the *coda* section could be manually triggered. Thus, it appears impractical to have expected the participants to remember, or even to consider it necessary to engage with this interaction. Lets now consider further the implications of user intervention, in relation to the *beginning* and *ending* of the soundtrack.

Beginnings:

The soundtrack needs to be initialized somehow. The first option could just be a user’s entry into the first trigger zone with no manual intervention required. In order to avoid user uncertainty and confusion as to when the soundtrack should commence (as was seen in the piloting process), some form of guidance would be necessitated to adequately convey the start and ending locales of the soundtrack (e.g., printed map, or virtual map on the UI display). The nature and appropriateness of this guidance would seem dependent on the type of locative experience the soundtrack accompanies. These examples might be appropriate for a cultural visiting experience, but they may not be for a mobile game, for instance. Prior research on the visitor behaviour in exhibition, museum and gallery settings have stressed the need for a ‘scene setter’ when visitors arrive, so they can understand and navigate their way into the experience (Screven 1986; Goulding 2000). Moreover, Benford et al. (2009) highlights the importance of ‘framing’ the beginnings and endings of an interactive experience, as entry into an experience is an important factor in setting the intended ‘tone’ of the subsequent events. This has been stressed in the works of Blast Theory, where orchestration – the behind the scenes work – may at times need to “*spill over into the ‘front of house’*” (Flintham, Anastasi, et al. 2003, 9). The introduction section of the YSP was a form of ‘scene setter’, a musical statement that announced the style of music to come, and an announcement that the experience has commenced. It would seem appropriate to place manual control of the introduction into the

hands of the user, so they are not tied to a particular location; they can introduce the soundtrack in their own time, rather than a time dictated by a location.

Endings:

The ending, however, may require a different tact to the one used here. It appears that a high expectation was placed on the participants to remember and recognise the value of the triggering the *coda* section without fully understanding its purpose or function. There are benefits for user control over the conclusion of soundtrack as manual control removes uncertainty, as the user is in control. Additionally, user control of the coda facilitates, as mentioned for the introduction, for flexible finish locations; a user could exit the experience at any point. However, the risk as was observed in the YSP study, is that users will simply forget or not deem it necessary to engage with it. A compromise solution would be to maintain the functionality of the current form (i.e., manual beginning and ending), but that a user's exit from outer boundary of the experience (at any locale) also automatically triggers the coda section, thus the music is brought to a satisfying conclusion upon any point of exit.

7.3.2 The interpretation of silence and global attachment

A user's interpretation of silence²⁵ continues to represent an attribute of this soundtrack that has yet to be satisfactorily addressed. The continuous nature of the soundtrack sets-up an expectation that it will continue to do so, so if music does stop (as a result of exiting an outer boundary) the user is prompted to interpret its meaning. We have seen three common interpretations to music cessation over the course of both studies, which are: 'the music has finished, so this must be the end of the experience' (study 1); and 'the music has stopped, I must have strayed somewhere I should not be, therefore I need to change my heading to re-discover the music' (study 1 and 2); and 'this must be a technical problem' (study 1 and 2). It was the observation of the first two interpretations in study 1 that launched the emerging notion of *Global Attachment*: that music functions as a container of the experience, and that while music continues to play and evolve in response to a user's movement around the physical space, the experience remains active. Although there were only a small number of examples of music cessation in the YSP soundtrack study, the subsequent responses of the

²⁵ The term silence is used here for its ease of use. The author recognizes that when the music stops playing the user is not actually faced with silence, but rather the myriad of ambient sounds present in any given setting.

participants were consistent with those observed in study 1. Furthermore, the script error in the YSP walk appeared to extend the walking duration for three of the participants – the music continued, they continued – adding some further weight to the notion *Global Attachment*.

The on-going challenge appears to be one of managing users interpretation of music cessation. Whilst it appears successful at indicating a change of state, a disruption to the experience, it does not communicate the connotations of this disruption and thus guide users to an appropriate response. This issue is evidently intertwined with that of managing *beginnings* and *endings* discussed above. A number of possible options could include:

- Any exit from the outer boundary could be accompanied by the automatic initiation of a coda section (as discussed in section 7.3.1 above) formed from a strong cadence, diminishing dynamic intensity and slowing of pulse (e.g., *ritardando*). This option may assist in confirming closure for the experience and may steer users away from an interpretation of technical failure, but would probably not indicate a ‘turn around and go back’ response.
- Flintham (2005) describes a relevant and interesting approach that was used in *Uncle Roy All Around You*, a mobile game by Blast Theory (Flintham 2005; Benford et al. 2004; Flintham, Anastasi, et al. 2003). It concerned the creation of two outer regions that encircled the desirable game-play regions. The purpose of these outer regions was to impart clues to players that they were straying away from the game area. They were subtle in the first region and then more forceful in the second, outmost region. A similar tactic could be used here. One option could be the presentation of music or sound of increasing dissonance.
- Finally, it may be that communicating the meaning of music cessation cannot be achieved via music alone, but rather it necessitates another form of intervention to clarify these transitions in and out of the auditory experience, such as a voice message integrated into the soundtrack.

A final note related to this. If an adaptive soundtrack of this type were publicly released part of its selling point would likely to be that it is ‘an adaptive soundtrack’, thus there would be no reason to conceal its functionality. Therefore, the implication of silence would be integral to its accompanying guidance, helping to eradicate this issue.

Music cessation has proved an important feature in understanding how music both frames and contains a locative experience. It has a powerful effect on a users understanding and engagement with location and the locative experience. However, harnessing this feature has also proved most elusive. Several embryonic approaches have been briefly presented and discussed here, but nevertheless this is an area that requires some exploration and investigation.

7.3.3 The case of the exhibit information signs

Field observations reveal that many of the participants sought out the exhibit information signs as part of their engagement with the sculpture exhibits. The importance of these information signs on the visitor experience has been widely investigated (Tolmie et al. 2014; Vom Lehn and Heath 2005; Vom Lehn, Heath, and Hindmarsh 2005; Diamond 1986; McManus 1987). In the YSP setting these were often placed some distance away from the exhibits (approximately 5-10 metres), further than is normally the case in internal galleries. Consequently, these information signs did not always fall within the radius of the arrival zones placed around the exhibit. In practice this meant that visitors when engaging with these signs were not accompanied by any corresponding *arrival* and *engagement* music. On reflection, arrival zones should encompass these information signs, or any other object or material related to the exhibit.

7.3.4 Interacting with the adaptive experience

7.3.4.1 The trajectory of interaction

One of the themes arising from the YSP study was that very few participants appeared to be aware of the adaptive nature of the soundtrack. A handful correctly predicted some type of ‘controlled’ system, but the majority did not divulge any evidence that inferred recognition of the systems functionality, whereas some were more assertive in their assumption of a fixed-linear recording. Consequently, there was very little feedback upon which to understand the impact of musical adaptations on the participant experience. Two readings of this could be taken, the first being that the adaptive soundtrack made no difference, it was just a sequence of musical extracts as far as the majority were concerned, and the fact that it changed at certain points was either imperceptible and / or irrelevant. The second reading takes the opposite view; it considers that the soundtrack blended into the experience effectively via its adaptations and style, thus was an integrated feature that the majority were consequently unaware of its functionality. The evidence for the second reading is as follows. All the participants noted that the music changed and developed over

the course of the soundtrack, but for most the music had blended into the background, so was mostly not attended to. Whilst only a small number noted regional adaptations, *approaches* to exhibits, *arrivals* and some *engagements* (those with non-musical sound design), they were then largely understood. Furthermore, some of the reported examples of serendipity were as a result of how participants interpreted these adaptations. Additionally, there were only two reported instances where the music was considered incongruent with the walking activity, both of these as a result of a technical problem where a musical cell continued to loop indefinitely. It would appear surprising for the deeply engaging experience the majority described to result from a random sequence of music overlaid onto the walk. The evidence for this second reading, whilst not conclusive, does nonetheless have some traction. Drawing on some literature, we now consider some specific details.

One of the more surprising results of the YSP study was that only four participants considered the *arrival* accents to signify something, and only one of these correctly understood their function. The others who acknowledged them described random sounds that felt out of place with the rest of the music. The integration of these arrival accents was in response to the notion of local attachment proposed from the findings of study 1, which proposed that short duration musical events can indicate the presence of a local point of interest. It would appear that these accent signifiers were not as compelling in the YSP study as they were in the preceding study. There is inadequate testimony to expose a detailed understanding of this point. On the one hand, the study of film soundtracks has noted that even when strong music statements are presented within a film, most viewers perception of these musical features endures at a subconscious level (S. D. Lipscomb 1989). Whereas, on the other hand we know that for a few participants the arrival accents were highly conspicuous and drew attention to themselves. FitzGerald et al.'s (2010) notion of 'geographic relevance' may shed some light on this point, stating that the placement of triggered media (typically GPS) at the location of specific objects often 'misfires' as the user's gaze is not directed towards the object when the media is triggered, which prevents a connection between the two modes – their orientation to the artefact is not accounted for. The user study of Sonic City also noted this (Gaye and Holmquist 2004). This may explain the disconnection observed between accents and exhibits. However, strong connections between music and artefact were formed on those instances of non-musical sounds placed at exhibits (as discussed in section 6.1.1.9), which appeared to be as a result of referential listening (Sonnenschein 2001). This may, therefore, be an important distinction in the

successful connection between media and specific local artefacts; a clear association or meaning that bridges between the sound and object. In sum, there are some possible inferences as to why these accents were not better interpreted, but a deeper investigation of the value of *local attachment* is required.

On reflection, the move away from *arrival* motifs individually crafted for exhibits, to the generic ‘chime’ accent as a result of the pilot-participants may have been a mistake. Whilst this change was made in an attempt to focus attention towards the accent and thus the moment of arrival, so as to form a connection between the action and the sound, it was evidently not successful. Although the author doubts that the more elaborate motifs would not have functioned any better at signifying the arrival events, they would have at least been musically fitting with the underlying soundtrack.

7.3.4.2 Audio / visual congruence

The next theme, the concept of congruence between the soundtrack and the YSP environment has been sampled at several points in the discussion already. This section offers a further exploration, specifically in relation to audio-visual congruence as drawn from the psychomusicology, film and video games literature (M. Boltz, Schulkind, and Kantra 1991; Cohen 1993; Chion, Gorbman, and Murch 1994; Scott D. Lipscomb and Kendall 1994; Scott David Lipscomb 1995; Collins 2013; Marshall and Cohen 1988; Scott D. Lipscomb 2005).

Lipscomb and Kendall’s (1994) ‘Attentional focus as a function of audio / visual congruence’ model proposes that the modes of music and visual imagery blend when the music is considered associated (i.e., appropriate) for the imagery and when the temporal alignment of accent structure is in place. A study explored the question of what defines an ‘accent’ so as to ascertain when these moments of ‘Musical and visual periodicity’ are liable to occur (Scott David Lipscomb 1995). The study used animated objects on the screen accompanied by different musical treatments and found that sudden direction changes of melodic phrases, change in interval size, dynamic accent, and timbre change were the most effective means of producing accents that were perceived as synchronous with the animation. Lipscomb and Kendall (1994) also remarked that the alignment of sound and visual events do not have to synchronise perfectly in order the viewer to perceive them as aligned, human compensate for misalignments, referred to as ‘psychological closure’ by (Zetl 2013). We have noted that the YSP participants deemed the music was appropriate for the setting and the task of viewing the exhibits, thus the music was arguably ‘associated’. The YSP soundtrack aimed to

align musical features such as dynamic accents and changes of timbre with key spatial 'accents', such as arriving at points of interest (arrival accents) and transitions between regions. Unmistakably, there is a fundamental difference between the synchronisation of visual imagery and music in display media experiences to those of a real-world, physical environment with all its inherent complexities and sensory information. Moreover, accents in the physical environment are not as a result of 'hard cuts' or sudden 'close-up's', a composite of carefully edited visual events. Rather, environmental 'accents' unfold slowly, are generally seen in advance and then approached; they happen 'in situ', attached to a locale in physical space. An equivalent for this can be observed within computer games, notably the 'stinger' which is used to indicate when a player has collected treasure or tokens by moving over marked area in the virtual environment (Collins 2013; Phillips 2014). Equally these are seen in advance and traversed to. The evidence for participants noting aligned 'accent structure' in the YSP soundtrack is a little thin with a few reported examples of noted synchronisations changes in addition to those moments of orchestrated serendipity. Moreover, the blending of the soundtrack into the background is further suggestive of audio / visual congruence. Thus, there is a tentative proposition for a degree of congruence between the soundtrack and the environment. If so, then this would also warrant a degree of traction for the notion of *regional attachment* (timbre, harmony and thematic material denoting physical areas). Berndt (Berndt 2009), in relation to music in interactive computer games, notes the "*challenge of an organic correlation*" (p.2), that the music can alienate itself if it does not unfold in response to the on-going narrative. This is clearly a knotty issue that cannot be fully scrutinised within the bounds of this single study, but nevertheless, some substantiation for the transference of audio / visual congruence (from display mediated media experiences) into a real-world setting has been offered.

7.3.5 Implications of a fixed linear soundtrack

As an antithesis to the above discussion, it is worth considering briefly, what would be benefits and challenges of using a fixed linear soundtrack in a setting such as the YSP. The primary benefits would appear to concern the ease of the soundtracks, design, development and future adaptation. Evidently, a fixed linear recording would be faster to assemble; a composer could work with greater freedom, creating either a single continuous piece, or a set of music selections that can be mixed together. Additionally, a playlist formed from existing commercial music could be employed, using cross-fades between tracks

to construct one continuous soundtrack. This approach would offer the curator, artist, designer or composer with a range of solutions for rapid soundtrack development. Furthermore, multiple soundtracks could be easily prepared and deployed for a range of contexts and settings, for example, different activities, times of day or weather conditions, all without necessitating extensive re-authoring of the app. A further benefit would relate to a soundtrack's longevity. As discussed in the design and development of the app, multiple changes and adaptations to the curation of the park was experienced, where some exhibits were resituated and new ones introduced. Evidently, a soundtrack that is not constrained to the spatial construction of the park and its artefacts is free from alterations and is therefore largely future proof. Lastly, as the soundtrack does not require a mobile device's location services to activate music playback, there would be a reduced potential for technical malfunctions and a decreased drain on the device's resources (i.e., battery life).

The following steers attention onto the challenges of implementing a fixed linear soundtrack. The first question concerns that of beginnings and endings, especially endings – how would a user know when to start and stop the soundtrack? Moreover, the boundaries of the experience could not be defined by the music. The second question would refer to matters of duration, specifically how long do you make the soundtrack last? Would it loop round when after a full cycle? The duration of the soundtrack (musical time) would be completely detached from an individual user's walking pace, dwell times at exhibits and chosen route through the park. Lastly, specific musical / sound treatments of exhibits of artefacts in the space cannot be produced, thus the relationship of the music to the space would only function on a very high-level.

There are both obvious benefits and challenges of having a fixed linear recording, as outlined above. However, the only factor that the fixed linear soundtrack offered over and above that of the adaptive variant was that of straightforward design and deployment. When it comes to matters of fitting into the experience the adaptive is considered superior.

7.4 Technical infrastructure

The focus is now steered to that of authoring the soundtrack. This discussion chapter scrutinises two distinct but interrelated attributes: the technical infrastructure and the physical environment to consider how each have driven or shaped this thesis work. The first part – the technical infrastructure – addresses

the following sub-research question: *What are the implications for a framework of guidelines for composing locative soundtracks as mediated through the chosen technologies?* Whereas the second part of this theme addresses the following sub-research question: *What are the implications of the physical environment on the development of guidelines for composing locative soundtrack experiences?*

7.4.1 Managing Seams

As discussed throughout this thesis the *AppFurnace* authoring platform was used exclusively. The constraints of this tool have also been highlighted throughout this thesis, principally the lack of note event synchronisation within its audio infrastructure. This could have been viewed in a negative light, as an unnecessary constraint that could (should) have been circumnavigated via the application of another authoring platform, which would have in turn permitted for a more ‘controlled’ musical delivery. However, this would have resulted in the loss of an opportunity to wrestle with one of the key issues found in most locative media experiences, namely the mediation of the experience through the technology. Therefore, it was important, if not essential for this work to embrace and engage with the current state of the (locative authoring tool) art and not to ‘dodge’ undesirable implications. This in turn brings up to the notion of ‘seams’, an area of extended interest within ubiquitous computing (Weiser 1994; Chalmers and MacColl 2003; Chalmers and Galani 2004; Chalmers et al. 2005). On the one hand, there is the proposition that a computing infrastructure should be comprised by series of parts that work together as ‘seamless’ whole, so being invisible to the user. On the other hand, ‘seamful’ systems was first proposed by Weiser (1994), who argued that ‘seamlessness’ drives the systems components to a base level commonality in order for them to function seamlessly. Thus he encouraged the design of ‘seamfulness’ systems where individual parts that created gaps, breaks or contrasts, that could still offer seamless interaction for the user - termed “beautiful seams” [4]. Chalmers (Chalmers and MacColl 2003; Chalmers and Galani 2004; Chalmers et al. 2005) has championed the notion of ‘seamful’ design’, where ‘seams’ are embraced as a design tool in digitally mediated user experiences, “*Seamful design, therefore, involves deliberately but selectively revealing seams to users, and taking advantage of features usually considered as negative or problematic*” (Chalmers and MacColl 2003; Chalmers et al. 2004). In the context of locative media experiences ‘seams’ may be represented by areas of poor or missing GPS connectivity (Chalmers et al. 2004), a theme now discussed.

The YSP soundtrack could be described as ‘seamful’, but nonetheless from the perspective of the study’s participants it appeared to have been experienced as relatively ‘seamless’. To this end it successfully observed Gorbman’s assertion that soundtracks should be *invisible* (1987). ‘Seams’ were introduced by the known inconsistencies of GPS, and via the constraints of the AppFurnace authoring platform.

Calvium, the makers of AppFurnace, stated that a GPS enabled smart phone “works out its location every second to around 10m under good conditions” (Hull 2012), which is broadly reflective of the WAAS²⁶ recent GPS analysis report (WAAS T&E Team 2015), which acknowledged that the global positioning accuracy is ≤ 9 metres horizontally (95% accuracy) and ≤ 15 metres vertically (95% accuracy). Nonetheless GPS error is a fundamental challenge in locative media experiences due to its lack of consistency, being particularly affected by reflections from buildings, objects and weather conditions which can result in GPS drift (Cater et al. 2007; Benford et al. 2003; Gildersleeve 2015; Benford et al. 2006; Benford 2005; Flintham, Benford, et al. 2003; Reid, Hull, et al. 2005). This inconsistency was observed when mapping the location of the sculpture exhibits in the Yorkshire Sculpture Park (YSP), as each ‘pass’ through the site to capture the location of exhibits resulted in significant differences. Even after several sets of waypoints had been blended to get the ‘best approximation’, further manual adjustment was necessitated. GPS can also experience errors in updating, leading to a delay in the systems recognition of a user’s current position (Magnusson, Breidegard, and Rassmus-Gröhn 2009). There are numerous reported examples of GPS error introducing uncertainty into locative media experiences. For instance a study of *Can You See Me Now*, a mixed reality game by arts collective Blast Theory noted GPS error as a major cause of uncertainty within the game play, for instance GPS logs reported a span of positional error between 4m and 106 m when the game was performed in Sheffield, UK (Benford et al. 2003; Benford et al. 2006). One of the resultant strategies for dealing with inconsistent GPS seams noted that some built-up areas demonstrated consistent GPS error, so that “with careful scouting, a game designer can focus play on good areas of coverage” (Benford et al. 2003; Benford et al. 2006). Fortunately, the YSP setting was for the most part open parkland with some tree cover in certain areas. Although there were some buildings – notably Bretton Hall – they were not numerous or especially prominent. All

²⁶ Wide Area Augmentation System (WAAS) set up by the Federal Aviation Authority to improve the performance of the Global Positioning System. <http://www.nstb.tc.faa.gov>

things considered the YSP was an effective setting for delivering a GPS driven experience. However, there were some observed examples of consistent GPS error, for instance some arrival accents regularly triggered in the wrong position (even though their mapping appeared accurate) and these required manual adjustment. Furthermore, some zones situated under tree cover were drawn to a larger diameter to compensate for reduced GPS accuracy. The need to compensate for GPS error via the diameter the trigger zones was also reported in the locative experience *Tactical Sound Gardens* (Vazquez-Alvarez, Oakley, and Brewster 2010). The post-task YSP interviews do not describe any participant acknowledgement of GPS error (other than those as a result of script errors). While GPS is not a perfect tool for locative media experiences, it is by and large the best currently available.

The second set of 'seams' relate to the authoring platform. The utilization of geo-tagged zones as the primary method for the triggering of media has in undoubtedly shaped the compositional process; whilst they compliment the notion of musical sections, however they also 'fastened' the iterative development of these guidelines to this 'sectional' perspective. If we consider that an alternative authoring and delivery platform may have permitted for the linear adjustment of musical parameters related to the distance to or from a waypoint or the orientation of a user to a point of interest, we would then, presumably, need to consider a different twist to the adaption of musical features. GPS 'seams' can also be observed along the extremities of trigger zones. If a user moves along the length of a zone boundary or is stationary while in close proximity to a boundary then GPS drift (Hull 2012) can result. This means the perceived location of a user (by GPS) may drift backwards and forwards across the zone boundary, creating undesirable triggering of the wrong media, or multiple retriggering of the correct media. A user study of *Riot! 1831* – a locative narrative experience – noted that some participants found it frustrating when they were inadvertently situated on a regional boundary and experienced two contrasting overlapped sound sources (FitzGerald, Taylor, and Craven 2013). In the YSP soundtrack this was accounted for, in part, by making sure zone boundaries were either set an appropriate distance away from walkways, if they ran in parallel or were perpendicular to them. Finally, absence of note event synchronisation – another 'seam' – has in turn focused an aspect of this thesis work onto the placement of fixed 'musical time' in to that of fluid 'experience time' (see section 6.1.1.7).

The author is not sure whether the work charted here can be correctly described as ‘seamful design’, but it is nonetheless ‘sympathetically seamful’. The idiosyncrasies of the system have gifted opportunities for investigative research from which a number of emergent tactics have been proposed.

The discussion regards the impact of GPS error on the size and placement of trigger zones moves the discussion onto matters of the physical environment, and specifically the formation of regions.

7.4.2 Defining regions

This soundtrack used a zone-based approach to the structure of the soundtrack. A fundamental facet of the compositional approach developed in this thesis regards the mapping of discrete musical sections on to physical regions, as discussed in Chapter 4. The intention wherever possible was to place the boundary lines of these regions (*AppFurnace* trigger zones) in harmony with the structural features situated in the physical space, for instance those changes in the landscape (e.g., formal gardens to open field), or to encompass clusters of exhibits, and account for elements of the built environment such as walls and hedgerows. The term boundary lines refers to the individual sides of the polygon shapes that formed the majority of the outer extremities of the regions, and this aspect of the discussion is reserved purely to the margins of each region, and not those zones (i.e., *approach* and *arrival* zones) contained within the regions. Region 14 was the single outlier, as it was circular rather than a polygon. In this instance, there was no obvious physical structure around which to shape the boundary, thus a symmetrical region was defined around the exhibit situated at its centre. The placement of boundary lines (i.e., defining regions) can be described by a set of four different types: *constrained*, *implied*, *negotiated*, and *unconstrained*. This set is now presented and discussed in the following.

7.4.2.1 Constrained boundaries

Constrained boundaries are defined in response to existing, (semi) permanent constructions such as walls, buildings and trees, hedgerows that restrict the movement of the users, i.e., they cannot cross the boundary. illustrates several examples of constrained boundaries in response to the types of restrictive physical objects or constructions mentioned. *Constrained* boundaries may either neighbour another *constrained* boundary or function as an edge, the outer boundary of the soundtrack experience.

7.4.2.2 *Implied boundaries*

Implied boundaries concern those defined in response to those physical affordances present in the natural or built environment that do not necessarily restrict a users freedom of movement. Examples of these were predominately related to either changes in landscape (e.g., formal to rural, grassed to concrete and tree cover to open) or around the location of exhibits (see). *Implied* boundaries may either neighbour another *implied* boundary or function as an edge, the outer boundary of the soundtrack experience.

7.4.2.3 *Negotiated boundaries*

Negotiated boundaries are formed when two or more adjacent regions share boundaries that are not defined along a *constrained* or *implied* boundary. *Negotiated* boundaries are termed as such as they may require some co-operation or concession between their margins. *Negotiated* boundaries must neighbour another boundary they cannot be edges. Typically instances of *negotiated* boundaries occurred when two adjacent regions where both formed to encompass an exhibit(s), rather than in response to an existing structural feature in the park, which resulted in an adjoining boundary line being defined, leading to an arbitrary musical transition. Although undesirable, this boundary type could not be avoided. Decisions on their placement were typically taken on the composer's best guess in response to self-posed questions, "*does it feel like I am still in the general area that encompasses this particular exhibit(s), or does it feel that I have moved closer to the physical area that services this adjacent exhibit(s)?*"

7.4.2.4 *Unconstrained boundaries*

Unconstrained boundaries are neither *constrained*, *implied*, nor share a boundary line with a neighbouring region (*negotiated*). Their placement is not related to any feature (physical or authored), but is nonetheless required to enclose a region (see). *Unconstrained* boundaries can also be edges.

The intention with this soundtrack was to have as many *constrained* or *implied* boundaries as possible, as it was through these that the structure of the soundtrack meshed into the physical environment. *Negotiated* and *unconstrained* boundaries were necessary, although undesirable. Although not explored in the scope of this thesis, *negotiated* boundaries, which form arbitrary musical adaptations, represents a theme for future work, to consider and explore how best to render these musical adaptations when the translation is not related to a physical feature. For instance the composer / designer may want to lessen the

degree of musical contrast on these transitions, and this could be achieved via a – or series of – intermediary regions, whose function is solely to enable a gradual evolution of the music.

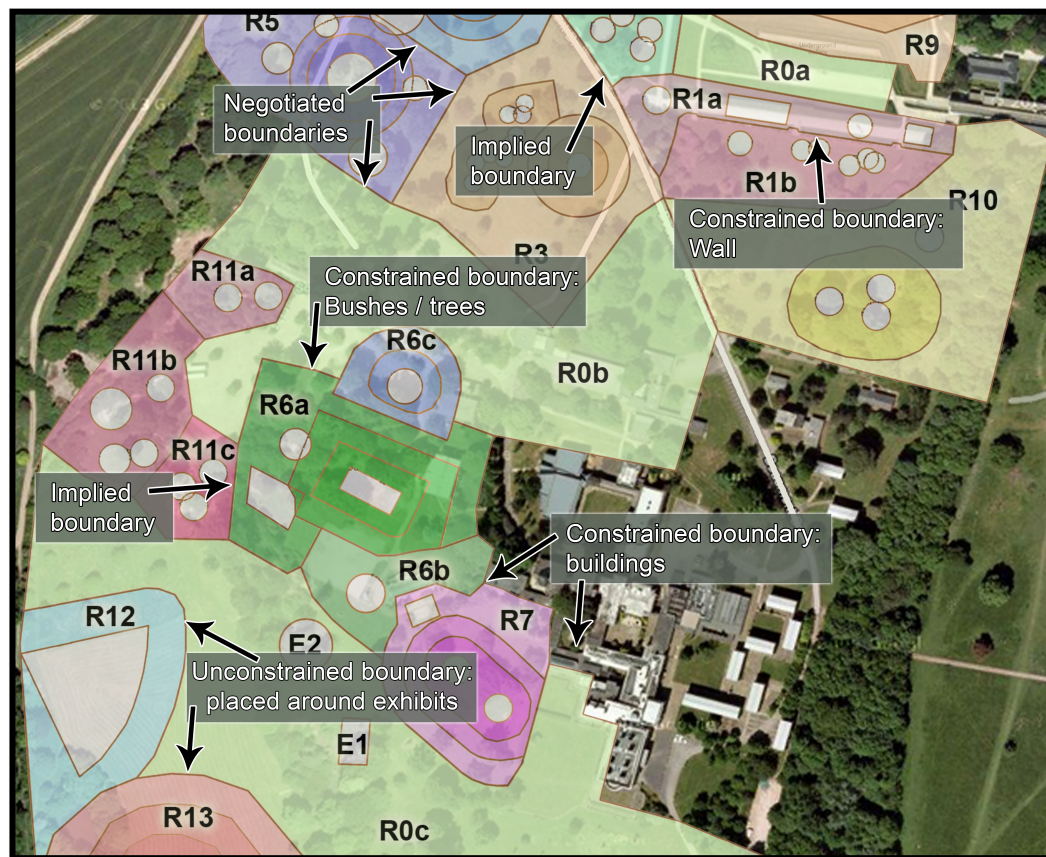


Figure 75: Examples of boundary types at YSP

7.4.2.5 Boundaries in other locative experiences

How does this notion of boundary types reflect prior work on zone-based locative media experiences? An examination of the literature has revealed sparse discussion around the formation of regions, or trigger zones in locative experience, particularly in relation to identifying differences between boundaries lines. Two examples are now presented.

The first is drawn from Flintham et al.'s design for the Colourmaps locative authoring tool (2005). The authoring tool was built around the concept of colour-referenced regions, zones and points that reflect different facets of the locative experience, such as "*associating different kinds of location based triggers with areas of a physical map*". The colour referencing was used as a quick and easy method of designing the locative experience, but also identifying – post-design – the function of the trigger zones. The tools had a number of levels to guide the

drawing of regions, start and stop positions and ideal routes through the space (Flintham 2005).

The second example concerns the location-based albums by Bluebrain (Bluebrain 2014a; Collier 2015; Geere 2015), which appear to be the closest examples to the YSP soundtrack in terms of the style of experience, unfortunately, there is very little detail available regards its design. A promotional video for *Listen to the Light* (Bluebrain 2015b), the locative album for Central Park, in New York, USA, offers a couple of clues about their use of regions and trigger points, as illustrated in the following two screenshots taken in the video (see screenshot in Figure 76 is captured in a section of the video where Ryan Holladay (Bluebrain) briefly discusses the structure of the trigger zones.

“Lets say this is a zone (having drawn the outer polygon region seen in the screenshot), within here it is completely dynamic and shifting as you move. So, say this is a pocket (as he starts drawing the circles) then this would be another pocket, then maybe a pocket here and a very large one here, then maybe small ones. So wherever you are it will always be unfolding” (time point in video 3:13 – 3:34).



Figure 76: Screenshot of Ryan Holladay explaining the use of zones.

The second screen shot () also in the same video (Bluebrain 2015b) appears to show a map view of Central Park, with a series of adjacent polygon zones (i.e., red, green, blue regions) and multiple waypoints (yellow markers) placed within them (). Speculatively, Bluebrain appear to be using some high-level structure of regions that use either *constrained*, *implied* or *negotiated* boundaries that relate in

some way to the park, and within these zones a series of geo-points set to various radii (referred to as ‘pockets’ in the preceding quote) to control a lower-level of musical detail, which, if the case, broadly reflects the approach taken in this thesis.



Figure 77: Screenshot of zones and waypoints

These examples reveal some similarities in the use of zonal structures to that used in the YSP soundtrack, although the degree of this similarity cannot be fully exposed with the limited available evidence. The Colourmaps approach (Flintham 2005) is the sole example discovered that empirically proposed the requirement for the zonal structure to be representative of the different facets of the locative experiences, to form a connection between regional boundaries and their experiential function. The emergent notion of the four boundary types presented here (i.e., *constrained*, *implied*, *negotiated*, and *unconstrained*) currently represents a reflective observation, rather than an active function in steering the compositional decisions. However, the author proposes that taking into account boundary types may prove beneficial during the design process of future locative soundtracks. For instance knowing that a set of adjacent regions are formed in negotiated boundaries (i.e., not in response to environmental ‘accents’), may in turn imply the need for regional transitions of a reduced contrast (i.e., temporal accenting), to those formed around implied boundaries, where the accent structure is stronger, and the need to reflect that musically is increased. Bolivar et al. (1994) noted that stronger instances of temporal congruence between music and visual modes encouraged “a greater focus of visual attention to which the meaning of the music consequently can be ascribed” (p. 32). Thus, these boundary types could be harnessed to define the degree of audio / visual (spatial)

congruence necessary for any given region / regional transition. This represents one example of how these boundary types could integrate into and drive the design process, and thus an area designated for future work and exploration.

7.4.3 Cross-fades

A detailed structure of cross-fades was used to manage regional transitions. An investigation of the locative media literature has not revealed any documentation that addresses this issue in any detail. As with a number of other approaches developed here they have arisen in direct response to the management of 'seams' (Chalmers and MacColl 2003; Chalmers and Galani 2004), and consequently a technical platform that offered note event synchronisation would in turn reduce the emphasis on cross-fades as a means to blend one section into another.

The use of cross-fades shares some similarities to that of the club DJ who's task is to 'mix' one track 'seamlessly' (Cliff 2000) into the next. One of the challenges they face is that of 'beat matching', the manual adjustment of the tempo of the incoming track to synchronise with the currently playing track, which requires a particular skill and is a crucial technique of the effective DJ (Gates, Subramanian, and Gutwin 2006; Cliff 2000; Ahmed, Benford, and Crabtree 2012; Andersen 2005). Consequently, a number of technical systems have been developed, which attempt to automate the process (Andersen 2005; Gates, Subramanian, and Gutwin 2006). However, as was the case with the YSP soundtrack a DJ set deliberately increases and reduces the intensity of the music at certain points, often achieved via changes to tempo, which means that 'beat matching' (i.e., making all tempi the same) is not always desirable. A common techniques in these instance is to cross-fade between the two tracks in their respective 'break-down' sections, where the rhythmic, or accent structure is not as pronounced (Cliff 2000). Referencing this to the YSP study would again advocate for the notion of 'bridging' sections that could facilitate transitions by a range of means, one of which one could be to mimic the 'break-down' transition as used by DJ's.

7.5 Summary of the user experience

The YSP user study revealed a rich and deeply engaging experience quite distinct to the typical visit to a cultural visiting site. The soundtrack contributed to the rich experience across the board and there is evidence to suggest that the soundtrack was deemed congruent with the wider experience, blending into the background (as intended). A number of experiential factors were reported as a result of the musical accompaniment. These factors are also observed in a wide

range of music listening contexts, but are typically realised when a listener has control over the curation of their own soundtrack, as appropriate to their mood and activity, so as to control their experience. Furthermore, the YSP soundtrack experience prompted some engaging moments of serendipity in addition to some strong emotional reactions. The observations arising from this visitor study and supporting literature has demonstrated that music frames and controls the experience. Collectively, these investigations have shown some support for the notion of attachment as proposed to study 1. The interpretation of music cessation and the degree of apparent congruence between the music and the visual (physical) space has given further sustenance to the notion of both *global* and *regional attachment*. But on the other hand the evidence for *local attachment* is weak and thus requires further investigation.

Chapter 8 - Conclusion

8.1 Introduction

Chapters 6 discussed the YSP soundtrack from the composer's and music theory perspective, whereas Chapter 7 considered the YSP soundtrack from the users' and an HCI perspective. A wide range of themes was subsequently revealed that have been discussed (largely) in isolation. This was necessary to achieve a focused understanding of the affective nature of each. In this final chapter these themes are coalesced into a set of conclusions. These conclusions are presented in four stages. First, the research questions listed in Chapter 1 will be returned to and answered in light of the key findings. Second, a framework of guidelines for composing locative soundtracks is then presented. This framework is essentially a detailed representation of the answers to the research questions, but packaged for use by composers. Third, a brief note on the application of the framework of guidelines is presented, followed by a scene setting of future work.

8.2 Research questions

In light of the work undertaken in the preceding chapters we now return to address and evaluate the research questions, starting with the principal research question: *Can a relationship between musical structure and spatial experience be formed, which informs and guides the composition of effective soundtracks that respond to and drive the spatial experience?*

The principal research question encompasses all of the work contained within this thesis and is essentially a question in two halves. The first half enquires as to how a relationship can be made between spatial structure and musical structure that enables the composition of a musical soundtrack to be guided by the features of a locative environment. The second half concerns the impact that a resultant soundtrack with this relationship may have on the user experience.

Considering the first half, the author (as a composer) embarked on the composition of a large-scale adaptive soundtrack for a cultural visiting experience (YSP), further expanding on and refining some approaches developed in the first quasi-experimental study. These approaches essentially involved the formation of pertinent mappings between the structure of the physical location (i.e., the natural and built environment), the activity taking place within the location (i.e., exploring the space and interacting with art exhibits), and the structural features of music (i.e., melody, harmony, timbre and dynamics). The

cultivated approach to these mappings essentially drew on analogies between spatial structure and musical structure (embodied cognition / metaphors), and established conventions as typically found in display media soundtracks, which would enable apposite relationships intuitive for both composer and user. Consequently, the music is tightly meshed into the fabric of the locative experience. This 'mapping' approach is considered ultimately transferable to other locations and locative activities, and as all locative experiences contain a unique combination of physical and activity structures, any resultant soundtrack will be exclusive. From the composer's perspective these guidelines actively stimulated the compositional process. One could imagine using these mappings simply as tool to guide the composition of absolute music, i.e., taking a locative activity and using the mappings as a template upon which a musical work is structured, without any intention to deploy the soundtrack into the setting.

The YSP soundtrack was experienced by a number of visitors to the YSP and they subsequently reported, and illustrated a rich experience; one quite distinct to a typical non-musically accompanied visit. The visitor study revealed a number of interesting experiential themes as a result of the adaptive soundtrack accompaniment that were explored and explained in a subsequent discussion chapter (Chapter 7). As a result, this thesis has shown that a strong relationship between spatial and musical structures can indeed be formed, which uniquely shapes a subsequent user experience. Furthermore, this represents an approach not previously studied or formally documented. In light of this, this thesis offers an emerging insight into a new and novel method of creating soundtracks for locative experiences.

Inevitably, there are a number of caveats that need to be noted. The main one refers to the work in this thesis hinging on one mature example of composition and subsequent user study. Whilst the chosen methodology enabled for a thorough in-the-field development of a compositional approach, this current knowledge is nonetheless based on this one specific example, which reveals a number of limitations. The first concerns the setting; a visit to a sculpture park is a very specific activity and inevitably this compositional approach will have emerged in resonance to the settings idiosyncrasies. The degree to which this has taken place is not yet clear, and will not be known until these guidelines are explored at other locations that support other activities. Thus, the transferability of this framework of guidelines – although theoretically attainable – currently has no practical evidence base. Furthermore, this work has been developed and applied by one composer (the author), whose particular compositional

perspective will have palpably coloured the outcome. Thus, it is unknown how other composers' may interpret and value these methods. Third, a comparison between an adaptive and non-adaptive soundtrack of original music has not been undertaken, and although the benefit of the adaptive variant was argued for Chapter 7, it cannot be unreservedly stated that the rich user experience observed at the YSP pivoted on the adaptive nature of the soundtrack. Evidently, a measured reading of this work's maturity is necessitated at this stage.

The author now shifts focus to the sub-research questions, which delves into a further detail. Sub-research question one asked, '*what are the implications for a framework of guidelines for composing locative soundtracks as mediated through the chosen technology?*' Clearly, the authoring and delivery application used in this work played a significant role in shaping both the compositional process (i.e., guidelines) and the user experience. As noted through this thesis, Calvium's *AppFurnace* did not permit for note event synchronisation of musical cells and stems. This necessitated a method of composition that sought to reduce the importance of rhythmic synchronisation (see section 6.1.1.7). Although ultimately undesirable and possibly irrelevant within other authoring platforms, this nevertheless stimulated an approach that (partly) accounted for this restriction. Furthermore, the authoring platform uses polygon and circular geo-zones as a means to trigger media, thus it is not surprising that the method of mapping physical structures to musical structures is largely based upon defining musical sections that are overlaid onto physical regions. This does not represent a restriction of the compositional guidelines, but rather a complimentary facet. Moreover, this zone-based structure has also instigated an emerging perspective on boundary types (i.e., *constrained*, *implied*, *negotiated* and *unconstrained boundaries*), which warrants future exploration and investigation (see section 7.4.2). GPS driven platforms, which are commonly used in many outdoor locative media experiences create a number of challenges in response to the 'seams' they produce (Chalmers and MacColl 2003; Chalmers et al. 2004), consequently these 'seams' either need to be embraced and integrated into the design, or need to be accounted for in some way. Examples concern the placement of boundary lines (e.g., avoid placing boundary lines along areas that users may walk along), the size of zones (e.g., larger when under tree cover or near to built-up structures), and to some extent the musical style (e.g., sounds with soft 'attacks', and a focus on more textural composition, rather than melody and accompaniment) were all methods that aimed to respond to the implication of these seams. Finally, GPS is largely effective at localising sounds to locales, but does not account for a user's physical orientation, i.e., if a sound is attached to an

object and the user is not looking directly at the object, then the connection between the two may be missed, as was observed with the *arrival* accents placed at the sculpture exhibits. These examples demonstrate the impact of the technical infrastructure imparted upon the work charted in this thesis. The *AppFurnace* platform was chosen as it represents a widely accessible commercial platform whose functionality is largely typical for these tools. It was important that these guidelines were developed to ‘speak’ to the common denominator. Had a more sophisticated or bespoke tool be made to suit the guidelines then their potential transferability may have been compromised.

Moving onto the second of the three sub-research questions, ‘*what are the implications of the physical environment on the development of guidelines for composing locative soundtrack experiences?*’ This question is situated at the core of the compositional guidelines developed here, as the mappings between physical space, user activity and musical features represent the basis of this work, as set out in relation to the principal research question. So, we have already stated that the physical and activity structure of a locative experience is effective for driving the compositional process, but beyond that what are the other implications of the physical environment that necessitate consideration?

Space between and the proximity of artefacts and physical structures represent the first of these. For instance, not all of the exhibits could be treated with a musical *approach*, as there were a number of exhibits situated too closely together to permit for an individual musical treatment. Ultimately, a balance is required between three factors, which are (1) the location of points of interest and their relationship to each other (e.g., where do trigger zones need to be vs. where would one like them to be?), (2) the limitations of GPS granularity (e.g., how close can trigger zones / boundaries be before GPS drift may ‘break’ the experience (i.e., ≤ 9 metres horizontally (WAAS T&E Team 2015)), and (3) managing the flow of the music (e.g., how often can one initiate musical change before the consistency and coherency of the soundtrack is lost?). Points 1 and 3 have to respond to point 2 (GPS), as this is the fundamental restrictor of any musical adaptation. Consequently, the composer / designer will need to establish a hierarchy of (desired) musical adaptations as related to points of interest in the environment, as a degree of compromise will undoubtedly be necessitated in practice to achieve a balance between the three factors listed.

The second implication concerns ‘change’ and this is addressed in two parts. The first refers to physical change, i.e., the introduction or removal of exhibits or

alterations to the natural or built environment by the park's staff. This was an unforeseen manifestation in the Yorkshire Sculpture Park work, which necessitated further composing and re-authoring of the adaptive soundtrack. The composer / designer needs to consider the impact of change during the creation period. With the case of the YSP, the composer's approach of largely interchangeable music reduced some of the impact of these changes, as musical regions could be readily rearranged, given that they were not related to specific exhibits or regions (with the exception of those exhibits which were treated with non-musical sound design elements, however, any re-arrangement of regions would necessitate an awareness of the re-arranging of key-centre relationships). This type of change also necessitated the re-drawing of trigger zones in the authoring platform and this represented the most significant impact. This is unavoidable, but if regular change is predicted in advance then the composer / designer may consider the degree of detail that the adaptive soundtrack assumes. For instance, if it is understood that artefacts regularly move position, then an accompanying soundtrack may just present a high-level regional structure and not choose to treat individual points of interest contained within the regions, thus removing the need to re-author the soundtrack upon each change. Conversely, other types of locative experiences, such a mobile game, might not be permanent, but rather a one off event, thus change is unlikely once the game is deployed. Each type of locative experience requires consideration at the outset as to whether structural change is expected, and then to establish the availability of resources and provision to address these changes, as and when they happen.

The second half of the dealing with 'change' refers to alterations to environmental conditions, such as those brought about by weather, the seasons, or phases of the day (e.g., daytime / night-time). As noted the weather conditions were challenging during the YSP study and this exerted a degree of influence on where visitors walked, for how long and their level of comfort. We noted that the YSP soundtrack, delivered via headphones cocooned the participants, effectively 'warming them up' in the face of inclement weather. This raises a question as to whether alternative soundtracks of different styles or musical intensities may promote or exclude these affects, which could then be deployed accordingly. Furthermore, the YSP, during the winter season did not see the same density of visitors' as is typically the case during the summer months. The YSP study participants reported that they felt accompanied by the music, not vulnerable on their own or bothered by other visitors. However, this may not be the case on a crowded summer's day. This might then call for a different soundtrack with a lighter accompaniment for instance, so visitors

would be more aware of their surroundings? These are unanswered questions, but they explore the potential for multiple variants of an adaptive soundtrack that are sensitive to changes of environmental conditions, in addition to acknowledging that environmental conditions may need to be accounted for in the design of the soundtrack.

The final sub-research question is now tackled, *‘what would be the experiential bearing of on the user experience of such soundtracks that adapt and respond to their exploration of a physical space?’*

Established literature reveals music to be a rich regulator of the human experience, and this was also been observed in the work charted here. Much of the this prior work has noted that music is at its most persuasive when the user is able to choose and curate their listening experiences. In this work the music was orchestrated but nonetheless many of the same control factors were still reported (e.g., (Michael Bull 2006; Herbert 2013; DeNora 1999)) such as a sense of accompanied solitude, the management of external and internal distractions, the enhancement of visual and physical artefacts, and regulation of mood, in addition to powerful moments of (perceived) serendipity (both orchestrated and by chance). Moreover, the discussion in Chapter 7 argued that the soundtrack achieved synchronicity (Chion, Gorbman, and Murch 1994), as the music was stylistically appropriate (i.e., associated) and the accent structure of the physical environment and music was temporally aligned, thus the walking activity and accompanying soundtrack were congruent and was consequently perceived as a single modality. This enabled the soundtrack to shape and drive the locative experience from a subordinate position, functioning as a background element. The author considers this latter point to be a key factor in the value of these compositional guidelines.

One limitation may be found in the solitary nature of this activity. While this proved to be of benefit for the individual’s overall experience, it evidently impacts on the design of locative experiences. The designer / composer ought to consider whether the activity benefits from a (semi) enforced isolation, or whether it is important of the activity to be socially mediated. This work does not promote adaptive soundtracks as an appropriate ‘fit’ for all settings and activities, but rather that they can offer a distinct alternative that brings with it certain characteristics that mould a different experience to the norm.

In sum, these research questions have been addressed via the work contained within this thesis, and inevitably they raise as many questions as they answer.

This is not considered a weakness, but rather an acknowledgement of the novelty of this line of work. In order for these conclusions to have a value they need to be presented in a form that would permit other composers to apply them in their own practice. To that end a framework of guidelines for composting locative soundtracks is now presented.

8.3 Framework of guidelines for locative soundtracks

8.3.1 Introduction

This framework is formed from the collective approaches used in the work charted in this thesis, but predominately draws on the musical analysis charted in Chapter 6, which summarises how different musical features were applied within the YSP soundtrack. Principally, this framework consists of two integrated approaches, namely *Musical landscapes* (ML) and *Musical trajectories through points of interest* (MTTPOI). They are complimentary in that they account for different facets of the music and the locative experience. *Musical landscapes* (ML) concern the higher-level structuring of the soundtrack, which maps to the high-level physical structure of the space. *Musical landscapes*, deal principally in matters of instrumentation, orchestration and key and mode. *Musical trajectories through points of interest* (MTTPOI) concern a finer granularity of musical detail, as integrated within ML, which maps users interaction towards, into and out of engagement with points of interest. *Musical trajectories through points of interest* (MTTPOI) relate to matters of harmony, thematic material, and dynamic flow. The amalgamation of this set of guidelines into a two level framework is ultimately about a process for creating coherent musical form – coherent to the perspectives of the music and the locative experience

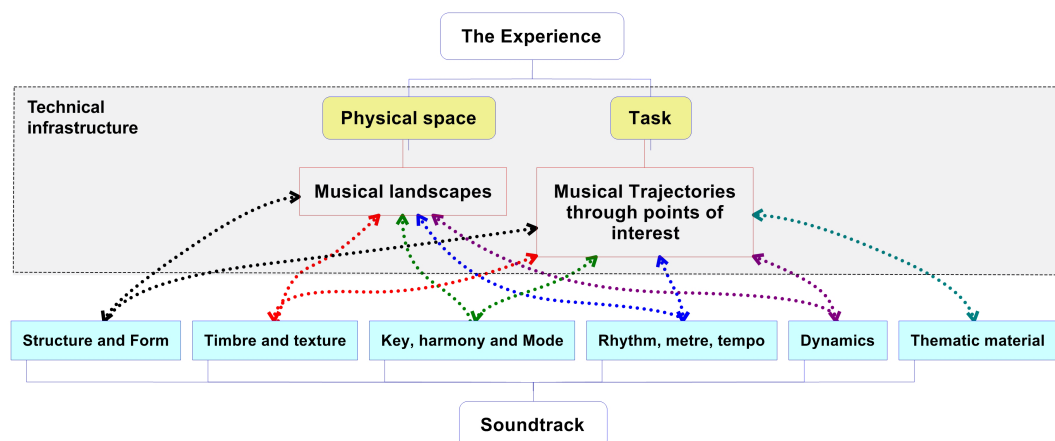


Figure 78: Framework for composing location-based soundtracks

Figure 78 illustrates a visual model of the framework. It is bookended by the two fundamental factors: the *experience* (which relates to the locative context) and the *soundtrack*. The experience accommodates the two principal factors that define the locative context: the *physical space* and the *task*. It is at the margins of these facets that the structure of the experience meets the musical framework. Here the structure of the *physical space*, with all its affordances and constraints as defined by the structure of the *location* and its *infrastructure* maps to the *musical landscape* (ML). The *task*, which represents the user's engagement with points of interest in the *physical space*, maps to the *musical trajectory through points of interest* (MTTPOI). The lower half of the illustration, which refers to the soundtrack, specifies mappings between ML and MTTPOI to musical features. These mappings draw on the methods discussed in the musical analysis in *section 6.1.1* Application of musical features. The final element of the visualisation concerns the technical infrastructure, i.e., the system that characterises how these mappings are authored and realised. Whilst, the work carried out here has been undertaken using GPS positioning within the *AppFurnace* authoring platform, the framework of guidelines as broad approaches should support transference into other authoring infrastructures.

The following sections present the two-layered framework, detailing their structure and application. This framework specifies only the fundamental structure, thus the reader is encouraged to reference back the musical analysis in *section 6.1.1*.

8.3.2 Musical landscapes

Principally, Musical Landscapes (ML) refers to the mapping and alignment of musical form to the physical form of the location. A ML is the higher-level structure of the soundtrack and is charged with defining beginnings, endings, and sections. The placement of these parts and their musical relationship to each other is determined by facets of the physical space, such as the construction of the naturally occurring and built environment. *Musical landscapes* draw on the notion of *global* and *regional attachment*. Finally, they draw on the guidelines proposed in *form* (*section 6.1.1.1*); *key centres, harmony and mode* (*section 6.1.1.2*); *timbre and textures* (*section 6.1.1.3*); and *musical dynamics and intensifications* (*section 6.1.1.8*).

8.3.2.1 *A global boundary*

An explicit musical boundary should surround the area(s) of the intended locative experience. Within this global boundary (GB) music should sound continuously, as breaks in playback imply departure from the boundary and therefore the experience. This draws on the notion of *global attachment*, where listeners form a mental model of the margins the experience (as situated in a physical space) in direct response to the margins of the music (i.e., where music is sounding vs. where music is not sounding). Thus, whilst music is sounding, listeners will feel contained within the environment. There is one additional factor that appears to further define this, which is that the music should be observed to evolve as the experience evolves, i.e., as listener moves through the space then the music needs to move on with them. This latter point, the evolution of the music, is also addressed in section 8.3.2.2. The formation of this boundary – where possible – should align with visible structures or features in the environment that mark out the stage of the intended experience. If this is not possible, then consider the alternatives and implications of boundary placement, i.e., can the physical stage be extended or retracted to match the available physical structure?

Beginnings, endings and excursions

The next question addresses how the composer is to manage the process of entry and exit of the global boundary (GB) – those beginnings and endings and (unintended) excursions out of the GB. These are important facets of the wider experience that can have an impact on how a user engages or perceives the subsequent interactions (see section 7.3.1 for further detail).

- **Entry:** could be manually or automatically initiated. Regardless of the process of entry, the composer needs to consider how the user will know what to do and where to start; transparent support or guidance will be necessitated.
- **Exit:** as above.
- **Excursions:** music cessation as a result of unintentionally leaving the global boundary (i.e., *global attachment*) requires careful planning. Music cessation is a powerful function in communicating engagement experience has been lost. Importantly, methods are subsequently necessitated to guide the user back into the experience (see section 7.3.2 for a discussion on potential methods).

8.3.2.2 *Establish regions / scenes*

Once a GB has been defined then attention should be turned to the formation of regions (musical scenes). Regions have a several functions. They define physical areas contained within the GB, they create discrete musical scenes of contrast so as to form musical progression and variation, which in turn maintains *global attachment*. The founding of regions also establishes the notion of *regional attachment*: the presentation of distinct musical sections that when sounded indefinitely (until a transition into the next region) are linked to the physical space they inhabit, thus they demarcate spatial boundaries. It might be desirable to define musically distinct regions for a number of reasons. For example, to present distinct musical accompaniments for areas in the space that contain artefacts, or points of interest, or that accommodates a particular activity.

- **Application of musical features:** regions can be formed around any musical feature that would offer a contrast to the music presented in any adjacent region. Recommended approaches include:
 - An individual texture in each region, formed from a unique combination and arrangement of instrument timbres – see section 6.1.1.3 for further details.
 - Each region to be composed a different key centre to those adjacent. The relationship between key centres can be important to facilitate pleasing modulations of key, however the nature of these relationships may depend on the style and intention of the soundtrack – see section 6.1.1.2 for further details.
 - Use different thematic material in each region - see section 6.1.1.7 for further details.
- **Traditional musical forms:** these can be used to guide the structure of the music, whilst still mapping to spatial structures. Sectional forms could be particularly effective (e.g., ternary or rondo) – see section 6.1.1.1.
- **Associate regions:** depending on the type of locative experience there may be a need for *associate regions*: two distinct regions that equally share some relationships (e.g., similar landscaping but a different set of artefacts, or distinct changes in landscaping but a consistent activity taking place in both). These are formed in the same way as other regions, but the subsequent music needs to reflect these relationships. Therefore, music for *associate regions* can be two variants of the same piece; some selected features remain consistent across them, whereas others provide the

distinction. For instance: keep the same thematic material, but modulate the key, or keep the accompaniment, but change the melody.

- **Dynamic levels:** keep a standard dynamic level across regions, unless a transition from one region to the next requires a sudden shift of dynamic intensity to match an attribute of the locative experience.
- **Passive regions:** not all regions will necessarily contain moments of engagement or interaction (i.e., artefacts, points of interest or activities). There may be areas in the location free from interest that nonetheless need to be entered and traversed through. Consider these as ‘passive’ regions (or holding regions), which require a lesser musical intensity than those ‘active’ regions that contain moments of engagement and interaction. The purpose of passive regions is twofold: first, by treating these areas with music, the preservation of *global attachment* is maintained; second, an accompaniment with a reduced musical intensity communicates to the listener that they are not currently located within an area of interest.
- **Regional transitions:** transitions between regions can be addressed in the following ways:
 - Unprepared transitions, which means a user’s entry into the next region is enacted upon immediately. This will have implications for the smoothness of the transition. This will be largely dependent on the textures, key centres, thematic material and tempo used in adjacent regions. Cross-fades can assist in smoothing regional transitions. Moreover, different cross-fade durations may be appropriate depending on the music exiting and the music entering, i.e., faster tempi may suit shorter cross-fade durations, whereas slow tempi may warrant longer cross-fade durations.
 - Prepared transitions – in the instance of using an authoring platform such as *AppFurnace* – transitions between adjacent regions can be prepared by using a bridging section between the end of the current region and the initiation of the subsequent region. These bridging sections can manage transitions between two distinct musical sections. This may include tempo adjustments (e.g., rall. or accel.) or prepared modulations of key, or graduated adjustments to thematic material (see section 4.6.4.3 for an example). The composer ought to note that bridging transitions ‘steal’ time from the newly entered region, as their duration needs to play out before the region’s music can commence. Consequently, bridging transitions should ideally be short segments (e.g., 1 or 2 bar duration), but this length may depend of the physical size of the region.

- **Regional boundaries:** When drawing regions, especially if polygons, there are different types of boundaries (the margins of a polygon region) which may steer the type of musical treatment required (see section 7.4.2). They are:
 - **Constrained:** drawn in reference to fixed physical structures that impede the user access, i.e., wall, fences, hedgerows, buildings, area that a user cannot cross.
 - **Implied:** drawn in reference to physical structures or objects that can be traversed, but imply a change of physical state, i.e., gates, changes of landscape such as formal gardens into rural parkland or from open grassed areas onto a walkway or a concreted area.
 - **Negotiated:** boundaries are not defined by any physical structure, but rather in response, or negotiation to another adjacent negotiated boundary.
 - **Unconstrained:** Not drawn to any physical affordance or in relation to any other boundary.
- **Note on walkways:** Do not use walkways as boundary lines. Although pathways appear to define natural boundaries in the physical world, as they intersect space, composers should avoid using them as they represent ‘seams’ between musical sections, which will result in undesirable retriggering of content.

Once a musical landscape has been defined the composer can turn their attention to the locative experience *task* (see Figure 78) and marking the accompanying musical detail. This segues into the second level of the framework – *Musical trajectories through points of interest* (MTTPOI)

8.3.3 Musical trajectories through points of interest

Musical trajectories through points of interest (MTTPOI) refer to the composition of music to accompany users up to, in, through and out of engagement with points of interest, artefacts or activities contained within the locative experience, i.e., the *task*. This process is – ideally – constructed around four sequential stages that form the trajectory: *approach*, *arrival*, *engage*, and *withdraw*. Figure 79 **Error! Reference source not found.** displays the stages, illustrates the dynamic level and the formal structure, which is a three-part sectional form (i.e., ternary). The arrival and engagement stages are nested, as the arrival stage is typically represented by the immediate entry to the arrival zone, which swiftly gives way to the engagement phase situated within the same zone. Each stage comprises of its own compositional guidance that are, nonetheless, all interrelated. The

MTTPOI model draws on the musical features of *form* (section 6.1.1.1); *key centres, harmony and mode* (section 6.1.1.2); *timbre and textures* (section 6.1.1.3); *phrases, themes and melodies* (section 6.1.1.7); *musical dynamics and intensifications* (section 6.1.1.8); and *non-musical sounds* (section 6.1.1.9).

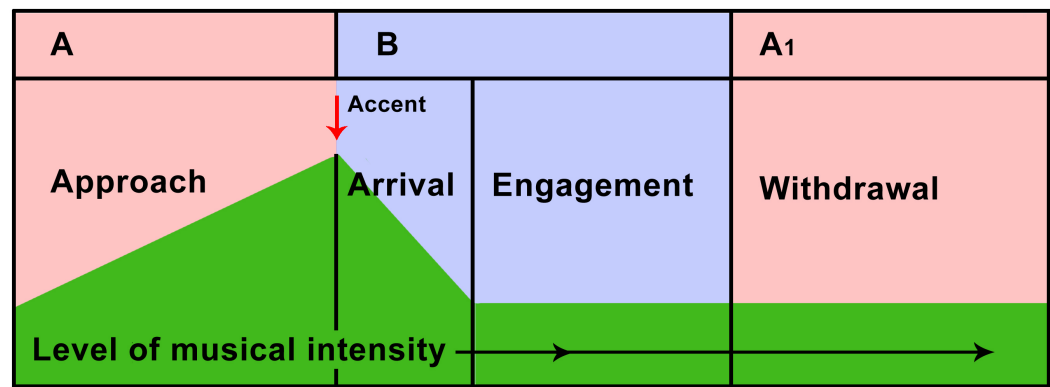


Figure 79: MTTPOI model

8.3.3.1 Musical trajectories through points of interest model (MTTPOI)

- Managing space:** regions may not support a MTTPOI at each POI they contain. For instance, the area of a region may be too small – as a result of *constrained*, or *implied* boundaries – to accommodate the set of zones required for a MTTPOI. Furthermore, a region may contain multiple POI that would ideally all have MTTPOI. However, their close proximity may in turn prohibit their application. In these instances the composer needs to make some choices regards the degree to which each POI can be addressed with a MTTPOI. Evidently, this would be determined by a number of factors unique to the locative experience. To this end there are three levels of MTTPOI that respond to space constraints within a region.
- Levels of musical trajectories through points of interest**
 - Multi-stage:** contain two or more approach / withdrawal zones, alongside an arrival / engagement zone. The number of approach / withdraw zones is at the discretion of the composer, but they should consider matters of space and relationship, i.e., at what point in the region does it feel that a POI is being deliberately approached, rather than just merely walked towards? This is subtle question that will not always have a clear answer, but should be considered. Further questions that may aid this deliberation might be: is the POI in line of sight? Are there other POI that are closer, even if not on the same heading?
 - Single-stage:** contains only a single approach / withdrawal zone along with an arrival / engagement zone.

- **Zero-stage:** contains no approach / withdrawal zones, just an arrival / engagement zone.
- **Arrival only-stage:** the same as the zero-stage type, but does not contain an engagement phase, just an arrival stage (discussed in the following).

8.3.3.2 *Approach*

An *approach* refers to the process of a user advancing towards an artefact, point of interest (POI) or activity. The role of the music in this stage is to foreshadow the point of arrival at the POI.

- **Musical intensification:** The music should intensify over the course of an approach phase (from the outer margins of a region to the locale of the POI). A range of techniques can be used to create a musical intensification, which can be used individually, or in combination. Combinations can be more pronounced and thus effective. For instance: building up the vertical texture by adding a new layer (voice) upon entry to each successive approach zone; use a chord progression that runs through the approach zones (new chord harmony enacted in each zone); increasing the rhythmical density in each successive zone (i.e., shorter note values, fewer rests); increase the global volume of the music in each zone (dynamic contour); rising pitch in a melody, or chord harmony (voice-leading). See sections 6.1.1.2 and 6.1.1.8 and Chapter 4 for further detail.
- These techniques can be employed in both multi-stage and single-stage approaches.

8.3.3.3 *Arrival*

An *arrival* signifies the user has arrived in close proximity to the POI. The purpose of an arrival is twofold: first, to mark the point of arrival, and second to resolve the musical intensification enacted by the *approach* stage.

- **Arrival marker:** a short duration motif or accent can be used to mark the moment of *arrival*. This fleeting musical event can assist in signifying a local POI. These can be individually crafted for each instance of an *arrival*. These markers could be crafted as leitmotifs, transposed and varied to suit the music in other regions. Finally, arrival markers also contribute to the arrival resolution. To make arrival markers distinct and thus recognisable, reserve a specific timbre(s) simply for this function. These arrival markers can be

employed in all four levels of MTTPOI (i.e., *multistage*, *single-stage*, *zero-stage* and *arrival only-stage*)

- **Arrival resolution:** this refers to the resolution enacted by the *approach* zones. The purpose of a musical intensification is to climax at the point it foreshadows. This is normally achieved via a resolution, which can be performed in number of ways. Given the purpose of the subsequent *engagement* phase the following methods are recommended: a modulation of key, or a return to the tonic chord of the region (assuming a chord progression was employed in the *approach*); and a final intensification of the music, using the same methods employed during the *approach* (the introduction of the arrival marker is also contributing factor).
 - This final intensification should not be sustained, but rather swiftly give way (*decrescendo*) to permit the presentation of the engagement phase.
 - **Zero-stage and Arrival only-stage types:** these types will not have a preceding intensification (*approach*), thus no resolution of intensity can be enacted. However, for zero-stage types a modulation of key and a moment of dynamic stress, crafted from either the arrival marker, or the marker in combination with other features is recommended to signify entry into a POI.
- **POI with multiple artefacts:** in the case of the YSP, a cultural visiting experience, artist information signs also accompanied the exhibits. These were deemed important artefacts that were also part of the moment of arriving and engaging with exhibit. Thus, the composer should be aware if the POI has multiple artefacts that may be dispersed. All of these artefacts should be housed within the arrival zone.

8.3.3.4 *Engagement*

The *engagement* stage is intertwined with the *arrival* stage, as they both take place in the same trigger zone that encompasses the POI. Its purpose is to accompany the user as they engage with the POI. The style and nature of the music will depend on what the POI of interest is. In the case of the YSP, music of a reduced dynamic level was introduced to make space for the participants to focus on engaging with the exhibits.

- **A reductionist approach:** typically the music was crafted from the same texture as used in the surrounding region, but significantly deconstructed. Voices of significant musical activity were discarded, or the degree of

activity was reduced to present a thinner texture with a lesser thematic or harmonic content.

- **Paraphrased treatments:** another option is to present a ‘paraphrased’ accompaniment, via the application of music or non-musical sounds, or narration associated with the POI. This would encourage referential listening, which can draw attention and interest to the POI.

8.3.3.5 *Withdrawals*

The final stage – *withdrawals* – refers to the method in which the music accompanies a user out from engagement with a POI. Rather than using the reverse of the *approach* stage (as would be performed by walking back out from the engagement zone, back through the approach zones) it is recommended that a variation of the approach music is presented that does not employ a dynamic contour, but rather maintenance of a reduced dynamic level established in the engagement stage. The rationale for this posits that there is no requirement for a process of preparation or anticipation when walkers withdraw, as is the case the approach stage. The user has traversed through engagement with the POI and at this junction the dynamic of the experience is in stasis. Holding the music at this lowered dynamic level also prepares for the next instance of approach zones, where the music can then intensify once more.

- **Methods of variation:** as a reduced dynamic level is required here, this will inevitably necessitate a reduced texture than the one constructed during the *approach*. If a harmonic chord progression was applied for the *approach* then this should also be used on *withdrawal*. The composer now has options to re-harmonise and use a different variant of the progression at this stage. Variations to thematic material could also be used to add variation.

8.3.3.6 *Managing ‘musical time’ to account for ‘experience time’*

The final guideline in MTTPOI refers primarily to the use of thematic material within regions. A locative experience is a non-linear activity, where a user’s walking pace, route choice and dwell times is fluid and unpredictable. Conversely, when using a ‘placed sounds’ approach, the pre-composed cells and stems are formed from fixed, linear constructions. This contrast reveals a challenge, which refers to the management of fixed ‘musical time’, in fluid ‘experience time’. Section 6.1.1.7 provides guidance on this issue.

8.3.4 Experiential design

Here we move from specific compositional guidelines to a set of notes regarding the user experience. The composer / designer should be aware that listening to a (congruent) soundtrack accompaniment via headphones can create a different type of experience for the user. We have witnessed an adaptive soundtrack reduce feelings of isolation, whilst promoting a prolonged and sharpened focus of attention towards environmental features. It also acted as a regulator of mood and led towards an enhanced appreciation of the setting and distracted visitors from inclement weather conditions. In light of this the composer is encouraged to read the 'key experiential themes' from the discussion in section 7.2, to gain an understanding of how a soundtrack can shape the user experience. Not all of these experiential themes readily transfer into compositional guidelines; that is to say that they cannot be easily controlled and composed for. Some result from the experience of listening to music via headphones, whereas other are related to subjective interpretation and responses. Nonetheless, the following draws attention to some issues of the experience that warrant consideration or that can be shaped via the music.

- **Tempo:** choice of tempo is not just a musical matter, but rather it can be used to subtly influence participants walking pace, via entrainment and also promote different feelings of intensity and energy. It needs to be noted that prior research suggests that humans best synchronise physical movements within a short band of tempi (i.e., 116 – 125bpm), however, tempi outside of these do promote advancement or abatement, but not necessarily entrained movement (Moelants 2002b).
- **Style and association:** humans, through historic exposure to music heard in relation to different contexts form binding associations that can be re-lived by exposure to the music alone. For instance music can be readily associated with cultural, geographical, historical, social, and emotional contexts. These associations can in turn promote strong listening experiences (referential), which could be deliberately harnessed in locative soundtracks.
- **Environmental conditions:** different environmental conditions can change the nature of the user experience. This may affect where users walk and for how long. A soundtrack can intervene in some way, such as 'warming up' the users and focusing and prolonging attention on to artefacts and environmental views.
- **Expect change:** dependent on the type of locative experience and degree of permanency, changes to the physical or activity structure could occur. The

composer / designer needs to consider and potentially prepare for this potential during the design process. If known changes are to take place post-deployment then a reduced degree of adaptive detail related to the artefacts or areas of change may remove or reduce the need for further composition and re-authoring.

8.3.5 Technical infrastructure

Finally, some notes on the implications of the technical infrastructure are presented. These are centred on the use of GPS as a driver for tracking user position and enacting media playback. Prior studies of locative media experiences, along with the author's experience here, have resolved that 'seams' that result from the integration of technologies need to be designed or accounted for (Chalmers and Galani 2004).

- **Compose for uncertain positioning:** if using a GPS driven system, then GPS error or drift will most likely occur in a locative experience. 'Built up' areas as a result of the built environmental or naturally occurring tree cover may experience a higher likelihood of positioning inaccuracy and uncertainty. It is important therefore to recognise and account for these potential troublespots and define trigger zones with a coarser granularity, such as larger zones so as to extend the 'capture' area.
- **Compose for uncertain synchronization and re-triggering:** a number of techniques were presented in section 6.1.1.7 and 8.3.3.6 that attempted to reduce the impact of unsynchronised triggering of music, dependent on the specific functionality of the authoring platform. These emphasised the reduction of strong rhythmical themes to smooth transitions between cells. Furthermore, unintended re-triggering of media is likely to occur as a result of GPS errors, thus the utilization of sounds with slow attack portions can reduce the intrusiveness of the unwanted re-triggers.
- **Trigger boundaries should be placed perpendicular to user walking direction:** avoid placing boundaries that lie inline with known routes and walkways, thus to reduce the potential of users walking along a 'seam'. In areas where users are free to roam, a study of user behaviour prior to defining trigger boundaries may assist in highlighting often-used routes.

8.3.6 Summary

These guidelines are a wide-ranging set of methods to guide the composition of locative soundtracks, which employ a set of mappings between musical events

and physical objects or actions. They consist of two levels of detail, first *musical landscapes* that addresses the high-level form of the soundtrack that characterises the relationship between musical sections such as key centres, tonal colour and orchestration; second, *musical trajectories through points of interest*, which accompany user interaction with points of interest located within the musical landscape (i.e., regions). The latter place a focus on dynamics, harmonic progression and thematic material. These mappings are aimed at the musical language of the western tonal tradition. In addition to these two levels of guidelines, some further guidance is presented that draws attention to how the composer can shape the user experience and account for ‘seams’ in the experience as a result of GPS positioning technology.

8.4 Application of the framework of guidelines

Having presented the framework of guidelines, the author now offers some notes on the application of the framework.

8.4.1 Levels of intervention

The framework guidelines are not a locked set, i.e., dependent on all attributes to be in place for successful application, but rather they propose a number of complementary methods that can be drawn on selectively if so desired. This section describes some of the options for selective application.

8.4.1.1 High-level structuring

‘High-level structuring’ refers to the application of just the *musical landscapes* stage. Here the composer can plan the ‘formal’ structure of the composition such as creating musical regions and consider their key centre, textural and thematic relationships. Beyond this the treatment of the music within the regions can be addressed as to the composers wishes, without any need to refer to other stages of the framework. In working with just this stage of the framework, the composer could, should they wish to, draw motivation from some established musical ‘forms’, which can in turn shape stylistic attributes such as key centre relationships, metre, and use of thematic or rhythmic variation techniques.

8.4.1.2 Low-level structuring

‘Low-level structuring’ represents the inverse of the above, as here the *Musical trajectories through points of interest* stage of the framework is applied without its accompanying *Musical Landscapes*. The guidelines of this stage detail how to accompany a user / listener into, through and out from engagement with points

of interest. This approach could be used for a single occurrence or multiple points of interest contained within the experience. Within this low-level structure, direction can also be taken from the traditional musical forms, notably those based on *tripartition* (i.e., three part-forms), as a three part A-B-A structure encompasses the (A) *approach*, (B) *arrival / engage* and (A) *withdraw* stages of the *musical trajectory through points of interest (MTTPOI)*.

8.4.1.3 Musical feature paths

‘Feature paths’ refer to specific ‘cuts through’ the guidelines, so as to define trajectories of individual musical features as they pass through the locative experience. These could be key, harmony, dynamics, timbre and texture for instance. Rather than using the guidelines as a set, which addresses all musical features, here just select ones are utilized. ‘Feature paths’ could be applied individually or in combination (note: the combination of all of them would result in the application of the whole framework). A *key and harmony feature path* for instance could be realised by the creation of a ML and a MTTPOI, where the location is divided down into a number of regions upon which a map of key centres for each region is overlaid, alongside harmonic progressions within those regions that create musical interaction with artefacts or points of interest. Alternatively, a *dynamic feature path* would chart the music’s dynamic flow and dynamic events across the locative experience. Here the composer can map a set of intended dynamic levels (see section 6.1.1.8) for different classes of regions (e.g., active, passive) or activities to aid the formation of this path. This chart then becomes the template to map out the dynamic flow of the music across the environment (e.g., beginnings, endings, passive regions, active regions, moments foreshadowing (approach), climax (arrive) and appeasement (withdraw)).

‘Feature paths’ permit for the mapping of particular musical features, enabling the composer to work detached from the other compositional guidelines. The author envisages *feature paths* as a particularly expedient method to plan, design and map out the structure of the soundtrack.

8.4.2 Applicability of guidelines to other musical styles

The following is just a small note on the relevance of these guidelines to other compositional approaches. Throughout this thesis the author has reiterated that this work is firmly rooted in the western tonal tradition of music and it is this language to which these guidelines speak. However, they can be transferred, with some adaptation, to support other musical approaches. For instance

Emmerson and Landy (Emmerson and Landy 2012) state that pitch treatment, duration (i.e., rhythm), dynamics, density (i.e., texture) and simultaneities (analogous with traditional harmony) are the important features of electroacoustic music, and timbre could certainly be added to that list. The author would argue that in fact these facets are contained in all musical styles. Consequently, these guidelines may have some purchase in informing the composition of many different styles of music.

8.4.3 A music first approach

Here the author / composer's approach has been to develop a set of mappings between musical features and spatial features, where the music is formally structured around the physical space. The reverse of this process could equally be applied, which reveals a further attribute of this framework. The reverse refers to a 'music first' approach, where the form and function of a physical space – for the purposes of the location based experience – is established in response to the structure of the music used within an accompanying soundtrack. This approach may be suited for a locative experience where the music is the primary modality, or in a setting with minimal attributes of contrast in natural or built environment, around which to structure the music. Viewed from this perspective a soundtrack's music could either be specifically composed for the experience, or existing commercial music could be re-purposed.

8.5 Reflections on the thesis methodology

This thesis took a mixed methods approach to tackling the research questions, applying a combination of quasi-experimentation, reflexive research through design and in-the-field observational study. As a result this thesis has presented a rich body of work that has addressed the research questions to a degree that a substantial set of guidelines has been consequently distilled for general dissemination. Furthermore, whilst the research questions have not been concluded, thus closed off from further exploration, the chosen methodology has also set the stage by revealing a number of answered questions and opportunities that warrant further investigation (see Future work). As with any research investigation the methodological decisions taken here required some negotiation and some compromise.

A key element of this methodology was the author's study of their own compositional practice (subjectivity and reflexivity), which enabled for significant insight into this process, which subsequently shaped the resultant

compositional guidelines. However, this also represents a limitation of this work, which arises from the subjective nature of this enquiry. The guidelines presented here are intended for the many, for the wider world, but there were realised through a single voice, thus a single perspective, and as yet other composers have not engaged them with. As the one 'voice' is that of the author's, this then enquires as to the objectivity of these guidelines. For instance, the observation of other composers would have permitted for an objective interrogation of their practice and the implications of the context within which their practice was situated. Whilst this was charted here, it was entirely from a subjective standpoint. As a result it is challenging for the author to pick apart the transferability and applicability of these guidelines outside of their own practice; are they (too) finely honed to this one composer's viewpoint? An answer cannot be offered at this stage, other than this calls for their continued investigation from an objective methodological perspective. The 'research through design' methodology required the author to switch roles between that of the researcher and the composer (Taylor et al. 2011; Benford et al. 2013). This transference of roles was not always clean, or deliberate, and was often retrospective. This does not seek to suggest this was the wrong methodological approach, but rather a further observation that an objective viewpoint would have offered a balance to the research outcomes.

The implications of two other methodological approaches are now briefly considered. The first of these would have seen a fully experimental approach, which may have revealed a finer granularity of detail regards the affect of individual musical features on spatial movements. This would have driven this work along a deeper investigation of embodied cognition and those conceptual metaphors of motion and spatiality in music. This may have extended and clarified the notion of *attachment*, but would have been at the expense of the real world application of adaptive soundtracks and the study of the user experience.

Second, a comparison study at the YSP would have potentially answered questions about the true impact and integration (congruence) of the soundtrack, if compared to a playlist of non-adaptive music. This was considered, and on reflection it would have been a very useful addition to the data captured and disseminated here. However, issues of time, recruitment and determining that the comparison group experienced the same conditions - i.e., seasonal weather – was prohibitive.

Patently, more time, resources and hindsight would have honed this research further. Nevertheless, this thesis has drawn upon established HCI practice and has utilized a range of methods to best exploit the intentions of this work, and in doing so has delivered a unique and purposeful contribution.

8.6 Future work

In this section the author presents some directions for future work. The themes presented here have been drawn from the preceding chapters, which noted areas not addressed within the scope of this thesis, in addition to those left unresolved. The first two calls for future work consider the wholesale application of the guidelines, then a focus on specific elements of them are presented.

Application of framework into other settings and activities

As noted in the reflection of this thesis methodology the work charted here represents one quasi-experimental study and one large-scale real world in-the-field study. Consequently, these guidelines, although extensive and successful within the work detailed here, have yet to be tested in other settings. Ideally, a series of engagements would witness these guidelines put into practice across a range of different locative settings that contained a number of different user / visitor activities. The author could envisage these being other cultural visiting or tourist tours, mobile games and nature, and urban walks. Furthermore, there is no reason to view these guidelines as restricted to external settings driven by GPS positioning technology. This, then ‘opens up’ the guidelines for application in a range of internal settings and the utilization of alternative positioning technologies and authoring technologies. Furthermore, this work drew from conventions in display media soundtracks. An interesting direction for this work would be to apply these guidelines into the composition of interactive soundtracks for display media.

Application of framework by other composers / designers

Following on from above, the guidelines require engagement from other composers and designers of locative experiences to validate their appropriateness from the perspective of others. Evidently, they have been developed in light of one composer’s particular take on the practice of composition, thus what needs to be addressed is the individual approaches of others. This process could be achieved by either handing over the guidelines to other composers to see how they interpret and apply them, or alternatively a set of structured activities (e.g., workshops) to pick apart and discuss their detail.

The voice of designers and curators of locative experiences is also not present in this work. Similar to the above, the future of the guidelines would benefit from their input, particularly in relation to the following themes. First, what they would they consider to be the key features of their spatial activities and would they correspond with the author's vision? Second, concerns the appropriateness of having a musical soundtrack for a locative experience and its potential impact on the user experience. In the case of the YSP, the park has a number of curators who design the external exhibition space, who place the exhibits in what they feel to be effective settings, what the author would consider a creative process. This comes after the sculptor whose vision created the artwork quite detached from the environments where it might subsequently live. Then a composer has entered the fold and added a third layer of (creative) intervention disconnected from the former. There are clearly issues of artistic practice, respect and appropriateness at play here, that dependent on the type of locative experience and at what stage the composer enters the process, may or may not need addressing. Whilst, this relates to one very specific example the question needs to be considered and explored when approaching the use of musical accompaniments.

Addressing the above two themes would enable all elements of the guidelines to witness further investigation and development.

The role of music cessation

Section 7.3.2 discussed the issue of music cessation, which although effective at prompting disengagement from the experience, it does, nonetheless confuse participants. That section tentatively suggested some approaches to better communicate to users what silence means for the experience, but these are as yet untested. Furthermore, some locative activities may require episodes of music cessation to enable users to engage with other sound sources. This, then questions how these moments might be mediated gracefully, so as to transfer users out of the soundtrack and back in again.

Transitional bridges

Late in the composition of the YSP, a transitional bridge between regions was introduced, where a short excerpt of music that led out of one region prepared the music of the next, and was considered as an interesting technique (by the composer) that warrants further development, which may lead to richer options for regional transitions.

Harmony – Mode

Whereas harmony was used extensively to define transitions between regions and trajectories through regions, mode was not explored (e.g., major, minor keys). This would begin the process of composing soundtracks for mood, emotion and interpretative affect. While this work charted what users had to say about the adaptive soundtracks, the intention of this work was not to engage with deliberate musical interpretation (with the exception of the non-musical sound design test cases).

Rhythm

Similar to mode above, rhythm, or rhythmic matters did not receive a notable exposition in this thesis and thus these guidelines would benefit from work in this area.

Boundary types

When defining trigger zones for the YSP soundtrack a number of boundary types (the boundary lines of the polygon zones) emerged that detailed how the trigger zones relate to different types of physical structures in the park; they were termed *constrained*, *implied*, *negotiated*, and *unconstrained*. In this work they had no function other than to retrospectively describe these relationships. However, the author speculates that they could become an active addition to these guidelines. Understanding boundary types early on in the design process may assist in guiding the types of musical interactions appropriate for transitions in those locales. But this requires some investigation to pick up what, if any benefit this approach may serve.

Re-structuring of existing music for walking experiences

Finally, another possible direction considers the application of these guidelines (or maybe just a selection of them) to existing musical works. The work charted here is centrally focused on the composition of original music and the guidelines are essentially a set of approaches to mapping musical structures onto spatial structures. Consequently, there may be some traction in their use to re-structure existing musical works, where fixed arrangements are de-constructed into constituent segments and then dynamically re-arranged. This direction of work may in turn allow for personalised experiences or the re-appropriation of existing music for different settings and activities.

A brief statement of potential areas for future work has been presented of which there are many possibilities. Some relate to scaling up their application, while others place a focus on musical features not yet, or not fully, explored. This is a rich area of work with untapped potential, and the work of this thesis represents an emerging strand.

8.7 Summary and contribution of thesis

This thesis has sought to understand the idiom of adaptive locative soundtracks as accompaniments for location-based activities. Its approach was to consider the idiosyncrasies of mobility, spatial structure, activity structure, musical structure as mediated through a technical infrastructure that consisted of a digital authoring tool and GPS positioning technology. The work began with quasi-experimental walking study that revealed some characteristics of how listeners interpret musical features in relation to spatial features (i.e., *attachments*). These qualities were then taken forward into the development of a large-scale composition of a soundtrack accompaniment for a cultural visiting experience at a cultural visiting site, which was designed and studied in-the-field. Here, the author, who was also the composer, charted an iterative process of composition and mobile ‘app’ authoring which developed, extended and applied the findings from the first study. The resultant soundtrack was experienced by a group of 22 visitors to the park, who reported a unique and deeply engaging visiting experience, where the music was congruent with participants exploration of the physical environment and subsequently blended into the background of the experience. These research activities have resulted in the formation of a two-stage framework of guidelines for composing locative musical soundtracks that detail rich mappings between musical features and spatial features. Stage 1, termed *musical landscapes* concerns the high-level formal structuring of the soundtrack, how physical regions map to musical sections based on defining key centres relationship and individual orchestrations. The second stage, termed *musical trajectories through points of interest*, refer to the adaptation of music within these regions, which accompany visitors in, through and out of engagement with points of interest situated within the location. This stage uses harmonic chord progressions, matters of orchestration, dynamic contours and dynamic events to realise the musical trajectories. In addition to these two stages of compositional guidance, a number of notes and suggestions are presented so as to orient the composer to experiential and technical issues.

This framework is aimed at experienced composers and they tender a set of options that draw a particular line through the challenge of creating locative soundtracks, an approach not been previously studied or documented. Thus, the author does not propose that this framework is the only method for tackling this activity, but rather one of many options. Moreover, the framework can be adopted exclusively, partially sampled, blended in with other methods, or simply viewed as a set of sensitizing statements. A soundtrack composed using this approach aims to integrate gracefully into a locative activity, where the user experience is equally reflected by the musical accompaniment. To this end this approach is most similar to those media soundtracks found in film, television and computer games.

The contribution also extends to an emergent understanding of the uniquely engaging and emotive experience an adaptive soundtrack accompaniment can create for users, as detailed in the body of this work (see Chapters 3, 5 and 7). Whilst many of the experiential attributes revealed from this work are as yet not comprehensively understood – as the subjective nature of the music listening experience is a particularly thorny issue to pick apart – they represent an emergent grounding upon which further work can progress forward. Thus this work then presents an emergent contribution to the wider understanding of music's connection to the human experience.

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