

Soundtrack-Controlled Cinematographic Systems

Thesis submitted to Newcastle University School of Computing
Science
in partial fulfilment of the degree of Doctor of Philosophy

Guy Schofield
November 2013

Abstract

Throughout the history of film, music has been used to accompany motion pictures. In the film industry, the relationship between music and film has for almost a century been largely static and hierarchical. Increasingly, in the domain of live music, this relationship between sound and the moving image is reversed. In contemporary popular music, live performances are often augmented with elaborate lighting and visuals in the form of video projections.

The research presented in this thesis explores the development of a new moving image paradigm: a narrative, soundtrack-controlled form of cinema, in which the languages of film and music are used to re-edit video in real time. Two questions are explored: how to control narrative visuals with music in real time and how to use musical instruments as high-level controllers. Three performance projects, approaching these questions in different ways are presented, each involving different collaborations with creative practitioners. Approaches are described through which authenticity of context and fitness for purpose are prioritized, through in-the-wild development and deployment processes. The research presented is intended to benefit creative practitioners, interaction designers and researchers working in the domain of live digital performance.

Acknowledgments

The research presented in this thesis could not have been accomplished without the help of the following people.

Thanks go to my supervisors Patrick Olivier and Peter Wright.

I would like to express particular thanks to Patrick Olivier for inspiring, supporting and encouraging me throughout my study.

I would like to thank the artists who took the time to participate in the studies presented in this thesis. Extra special thanks are due to Harriet and Rose for the time, thought and artistry they brought to the project. Thanks also go to Dave Green for co-piloting the *Orientation* film project and to Rachel Gay for being so talented, professional and enthusiastic.

Thanks also go to all my colleagues who also gave their time and energy to help out. Thanks to Tom Smith and Jordan Wise for leading the *cinejackplayer* development. Thanks also to Ko-Le Chen, Lianne Bell and John Shearer for their excellent camerawork.

To Ilaria and Tom, thanks for the moral and physical support throughout the final phase of the research. And to Toni, I can't thank you enough for your kindness, patience, thoughtfulness and enthusiasm.

Finally, the biggest thanks go to my best friend Rachel, without whom this research would never even have begun.

Publications Arising from this Thesis

The following publications are based wholly or in part on the research presented in this thesis:

Hook, J., Schofield, G., Taylor, R., Bartindale, T., McCarthy, J. and Wright, P. (2012) Exploring HCI's Relationship with Liveness. In *Extended Abstracts of CHI 2012*. ACM Press, pp. 2771-2774.

Lino, C., Christie, M., Lamarche, F., Schofield, G., & Olivier, P. (2010) A real-time cinematography system for interactive 3D environments. In *Proceedings of the 2010 ACM SIGGRAPH/Eurographics Symposium on Computer Animation*. Eurographics Association, pp. 139-148.

Taylor, R., Schofield, G., Hook, J., Ladha, K., Bowers, J., & Wright, P. (2013) Crafting interactive systems: learning from digital art practice. In *CHI'13 Extended Abstracts on Human Factors in Computing Systems*. ACM Press. pp 3223-3226

Taylor, R., Schofield, G., Shearer, J., Wallace, J., Wright, P., Boulanger, P., & Olivier, P. (2011). Designing from within: humanaquarium. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM Press, pp. 1855-1864

Abdullah, R., Christie, M., Schofield, G., Lino, C., & Olivier, P. (2011) Advanced composition in virtual camera control. In *Smart Graphics*. Springer, pp.13-24.

Schofield, G., Casey, R., & Olivier, P. (2010) OverWatch: real-time narrative visuals from live performance. In *Smart Graphics*. Springer, pp. 261-264.

1	Introduction	9
1.1	Introduction	9
1.2	Contributions of the Research	12
1.2.1	Exploring controlling live visuals using musical instruments.	12
1.2.2	Connecting devices from cinema and music in live performance.	13
1.2.3	Developing a novel form of audio/visual performance	14
1.2.4	New Ways of Leveraging Creative Practice for HCI research.	15
1.3	Structure of the Thesis	17
2	A Starting Point in Practice.....	20
2.1	Introduction	20
2.2	Context	21
2.3	Motivations, Goals and Constraints	22
2.4	Conclusion	28
3	Hybrid Performance	30
3.1	Introduction	30
3.2	Dimensions from Hybrid Performance.....	31
3.2.1	Engagement with Cinema and Live Music	31
3.2.2	Other Models of Viewing	34
3.2.3	Immersion and Appreciation.....	35
3.2.4	Constructing Space.....	37
3.2.5	Narrative and Temporal Structures.....	38
3.2.6	Relationships between sound and Image	40
3.3	Interactions and Interfaces	42
3.3.1	Dedicated Control Surfaces.....	45
3.3.2	Augmented Instruments	47
3.3.3	Existing Instruments as Interfaces	48
3.4	Conclusion	51
4	Devices from Film and Music	54
4.1	Introduction	54
4.2	Music and Film	55
4.3	Devices from Film Music	57
4.3.1	Orchestration, Style and Allusion.....	57
4.3.2	Leitmotifs.....	59
4.3.3	Pitch, Discord and Harmony.....	60

4.3.4	Volume	61
4.3.5	Tempo	62
4.4	Basic cinematographic devices.....	63
4.4.1	Framing.....	63
4.4.2	Composition	67
4.4.3	Exposition	69
4.4.4	Editing.....	70
4.4.5	Special Cases	71
4.4.6	Style and Allusion	72
4.5	Discussion: Towards a Soundtrack-Controlled Cinema.....	74
4.6	Conclusion	78
5	<i>OverWatch</i> : A Scoping Study.....	79
5.1	Introduction	79
5.2	Configuring the research.....	80
5.2.1	Practice Context	80
5.2.2	Configuration of research and practice.....	82
5.2.3	Performance Context	82
5.3	Design.....	83
5.3.1	Controlling Visuals with Music	83
5.3.2	Instruments as controllers	85
5.3.3	System description	86
5.3.4	The piece	88
5.4	Evaluation and Reflection	91
5.4.1	Rehearsal.....	91
5.4.2	Performance.....	92
5.4.3	Evaluating the research process.....	96
5.5	Conclusions	97
6	<i>Golden Shroud</i> : Live Visuals for an Album Launch	100
6.1	Introduction	100
6.2	Practice Context	101
6.3	Configuration of research and practice.....	103
6.4	Performance Context	104
6.5	Design.....	105
6.5.1	Controlling Visuals with Music	105
6.5.2	Instruments as controllers	108

6.6	The Piece / System Description.....	109
6.7	Evaluation and Reflection	113
6.7.1	Rehearsal and composition	113
6.7.2	Performance.....	114
6.8	Conclusion	117
7	<i>Orientation: Soundtrack-controlled Cinema</i>	119
7.1	Introduction	119
7.2	Practice Context	121
7.3	Configuration of the Research	122
7.4	Performance Context	123
7.5	Design.....	124
7.5.1	Controlling Visuals with Music	126
7.5.2	Instruments as Controllers.....	127
7.6	System Description: <i>Cinejack</i>	128
7.6.1	The piece	132
7.7	Evaluation and Reflection	135
7.7.1	Rehearsal.....	135
7.7.2	Performance.....	135
7.7.3	Configuration of the Research	139
7.8	Conclusion	140
8	Conclusions	142
8.1	Introduction	142
8.2	Connecting devices from cinema and music in live performance.	143
8.3	Exploring Controlling live visuals with musical instruments	145
8.3.1	Controlling narrative visuals with music	145
8.3.2	Using musical instruments as controllers.	147
8.4	Exploring new ways of using creative practice in research.....	148
8.5	Developing a novel form of digital live art	150
8.6	Further work.....	151
8.6.1	<i>CinejackLive</i>	151
8.6.2	Cinehack (with David Green).....	152
8.7	Concluding Remarks.....	153
9	References.....	154
10	Appendix A: DVD Contents.....	163

1 Introduction

1.1 Introduction

Throughout the history of film, music has been used to accompany motion pictures. Presentations of the earliest movies were often accompanied by an instrumentalist who would improvise a score from the popular tunes of the day and ever since, music and the moving image have been inextricably intertwined. In the mainstream film industry, the relationship between music and film has for almost a century been largely static and hierarchical. In most cases, musicians or composers begin their work, long after the cameras have finished rolling, writing each score to the director's specification, for films which are already very much finished artefacts (Kalinak, 1992). However influential a composer may be, it is usually their task to support the image track and the narrative set out by the director.

Increasingly, in the domain of live music, this relationship between sound and the moving image is reversed. In contemporary popular music, live performances are often augmented with elaborate lighting and visuals in the form of video projections. Since the 1980s, rock bands such as Muse (see figure 1) have used video imagery displayed on large screens situated around the focal point of the stage, usually controlled from off-stage by a dedicated operator (Kirk, 2010). Once solely the domain of commercially successful bands performing in stadia, music festivals and other large venues, live visuals are now becoming an integral and increasingly expected part of performances at grass-roots level, used as both a way of maintaining audience engagement and reinforcing an act's identity in the otherwise generic visual environment of a theatre or club stage (Dekker, 2003).

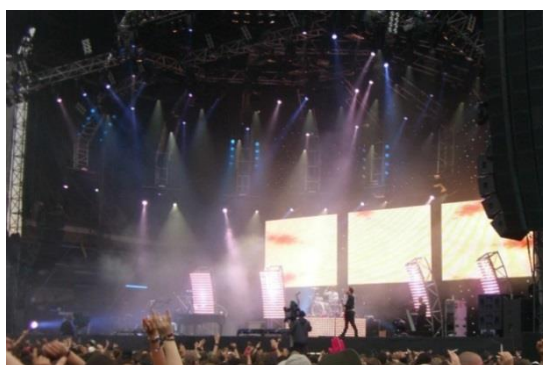


Figure 1: Concert Visuals used by the band Muse

This appropriation of the moving image by musicians has largely been achieved through advances in available technology and a decrease in traditional sources of revenue from recorded music (Smirke, 2103). As record sales continue to fall, musicians turn increasingly towards innovation in live performance facilitated by new tools. Powerful and portable laptop computers and video projectors are now within the financial reach of many musicians and easy-to-use software for preparing visuals has also become available due to the simultaneous emergence of Video-jockeys or VJs (artists who provide visual projections to accompany musicians or recorded music in nightclubs) (Spinrad, 2005).

As discussed later in this thesis, this augmentation of music with moving imagery involves many techniques developed from cinema and other media but differs in its relationship to sound and music. Visuals here are used to support a narrative and affective arc the contours of which are determined in real time by musicians and which contribute to the character of a live concert. Although the goals here are somewhat different from other screen-based media such as cinema and TV, with a greater focus on affect over narrative, semiotic devices are deployed in a broadly similar way, through association, affect and direct communication (Dekker, 2003).

Currently the tools available to musicians for creating and presenting live visuals mainly offer low-level control of video. Although developed for a domain in flux, where innovation and experimentation is a crucial factor, they mostly assume fixed modes of use, mostly the model of the solo VJ (Spinrad, 2005), who during performance is solely involved in the manipulation of visuals. Few pieces of software are able to leverage any of the subtle languages of cinema and music and all rely on a high level of manual control and configuration to operate them.

The research described here begins at the relationship between music and the narrative moving image. It explores how connections between the languages of film and music might be exploited by musicians to enable them to control narrative film through music in real time. The research is structured around the creation of a series of live audio/visual performances which explore different applications of these languages. In these works, conventions and devices used by film makers are mapped, using technology, to those used by composers in order to disrupt or reverse the hierarchy between image and sound in film. The result is a novel type of hybrid performance art, which combines elements of both media in the context of live performance.

Liveness, the essential difference or lack thereof, between attending a live performance and watching a mediated form of entertainment such as film, is a point of much recent debate between theorists. Phelan (2004) stresses the value of the unrepeatability of live events and the visceral experience of being physically present in watching a performance. Auslander (2008) refutes this, arguing on the one hand that the social and physical conditions of watching television or cinema constitute a form of *liveness*, and on the other that the experience of live events is coloured by constant exposure to digital media. The research described in this thesis, proceeds from the first of these two viewpoints. Working largely from the viewpoints of practitioners, it explores the value for musicians of a live connection with audiences.

The motivation behind this research emerged directly from my own creative practice as a musician playing in an electronic rock duo called *The Turing Test*. It arose as a result of pursuing a collaborative music practice alongside other musicians in a large UK city with a thriving music scene. The project's goals, structures and approaches are, from the outset, multidisciplinary, and focus not only on the theoretical disciplines upon which they draw but also the interactions between them which occur in the making of audio/visual performance pieces. Most crucially, they are rooted in and motivated by art practice, emerging from the my own creative work and involving collaborations between various musicians, film-makers and artists.

As a multidisciplinary project with technical and theoretical outcomes, it is anticipated that a number of audiences might benefit from the research described here. The tools and theoretical approaches developed here mainly describe experiments in control of video via music: as such, it is suggested that both musicians and VJs might find use for them, and might extend their use beyond the project. The project emerged from a practice focussed on live rock music and - as we will see later - other musicians were integral to the design process. Central to the research was a plan to make any tools which emerged available to other creative practitioners facing similar challenges to our own. Film makers were also considered while developing the research, especially independent practitioners working at grass-roots level, where developing new working methods and approaches is more feasible than at studio level.

The research also takes into account existing approaches in digital live art and multi-media theatre, offering technical and conceptual ideas which could be applied to other forms of live performance. Theatre groups have for many years experimented with multi-media

approaches involving live visuals, sound and live action and this research contributes to a growing body of knowledge around this type of hybrid practice. In particular, the technical interface between screen-based and live elements is addressed; however, different ways of considering space and narrative are also taken into account.

1.2 Contributions of the Research

The research described here follows a practice-led process of inquiry combining various perspectives and elements of autobiographical and human-centred design. The central contributions of the work have implications for both creative practice and research in interaction design. A number of main contributions are discussed below, which are revisited throughout the thesis.

1.2.1 Exploring controlling live visuals using musical instruments.

The core concern of the research is to develop ways for musicians to augment their performances with live visuals, using resources already at their disposal. This concern is of as relevant to musicians and creative practitioners as it is to researchers in interaction design and is intended to contribute to both domains. For the sake of clarity, throughout the thesis a partial separation is made between the specifics of interfaces between musicians and visual systems and the wider context of controlling visuals through music in live performances.

1.2.1.1 *Instruments as Controllers*

In order to make the best possible use of musicians' resources, a highly pragmatic approach is taken through which musical instruments are used as interfaces to control narrative video. This re-purposing of existing interfaces required, once again a consideration of context, acknowledging that besides functioning as interfaces for making sound, musical instruments are culturally loaded objects. The research takes into account the complex interactions which occur between musicians and their instruments, both on a haptic level and in social and psychological terms. Consideration is given to the place that they occupy in their users' lives, as aspirational objects, communicative devices and interfaces at the locus of long-term processes of learning and creative expression.

Several sets of mappings and approaches are attempted throughout the performance projects described here which involve both high and low-level control schemes. The benefits and limitations of each, both in practical and aesthetic terms, are discussed. The conclusions drawn are offered as contributions to the field of interaction design.

1.2.1.2 Controlling Visuals with Music

Presenting live visuals alongside musical performance is considered in context, and the practical and aesthetic implications are discussed. Related work from VJ practice, digital live art and theatre are explored along with approaches from HCI. The historical antecedents of soundtrack-controlled cinema including classical music performances and magic lantern shows are also considered in detail, especially with regard to how audiences and musicians might engage with soundtrack-controlled cinema presentations.

This discussion, explored throughout 3 performance case studies, is shaped by a number of goals established in relation to live performance practice. For the research described here to be useful to creative practitioners and interaction designers, it was crucial that the projects developed were fully rooted in the domain, taking into account the exact contexts of live musical performance, therefore a direct link to practice was crucial in structuring the work. Beginning with an examination of my own performance practice, a number of important elements are identified which are then used both to evaluate each phase of the work and as a point of comparison with which to discuss other performance practices. *The Turing Test*; the band which forms the focus of my musical practice, not only formed a ready-made testing and evaluation platform throughout the research, but was used as a lens through which to consider every aspect of the design.

An important difference in many approaches from art and HCI is the presence of the designer or maker in the creative process. Gombrich's quote "There really is no such thing as Art. There are only Artists" (1995), emphasises the view that art should be considered as a discipline of communication between people, where the artist's intent, rather than the resulting object or act, is key. Art theory, since the late 19th century, stresses the role of the individual artist, their own personal narrative and motivations (Lynton, 1980), with the viewer's experience often acknowledged only as way of understanding them. Recently, approaches in HCI have begun to attempt to factor in the motivations of the designer in the development of technology (Neustaedter, Sengers, 2012). In this research project, these motivations are unpacked and analysed.

1.2.2 Connecting devices from cinema and music in live performance.

The performance projects described here explore the development of a type of narrative cinema which draws on the formal aspects of conventional film but is driven by a different set of aesthetic devices, derived from live music. Each performance described relies on the

deployment of a set of conventional devices taken from cinema and music. As such, the project relies on exploring the repurposing of connections between musical and filmic conventions. The research explores whether these devices are legible and meaningful in a new context involving different actors and environments. Drawing not only upon cinema and music theory but also working within a growing tradition of multi-media performance, this aspect of the research relies for its success on engaging audiences and other artists, succeeding or failing on aesthetic terms. Included is a detailed exploration of a number of common devices from both cinema and film soundtrack, which are used in the development of performance works but also are intended to form a body of knowledge for other creative practitioners working in interactive cinema. This work builds on approaches developed by the IRIS (Integrated Research in Interactive Storytelling) research network (Cavazza et al. 2008) and has formed part of the research for the publications ‘Advanced composition in virtual camera control’ (Abdullah et al, 2011) and ‘A real-time cinematography system for interactive 3D environments’ (Lino et al, 2010).

1.2.3 Developing a novel form of audio/visual performance

In this thesis, soundtrack controlled cinema is presented as a new art form; a hybrid discipline emerging directly from the same historical antecedents as VJ practice but offering a new configuration of theories from music, art and cinema. The practical research, described in the later chapters of this thesis involves the production of 3 pieces of performance work. These pieces are in each case designed to stand alone as artworks in their own right. A central proposition of the research, elaborated throughout the work, is the importance of a holistic approach in conducting research of this kind. Hence, in each case, the test-bed pieces were conceived not only as necessary phases in the research but as having distinct goals proper to each. Included in this thesis is a detailed account and deconstruction of the planning, production and presentation of 3 major projects, each involving technology-mediated performances shown in public venues. An account of the first of these pieces is detailed in ‘*OverWatch*: real-time narrative visuals from live performance’ (Schofield, Casey and Olivier, 2010).

The knowledge gained in developing these performances is also embodied in a number of pieces of software, which are made freely available to other researchers and practitioners. Over the course of the project, a software system which began development in the earliest piece *OverWatch* and which came to be named *Cinejack* evolved from a highly specific single-purpose performance set-up to a flexible set of software modules, now available to

other musicians. The thesis includes a detailed account of *Cinejack's* development into a set of inter-connected performance modules including a high performance, music-controlled video player. Consisting mainly of Max/MSP/Jitter patches, these programmes each address elements of the research and together make up a suite of easy-to-use and versatile tools for controlling video projections from live audio and MIDI sources.

From these practical concerns, the central research contributions of this project emerge through a practice-led process of inquiry combining various perspectives and elements of autobiographical and human-centred design. This thesis offers a detailed account of these approaches in context, which might be used as a template for similar projects in this domain.

1.2.4 New Ways of Leveraging Creative Practice for HCI research.

The design approaches taken during the research proceed from the proposition that to fully understand the transactions taking place in a complex domain such as multimedia performance, a variety of perspectives are needed, some of them involving an insider's knowledge of the design space. The thesis involves an exploration of how the interaction between multiple creative practices and multiple theoretical fields can be used to drive different phases of a design project. By collaborating on different parts of the project with a range of creative practitioners, a framework was established whereby these perspectives could form a coherent set of voices on the design. Importantly, this process took place within a number of creative practices and in each case attempts were made to develop approaches which would not only prove insightful but could be deployed practically in authentic design settings. This aspect of the work has, during the research, led to several parallel projects, one of which is described in the publication, 'Designing from Within: *humanaquarium*' (Taylor et al, 2011).

Throughout the research described here, a strategy is developed where issues often considered specific to art and performance are treated as problems in interaction design. A key hypothesis of the research is that this by considering artworks from this perspective, fresh insight can be gained. This concern is hardly novel as for many years, researchers in HCI have turned to live performance as a domain in which to test innovations or examine interactions which might have applications in the wider world (Benford et al, 2002). This has led to a number of interesting writings on performance that have shed light not only on the specifics of their own domain but on interaction design in general, some of which are discussed in Chapter 3. The unpredictable, complex and often uncontrollable nature of

performance contexts has been used as a theoretical acid test for design, by researchers from Buxton (1997) to Benford (2002). Live multi-media performance often involves actors with complex relationships, interacting with technology on multiple sensorial channels. Straightforward task-based analyses of these phenomena quickly break down under the weight and complexity of these transactions, necessitating holistic, qualitative approaches which take into account both the ineffable nature of what might be taking place and the value systems at work (Suchman, 1987).

Increasingly in the field of Human-Computer Interaction, researchers and designers are attempting to place interaction design in context by considering our meetings with technology holistically, occurring within the daily lives of real human beings (McCarthy and Wright, 2004). Inspired by approaches from disciplines as diverse as ethnography, psychology and performance studies, theorists have developed a number of models that consider not only technologies in their primary context of use but the deeply human factors involved in interacting with them.

The notion developed by Suchman as early as the late 1980s (1987), that traditional task-centred approaches to technology design may prove inadequate or even misleading for real-world design situations, is now widely accepted and forms an important ideological component of what is often referred to as the 3rd wave of HCI (Bødker, 2006).

Contemporary researchers such as McCarthy and Wright describe technology in terms of experience (2004), recognising that activities outside the frame of the interaction may have an effect, colouring people's motivations and abilities as they interact with a piece of technology. The research described in this thesis considers this in practical terms, asking how the context in which the technology being developed is deployed, affects how successfully it works.

Buxton, writing about design of musical instruments (1997), jokes that there are 3 levels of design, standard spec, military spec and artist spec, highlighting the difficulties in designing systems which work well in the unpredictable environment of a live performance. This research explores this issue principally through authenticity of context in the development process. Rather than developing systems within the laboratory and then taking them outside, an attempt is made to immerse the research completely within its proper context, leaving the lab for the rehearsal room and concert stage where possible and using working methods borrowed from the practices under investigation. This question of context and authenticity is revisited continually throughout the thesis. A key consideration

of every design decision made here was whether the resulting system would work in live performances in front of real audiences and whether it resonated with the practices of musicians who might eventually use the system.

Lastly, a number of research projects have already explored various benefits of involving artists in interaction design scenarios, many of which stress depth of engagement in order to surface deeply-embedded knowledge. Few of these studies however, consider the impact on the creative practices concerned, of engaging in demanding research projects. This thesis examines with specific examples, the benefits and risks to a creative practice used in this way. The effect on my own practice and that of my principal collaborator, of using our band as a platform for research, is explored at length.

1.3 Structure of the Thesis

As already discussed, the project described here is highly interdisciplinary in nature, relying on establishing meaningful connections between different aesthetic vocabularies. However, not only did the research involve multiple fields of study, it also relied on the interaction of multiple creative practices. Beginning with my own music practice (itself a long term collaboration), I worked outwards to include other musicians over the course of several sub-projects. Structuring a long term body of research around several creative practices in this way was challenging as it meant that each phase of the research had to be adapted to the performance schedules of the participants involved. In each case, my own creative practice was also used as a development platform and provides a constant backdrop to the research.

Chapter 2 describes the starting point of the research in an existing creative practice: my own musical collaboration *The Turing Test*. Various dimensions of this practice are discussed with particular regard to the motivations and constraints present in creative projects. Consideration is given to how these might be used to establish criteria by which to evaluate the research. A number of goals are identified against which the project is measured throughout the thesis.

Chapter 3 describes related work in the fields of multimedia performance and discusses a number of important theoretical and technical points from several disciplines to apply to the development of a new form of cinema. Approaches from live music, theatrical performance, digital live art and VJ practice are explored along with features from cinema's historical antecedents. In particular, silent cinema is considered in relation to the

project, drawing as it does upon a similar set of resources. The construction of space and narrative is addressed along with ways in which audiences engage with various performance media. Accounts from the HCI community of the interactions taking places in these scenarios are also considered and compared.

Chapter 3 also explores related work in musical instruments and new interfaces for musical expression. A number of historical approaches to control technology for musicians are discussed with particular reference to how they fit into the challenging conditions of real-life musical practice discussed in **Chapter 2**. A number of technical and conceptual starting points are identified for developing interfaces to control video via live music. An approach is described whereby the existing affordances of musical instruments may be used for high-level control of moving images.

Chapter 4 details a number of devices from cinema and film soundtrack which might be deployed in the making of soundtrack-controlled cinema productions. This collection of devices is used as the basis for the works developed later in the thesis but is also intended to form a resource for practitioners experimenting with interactive cinema in general. The result of deploying these devices in soundtrack-controlled cinema performances is discussed, with regard to their legibility and how meaning might be preserved in a new format.

Chapters 5, 6 and 7 comprise accounts of the planning, production and outcomes of the performance works created during the research. In each case these works were intended to function both as prototypes representing iterative revisions of a continuing design process but also as stand-alone musical performances. Each project was planned to not only explore the research questions but also to attempt to gain a new position in relation to the design space. From the highly subjective setting of my own practice, to a user-led design project and culminating in a complex collaborative work, the research attempts to bring to bear multiple perspectives from inside and outside the design space, each time further refining the design of the technical underpinnings of the work. To place these individual works in context, **Chapters 5, 6 and 7** begin with a diagram summarizing their place within the project.

Chapter 5 describes an initial piece, entitled *OverWatch* which used real time 3D Graphics controlled by an electronic live score, composed, built and performed by myself and my musical collaborator Rachel Casey. The aim of the project was to scope the design space

and form a point of departure from our usual creative practice. A detailed evaluation of the work is included in terms of technical innovation but also in relation to the criteria identified in **Chapter 2**. Insights and challenges are identified which are fed directly into the next phase of the work.

Chapter 6 includes an account of the development from the *OverWatch* software, of *Cinejack*, a flexible system to control live narrative visuals for a professional musician, designed for 2 specific concerts scheduled around the launch of a new album entitled *Golden Shroud*. During this project, development was dedicated entirely to specifications set by the participant musician as we compared her practice to our own. The technical developments which took place are described at length, as are the benefits and drawbacks of the methodologies used. Once again, limitations and successes are discussed with regard to further development of the work.

Chapter 7 is an account of the making of *Orientation*, a full-scale original piece of soundtrack-controlled cinema written, directed and composed specially for the research. It involved collaborations on equal terms not only with another musician but with a film maker as we took on the task of shooting a live-action multi-track cinema piece. Besides artistic motivations, an aim of the work was to provide a set of high-quality content for the final development, testing and showcasing of *Cinejack*. The recruitment of a collaborator with whom to develop a performance around *Orientation* is described as are a number of developments to the system. An evaluation of the resulting performance is also included which surfaces a number of important factors that arose during the design process.

Chapter 8 comprises a summary of the outcomes of the project and its research contributions. The development of the performances and software in relation to the initial goals of the project are discussed and evaluated. **Chapter 8** also includes a discussion of the impact of the research on my own creative practice as it was used in various ways to drive the research and the implications of this for using creative practice in research. Also discussed is a number of further works resulting from the research.

2 A Starting Point in Practice

2.1 Introduction

A constant challenge throughout this research was managing not only the different conceptual threads which make up the work but also understanding the different journeys undertaken by the participants. Tacit knowledge has long been considered an integral part of the creative process (Polanyi, 1966), especially with regard to abstract and non-verbal forms of expression such as music. Many accounts of the act of artistic creation assume that much about it is ineffable (Boehner, Sengers and Warner, 2008). This is of little help to the designer developing a tool to support the creative act in others, or even the artist attempting to unpick unarticulated processes at work in his or her own practice. In this study, a number of devices were employed which aimed to surface tacit aspects of creative practice, drawing on approaches to autobiographical design described by Neustaedter and Sengers (2012), Bowers (2002) and Tanaka (2000).

Key to understanding my own music practice and those of others was rationalising the deeply intuitive processes at work in performing live music. Unpicking years of habit, intuition and carefully managed personal relationships was no trivial matter. A necessary part of this was achieving a greater understanding of my own creative goals and motivations in relation to those of others, including my principal collaborator. As touched upon in the previous chapter, this research project did not start from a completely blank slate; rather the art form envisaged here was originally conceived as an extension of my existing work with *The Turing Test*, an electronic rock band comprising myself and my long-term musical partner Rachel Casey (see figure 2).



Figure 2: The Turing Test, with pre-synched projections behind the stage

Using my own established musical practice seemed to offer a number of advantages as opposed to working with other musicians. As the project arose from the requirements of our own work, it seemed a timely and natural extension of our practice and would - we hoped - yield benefits to the practice itself. Our own long-established working practices could be used to quickly develop content and the network of venues, musicians and promoters with whom we had become familiar could be used to showcase the pieces.

2.2 Context

The Turing Test began as a musical project in 2008, building upon 2 years of previous work with other musicians as the band *Kalidah*. Between the two bands, Rachel and I had played over 50 concerts together, ranging from small bar gigs to music festivals, art gallery openings to house parties. We met originally through a musicians' listings website and followed up with a meeting in a bar in our home city where we briefly discussed our ideas, musical history and what we were looking for in the collaboration. We began weekly jam sessions and over time developed a collaborative practice where we not only wrote, recorded and performed music together but formed a close friendship. This collaboration and the social bond arising directly from it, is in the main, fluid and mutable. *The Turing Test* is not our 'day job', we have no contractual and few financial obligations to the project. Like the vast majority of musicians, the terms of our practice are constantly being renegotiated not only by artistic considerations but by other factors: balancing the work with other creative projects, earning money and pursuing a social life outside the project.

Over the last five years we have evolved approaches and strategies which allow us to not only make music which is satisfying for both of us but also to maintain the productive social bond between us. We rarely work separately, collaborating not only on writing and performing music but recording, mixing and pursuing the other corollary activities necessary to support our practice: for example making artwork and photographs, organising press coverage and booking venues. It is perhaps surprising then, that the goals of the project were, at the beginning of the research, almost entirely unarticulated in formal terms.

Our practice involves far more doing than planning: we play together principally for the pleasure in the act of making music and performing, rather than as any kind of structured inquiry. It was important therefore, to both connect our own experience of playing to the theoretical structures I was planning to draw upon and to begin to unpick our own and each other's motivations, preconceptions and strategies. It was particularly necessary to try and

achieve some objective understanding of the transactions taking place during the various phases of this collaborative work: writing, rehearsing and performing, both in terms of affective, expressive and communicative features and in technical terms of inputs, controls, mappings and outputs. We could then use this body of knowledge to compare and contrast with the experiences of other musicians, hopefully leading to a greater understanding of what was unique and specific to our practice and what was common to musicians working in our domain.

To accomplish this, a number of strategies were employed periodically throughout the work. These consisted of note-taking, recording of performances and practice sessions using both audio recording devices and video cameras and conducting informal interviews. In each case, the aim of recording was to capture a deep understanding of the specifics of what was occurring with the aim of surfacing concrete design requirements. A number of techniques were used over the course of this research to try and gain objective insights into various aspects of our practice. The first and most formal was a number of recorded discussions with Rachel where I asked open-ended questions concerning how she viewed our work together, her own motivations and what she thought was important or valuable in our work. These were staged at various points of the research: beginning immediately before *OverWatch* (the first performance piece discussed in Chapter 5), with the final discussion scheduled after the first screening of *Orientation* (the final piece, discussed in Chapter 7).

2.3 Motivations, Goals and Constraints

The first interview was used to attempt to ascertain what Rachel found rewarding about our work together, how she thought it related to our audiences and what functions our existing visuals system performed. In addition to these broad points, specific questions were asked about how she considered the various instruments we played in the band. From this discussion a number of themes emerged, which would form the starting point for the research. A second interview took the form of a video session, where an attempt was made to dissect in conversation, a video of one of our concerts, shot by a friend. Further sessions involved recording practice sessions and noting down specific details, particularly with regard to temporal structures, visual presentation and communication.

2.3.1.1 Groove

When asked what her favourite aspect of the work was she identified, without hesitation, rehearsal and jam sessions. The liminal state of ‘groove’ or ‘flow’ entered in the making of

a song was a motivation here in itself, with emergence and unpredictability being key components.

'I think I find jamming and writing and stuff the most exciting part because it's before the song is formed and sometimes I feel disappointed when the song is formed because you can't jam it out any more ' -Rachel

This unpredictability was tempered for Rachel with a sense of the creative act being one of progression and growth. For her, this sense of building towards a mystery goal extended to her whole view of herself as a musician, a central reward for her being the enjoyment in learning new instruments and new ways of realising her ideas.

'I still feel like I haven't written the best yet. And every time we come up with new stuff, I feel we're getting closer to it and we're getting closer to it and we're getting closer to it and that's what makes me want to keep on doing it.' -Rachel

This enjoyment of a process which yielded unexpected results extended to our entire practice. When asked about unifying factors or common threads running through our work Rachel said,

'We've got unifying factors but we haven't really got a set idea of what sort of band we are really. Ok, we do electronic stuff, we also do guitar stuff, we also have lyrics that don't quite fit electronic music, they're a bit more folk, you know. It's kind of like where are we and what are we doing, and I like the fact that I don't really know.' -Rachel

2.3.1.2 Engaging the Audience

Rachel was asked to list a number of factors which she thought comprised a successful performance with *The Turing Test*. Once again she was able to answer this without hesitation, stating that from her point of view, playing technically well, (being '*as tight as we can be*') having the visuals system work well and having good sound were the most important. This led to a discussion about the importance of engaging the audience as a reward in its own right. For Rachel, co-experiencing enjoyment with the audience was key to her own enjoyment of a gig. As a performer who also wrote her own songs, sensing that she was successfully communicating the ideas and experiences contained in her work was a key motivation in performing to an audience.

'...you just want people to get what you're doing and enjoy it and take some little bit

of enjoyment out of it, as much as you get...even if it's just a couple of songs, one song or a visual that they like, taking some enjoyment away...' -Rachel

'...in the past, when I've written things...its stuff that's really personal and I don't really hold back and when I've been able to write properly...and for people to really sort of like it or connect with that, I think that's important.' -Rachel

Rachel elaborated on techniques which she felt assisted in this engagement such as giving the appearance of making eye contact with the audience (often not possible in reality because of stage lighting) and singing directly to audience members.

'I've learned, as a performer, it's something that you become more confident with - because a lot of it is confidence - and you become more used to doing it the more gigs you do and understanding that if you're singing to people they're really going to listen.' - Rachel

The visuals were also cited as an important factor in creating a memorable and exciting experience for the audience, helping establish a deep level of engagement. She mentioned several times the idea of engaging the audience through the creation of a coherent experience.

'that's what I feel that I want to do.. to connect with people and also to make an experience: something that people walk away and go 'That was fucking awesome.' or 'the visuals were amazing' and there's been so many times when we've had gigs where people have said 'oh the songs were great but the visuals were amazing'. - Rachel

This desire to manage the entire audience experience as a coherent whole in order to promote engagement was particularly helpful as a factor that could be planned into the development of the new work.

2.3.1.3 Self Presentation and Roles

The question of communication with the audience related strongly to the way Rachel thought she and I presented ourselves as *The Turing Test*. As a duo, Rachel and I had always shared the work involved in preparing and performing shows. As we both play a number of instruments, this has meant many shifts in role, often during a single performance, involving frequent changes of instrument, sharing of vocal duties and collaborative adjustment of technical kit. The most surprising and illuminating statements

made by Rachel in the initial discussion related to the changing nature of our roles. Some of these related to her view of the structure of our collaboration: again, something that we rarely talked openly about. In terms of the make-up of the band, I had always considered Rachel to be the more engaging performer and to be more often the visual focus of the band, something that she corroborated but said she felt somewhat uneasy about.

'It's a bit like Dave Stewart and Annie Lennox isn't it? Dave Stewart's in the background and Annie Lennox is at the front and that's it but Dave Stewart's, he's the most important element in that whole set up...' - Rachel

This view, in itself was not unexpected, however what emerged from the discussion was that this difference in roles was for her a source of anxiety. Rachel's view of our collaboration was as a team: where equal contribution was important. In particular different levels of technical knowledge, particularly with regard to setting up the technical elements of our show were for her, sometimes a source of stress.

'You kind of try and find something that you can do, for example I've been writing more at the moment and doing more things, I've had more time to do that so I've felt really useful in the team I suppose and learning how to do new things and bringing something to the table which in the past...I've always worried that I haven't brought enough to the table...' - Rachel

'I think, it's not something that I've ever really kind of worried about or something that... I just think sometimes that it's not fair that I'm relying on you to kind of...sort things out in a way. I suppose its wanting to be more useful.' - Rachel

These worries had previously never been voiced openly. In changing the pattern of our work to accommodate new practices and in particular, in adding more technical complexity to the work, they would be extremely important in making the new work satisfying as a joint creative venture, separate from any other requirements of the research.

2.3.1.4 Relationships with Instruments

As multi-instrumentalists, playing guitar, drums, keyboards, xylophone, mandolin and violin along with electronic instruments such as laptops, groove-boxes and drum machines, our relationship with our collection of musical instruments is complex. When asked which instrument was her favourite, Rachel expressed consternation; joking,

'I can't give just one. I love every instrument as if it was my own child'. - Rachel

When questioned more fully, Rachel cited a Fender electric guitar of mine as her favourite not because of its sound but because of aesthetic and haptic considerations:

'I love the telecaster, I don't know why it is, I think One, just because it looks cool but Two, I think, it just feels nice to play, it just feels like I can play it well and it just feels like its the right guitar for me.' - Rachel

This view of instruments in rock music as aesthetic props is well documented (Waksman, 1995), however beyond that statement, Rachel's thoughts on instruments were very much concerned with their capacity to realise her musical ideas rather than their qualities as objects, describing the telecaster as a *'tool to make sounds'*. Her enjoyment of instruments was concerned with the building of musical pieces from fragments created by both of us: in her words,

'...when you put things together and they work.' - Rachel

She also expressed an enjoyment in experimenting with programming electronic instruments but considered them limited in satisfying the moment-to-moment haptic pleasure of playing, stating,

'all that stuff is really cool but you can't really play it, not like the drums' - Rachel

This frustration with the haptic and expressive limitations of electronic instruments is well-documented among musicians (Stuart, 2003) and provided a useful starting point to consider how the new work might be controlled, suggesting that in order to create a satisfying playing experience, it would be necessary to look beyond traditional electronic interfaces.

2.3.1.5 Working Practices

In all of the phases of our work, a great deal of non-verbal communication, combined with shared knowledge is vital. As performers with years of shared experience, our rehearsal and writing sessions feature very little spoken communication between us. Instead, an assumption of shared goals and the development of a 'groove' is used to drive the creation of the work. When interviewing Rachel, she stressed that for her, our writing and rehearsal sessions were the part of the work which typically yielded the most enjoyment. Having identified moment-to-moment aesthetic satisfaction as a major goal of the work, it was necessary to examine the specifics of these sessions.

The vast majority of our work begins as individual songs, composed jointly in the rehearsal room. These begin life typically as song fragments or snatches of lyric written by either Rachel or myself. During writing sessions, these ideas are played by the writer while the other musician at first listens carefully and then selects an instrument and adds their own response. The idea is jammed together; additions are suggested, sometimes verbally but more often through playing, and the piece gains momentum. During this time, the piece is fragile, we are both careful to tread lightly, so as not to lose sight of the original idea, disturb the flow of playing or exclude the other player's ideas. As discussed earlier, these rehearsal and composition sessions account for the greater part of the time we spend working together and for Rachel were the most rewarding part of the work.

During these sessions we talk over the music, dance, and stop to discuss particular points and affirm or express reservations over particular developments. For these sessions to generate satisfying material, we strive to achieve a sort of liminal state, a degree of un-self-consciousness, focus and dis-inhibition which allows us to share very personal ideas and stay in the groove: responding quickly to each other's decisions. When attempting to describe this process, I recorded one of our practice sessions to analyse how communication takes place between us. The results were surprising in terms of how little we communicate verbally. Far more communication takes place through nods, grimaces and simple 'yes', 'no' and 'uh-huh' statements. From these simple cues, our deep familiarity with each other allows us to communicate complex information about how we feel the session is progressing. A nod could mean that a particular riff is working, or that the other player has found a solution to a musical problem. A grimace or hiss means that what is happening is not what one of us is looking for, or that one of us is struggling to articulate an idea.

This method of working is clearly very different from formal design processes. There is no set goal: other than a continued contribution to a growing body of work, neither is there an articulated specification. Instead, the process of jamming itself and the aesthetic satisfaction achieved through crafting a coherent and engaging piece of music are the main structuring elements. We rarely know what type of song will emerge from the ideas we began with and in many ways this is not the point. The progression from idea to finished artefact is as much a structuring strategy through which to keep the project moving and thus generate more opportunities for playing and performing.

2.3.1.6 Technical and Logistical Factors

These motivations behind our practice must of course be balanced with a number of practical constraints. As performers working at grass roots level, we are usually responsible for most of the organisational details of the concerts we play, negotiating to play in the first place, organising equipment, transporting and setting up not only our own rig but also the venue and working with other bands to ensure the success of a particular venture. As a duo, this means that we are often extremely stretched in terms of time and resources. Our work is limited chiefly by the amount of time we are able to spend playing, with economic considerations and our own skill as musicians also coming into play. In examining our work more closely, it was vital that we were fully aware of how these factors affected our work at a day-to-day level. These findings could then be fed into the planning of the new work but more importantly, compared to the work of other musicians. Logistical and technical factors were entangled within all aspects of the performance experience and were often - given our different levels of technical expertise - a source of anxiety. When asked to describe the process of performing a concert in its entirety, Rachel's first response was,

'There's lots of carrying things involved.' - Rachel

She also spoke of disliking the recording phases of our work due to the numerous technical issues surrounding our use of a shared recording studio.

'I find recording difficult, just because of the equipment in that building and it just not being set up and having things all over the place'. - Rachel

These small-scale practical problems were, for Rachel, disruptive enough to dispel her enjoyment of what is an important activity for musicians. This indicated that, in developing the new work, particular care must be given to these seemingly minor disruptions.

2.4 Conclusion

The process of self-reflection described here provided a number of insights into my own and Rachel's motivations and views on our shared practice which were useful in setting a specification for the projects to follow. A number of solid design requirements had emerged which would suggest how to begin developing new work. By discussing our personal motivations in working together, it was possible to formulate a set of minimum requirements that soundtrack-controlled cinema pieces must meet in order to add value to our performance practice. Again, these requirements were surprisingly concrete: to build on the sense of a coherent experience, to allow deep engagement on the audience's part in

order to best communicate our ideas and most importantly to support a satisfying playing experience, through haptic pleasure and support of 'groove'.

The strategies used to create our music, once articulated also suggested methodologies we could use in the development of the project in order to support these objectives. In particular, the use of jamming and a live collaborative creation process which stressed intuitive processes and moment-to-moment decisions seemed particularly appropriate to creating work in this domain. Rachel's views on the structure of our collaboration were of particular interest, not solely because they suggested working practices we might expand upon but also because they surfaced anxieties and tensions within our collaboration which might prove problematic if ignored. In particular, it would be important to address the question of our respective roles carefully in the coming work so as not to provide a source of frustration for both of us.

The process also surfaced insights which also suggested technical and practical considerations for the design of systems and interfaces. Once again, flexibility and an ability to respond quickly to live processes emerged as paramount but also the creative affordances of musical instruments was a key factor. This would be borne in mind while considering the creative and theoretical structure of performances we might make and applied rigorously in the design of technical supports for those performances. They would also be used as a basis for comparison during phases of the work which involved other musicians.

3 Hybrid Performance

3.1 Introduction

This project began initially from a simple question: how to map musical action to cinematic action through a technological interface. In considering how to achieve this, it was necessary to analyse the complex and interwoven factors at work during musical performances and film presentations, and the technologies used to support both. For soundtrack-controlled cinema to be feasible, the interface between the two spaces: the physical in-the-moment 'live' space of the performer and the notional, narrative space of the film would need to be selective, favouring some inputs and outputs, while playing down or disregarding others.

In this chapter, film and live music are considered in the context of their presentation, taking into account the way they are experienced in time and space. A particular challenge in considering film as part of a performance project is the dominance of classical cinema in film studies and the assumption of a standard and fixed model of viewing: that of the movie theatre. To understand what might be involved in combining these forms in a new way then, it is necessary to look at fields other than music and film, at other art forms and other ways of understanding their constituent parts.

Developments in theatre, digital live art and audio/visual performance are explored with relation to how they might inform the development of a new form of hybrid performance, comprising live music and cinema. Also discussed are features from cinema's historical antecedents, which have much in common with the aims of this project. Much of the literature from both live music and film assumes that many of the conditions under which they are experienced are fixed points and indeed, such is the strength of the cultural codes surrounding viewing cinema and music as an activity, audiences themselves- as we shall see - reinforce these assumptions.

This chapter also includes an account of the decisions leading to the development of an interface which uses musical instruments themselves as control surfaces, substituting direct low-level control for a higher-level interpretive interaction scheme. Ideas from the burgeoning research field of new interfaces for musical expression are discussed and compared to approaches which use augmented or traditional instruments. Existing technical supports which already allow integration of video and audio are also covered and the limitations of these tools when applied to soundtrack-controlled cinema are considered.

3.2 Dimensions from Hybrid Performance

Since the advent of cinema and television, there have been many experiments in live art, theatre and music performance which have combined screen-based and live performance elements. Hybrid art forms which comprise elements of the live, the technologically mediated and the recorded, are not solely a product of the digital age; indeed many pre-date photography (Castle, 1988). The ways in which these media work in context offer useful models for combining narrative film and live music.

3.2.1 Engagement with Cinema and Live Music

Viewers of a new media invariably understand them in terms of existing media (Bolter and Gromala, 2005). This re-mediation (apprehension of a novel form through familiar codes) can be seen in early cinema, television and live art; and can be used as a tool with which to leverage specific types of engagement. It seemed likely that soundtrack-controlled cinema would be read in terms of cinema, live music, or digital live art or all three in combination depending on the viewer's prior experience. If the work was to be successful against the criteria established in Chapter 2, it was important to consider how viewers could be persuaded to engage with it.

As different art forms leverage different methods of engagement, approaches from a number of media are relevant to this project. In comparing primarily visual and primarily auditory media, it was first important to acknowledge that for human beings, sound and images are experienced in very different ways. Even within film, the ways in which the viewer hears the soundtrack and views the image track differ in a number of important ways. Images occupy a specific and finite point in space (Chion, 1994). In a film presentation, the image is contained within the confines of the screen and cannot exceed it. Although large and brightly illuminated, it inhabits the space in which it is shown and no other. If the viewer looks away or closes his or her eyes, it vanishes. For this reason, film and indeed most screen-based media, require the viewer's undivided attention and are unable to work if the viewer is occupied in looking elsewhere.

By contrast, in modern film theatres, sound comes from speakers on all sides of the audience and is not usually especially sensitive to the listener's position: it permeates the space. Even at a rock concert, where sound emanates directly from the stage, the aural environment is far less specific than the visual. Fans may compete physically for a good view of the act, but do not usually need to seek out a 'good view' of the sound (Chion, 1994).

This difference in the way that we engage with media on a sensory level has a powerful effect on the way that certain media have developed, leading to highly conventionalised models of engagement, with which audiences are very familiar. Film viewers, are conditioned to engage with films in a specific way, voluntarily and with little prompting. Film-makers, even in the age of the DVD, can assume that their audiences will watch their work in a particular way: sitting quietly in rows in a darkened auditorium while the film is displayed using a high quality projector on a large, rectangular screen (Chion, 1994).

This privileged relationship that cinema has with its audiences is no accident but is rather the result of a century of careful management by film distributors and cinema managers. Early film programmes were marketed along the same lines as Vaudeville shows and audiences were correspondingly boisterous. Talking, laughing and cheering throughout performances were considered perfectly acceptable: a situation very different from the reverent silence of modern cinema (Gunning, 1990). In early silent cinema, sound quickly became an important tool; deployed not only for aesthetic and narrative purposes but to fulfil a number of practical purposes, from covering the roar of the projector (Brown, 1994), to establishing an aural background which would both set the mood and prohibit conversation. Music was used to reinforce a certain type of viewing. Just as a Vaudeville compere might prepare the audience for a certain type of appreciation (cheering for a comedian or hushed expectation for a conjuror), so music was intended to lead the audience in viewing the film in the 'correct' way (Gunning, 1990).

Film viewing then, is subject to conventions which have become rules. In considering variations on cinema's form it is important to consider the most common of these carefully.

- The film will be seen in the dark.
- The audience will be silent (except for laughter or the occasional scream).
- The audience will be comfortably seated (and provided with snacks to quell any distracting hunger).
- Attention will be squarely on the screen.
- The film will be watched from beginning to end without interruption.
- The start and end will be clearly indicated with titles, credits, censors' cards and advertisements.

As cinema is a recorded media, these rules cannot be enforced by the artists who made the film. Instead, cinema goers are familiar with how to engage with cinema and effectively

govern themselves, to the point where noisy or disruptive viewers may be hushed by their fellow audience members.

Genre and recognisable styles also help the engagement process. Through familiarity with cinematic genres such as the horror or the musical, audiences begin to engage with the work already aware of which set of cinematographic and narrative devices to expect (Altman, 1999). Directors are able to use these expectations in a number of ways: either reinforcing or elaborating on the stereotype, or subverting it through the deployment of devices from outside the genre. Cinema audiences, enter what is often termed a 'willing suspension of disbelief' (Coleridge, 1817). Structures such as form and genre help this transition, hastening engagement and encouraging dis-inhibition (Grant, 2007).

In live music, engagement is equally dependent on convention, style and genre. In concerts and music festivals, musicians, lighting technicians and sound engineers constantly work with and against rapidly changing visual and auditory environments to keep the audience engaged, adjusting sound levels, changing lights and in many cases directly communicating with the audience (Thompson, Graham and Russo, 2005). Complex issues of content such as narrative, which may be intrinsic to the work, are difficult to manage on top of these immediate, urgent concerns. For this reason, conceptual threads from cinema and live music might not translate from one medium to another unchanged. Unlike film, different genres and styles of music assume different models of viewing. A list of ideal conditions for viewing music might contain the following points.

- Music should be seen in the dark, with the stage brightly lit.
- The audience should be comfortably seated
- The audience should be quiet.
- Attention should be squarely on the performer(s).
- The concert should be watched from beginning to end
- The start and end will be clearly indicated by changes in lighting, the emergence of the musicians from backstage and direct communication with the audience (bows, smiles).

Applied to any music event other than a classical recital this list reveals a number of obvious generalisations. For rock, folk, pop or experimental musicians, finding the combination of audience and venue that fulfils the conditions of this list might be either a utopian and unattainable vision or a horrible nightmare. At festivals, folk gigs and rock

concerts, audiences are carefully and actively managed to maintain states of engagement which are peculiar to each (Moore, 1993). Just as loud conversation is considered unacceptable during classical concerts, silent appreciation at a punk rock gig is also deemed inappropriate. Again, awareness of genre and style is a key factor here. Such is the cultural reach of musical genres through the media that people are fully aware of what to expect in terms of engagement before ever attending a concert (Moore, 1993).

3.2.2 Other Models of Viewing

The viewing model for live music then, is often more flexible than that of cinema, however other models also exist, which privilege the audio over the visual or vice versa. Building on experiments in theatrical form in the 1950s and 1960s, theatre groups such as Punchdrunk (White, 2012) have pioneered forms of immersive theatre: unscripted audio-visual performances which often involve participation by the audience. Works such as *Faust* and *It Felt Like a Kiss* abandon conventional proscenias for large-scale environments in which actors, sound effects, lighting and sculptural objects are arranged to form a holistic experience. These pieces explore the role of the audience, assuming little about their behaviour and attempting to elicit new forms of spectatorship and new relationships between audience, players, space and narrative. Often the role of the audience is fluid and liminal, moving between participation and passive spectatorship many times during a performance.

This approach of support-through-environment has also been used by groups such as Secret Cinema (2013), who produce 'film performances', where a familiar movie is augmented by live elements, in theatrical set-ups which precede and surround the viewing of the film. In Future Cinema's (2013) productions, the presentation of a film is surrounded by elaborate sets and actors. In a recent showing of *The Shawshank Redemption*, movie goers were driven to a specially prepared theatre in a vintage prison bus, guided by actors who remained in character as prison guards. The experience extended to the audience being ordered to change into prison uniforms. In this way, live and environmental elements were used to lead the audience into a deeper or at least more exciting engagement with the film than they might otherwise have had. Of particular note is Secret Cinema's collaboration with singer/songwriter Laura Marling. To promote the launch of her album *Once I Was an Eagle*, Secret Cinema and Marling created an elaborate production around a series of concerts, set within an imaginary 1920s hotel (see figure 3). Concert goers were requested to dress in period clothes and were greeted at the venue (a grand Victorian

building) by actors before being allowed to explore a number of themed rooms which related to songs from the album.



Figure 3: A room from Laura Marling and Secret Cinema's concert series around Marling's album Once I Was an Eagle.

Unlike much film theory, theorists in performance studies, have in recent years attempted to extend their understanding of engagement beyond the stage itself. Schechner's (1988) work on performance attempts to place theatre in an ethnographic context, not only exploring its roots in other cultures but also examining how it is consumed in first world societies. Schechner's account includes discussions of audiences' interactions with each other in the theatre before and after the performance, their conversations in the foyer and on their journeys to and from the theatre.

3.2.3 Immersion and Appreciation

Classical Hollywood cinema has been characterised by a number of commentators as essentially voyeuristic. In Hollywood films, the camera is an invisible and unacknowledged presence, through which the audience spectate on actors who never seem to realise they are being watched. Its model in this sense is conventional theatre, where a silent audience watch characters interact with each other, through the frame of the proscenium. As Shechner puts it, '...literally the audience is in one room looking into another' (1988). By contrast, earlier forms of mediated entertainment referenced other theatrical forms such as Vaudeville (Gunning, 1990) where the mode of presentation was exhibitionist rather than immersive: appealing directly to the audience rather than requiring a willing form of immersion.

The earliest projectors, known as magic lanterns, used a light source such as a candle, an

image and a glass lens to project huge and often terrifying images in the darkened space of a theatre or church. As early as the 15th Century, inventors and experimenters, including members of the church were using these devices to instil fear of the devil in their audiences and congregations (Castle, 1988), illustrating their sermons by throwing coloured images of demons and ghosts. The phantasmagoria shows which evolved from these presentations, are important in the history of technological theatre in that they invariably used combinations of narrative and spectacular effect to create hybrid viewing models. Many of these shows were formulated as re-mediations of established and familiar forms such as psychic séances and played upon the gothic and supernatural themes beloved of Victorian audiences (Castle, 1988). Narrative and effect were used to create a state of engagement where the viewer would oscillate between immersion in the story and objective appreciation of the craft or novelty of the effects. Again, these shows were a hybrid form of theatre, where pre-prepared audio/visual elements were used to augment a live show led by real actors (see figure 4).



Figure 4: An 18th Century Phantasmagoria

A legacy of this is apparent in spectacular cinema genres such as science fiction or action-adventure, where events are to a large extent pushed outwards towards the audience as explosions rush at the camera or the viewpoint is suddenly hurled after chasing cars. Eisenstein (1974) refers to these 'units of impression' as 'attractions'. Gunning (1990) comments that 'the cinema of attractions directly solicits spectator attention, inciting visual

curiosity, and supplying pleasure through an exciting spectacle – a unique event, whether fictional or documentary, that is of interest in itself'. In this type of cinema, narrative in the classical Hollywood sense is relegated to a supporting role or dispensed with altogether, at least temporarily. As Gunning puts it, 'The cinema of attractions expends little energy creating characters with psychological motivations or individual personality' (1990).

In considering soundtrack-controlled cinema, this state of oscillation between immersion and appreciation might be a key to engaging audiences with both the performance and narrative elements. Rather than attempting to achieve a homogenous level of immersion, audience attention might be allowed or encouraged via various devices to travel between performer and screen during a show.

3.2.4 Constructing Space

Classical Hollywood cinema, as the dominant narrative form of our time, has a powerful effect on the way we consume other media, especially with regard to the way in which it allows the construction of space. Mid-20th Century accounts of early cinema often cite the influence of conventional theatre on the development of film, citing the resemblance of the screen to the proscenium arch and the staging conventions and wide-shots featured in many early films to those of theatre, however Gunning (1990) repudiates this claim, drawing attention to the deep fields, changes in angle and variations in time featured in the very same pictures: features that could never be realized in theatre. Early film-makers were quick to exploit the plastic possibilities of space in film, realizing that the camera could be used not just to record the appearance of a place but to synthesise new spaces from it. By editing and framing and through special effects a set could become tiny or huge or could totally change its spatial configuration.

In many multi-media and performance art-forms, this construction of different spaces and the relationships between them forms a subject of the work. Dixon comments that 'This sense of in-between-ness - a liminal space operating between the screen images and live performers - is often the essential kernel, what one might even call the 'meta-text' of digital theatre production' (Dixon, 2007). Many multi-media works from the 1960s onwards explored established conventions from TV and cinema, playing with notions of linking spaces. Artists such as Carolee Schneemann explored which combining live performance with recorded video elements, using TV screens and projections in unexpected ways. In *Ghost Rev* (Schneemann, 1998), the space of the screen and live actor are combined in one site as the human body is used as a projection surface, a strategy which once again made

the materiality of space both medium and subject.

Combining different types of space in the ways discussed above, predates cinema and indeed photography, again having its roots in magic lantern shows and phantasmagoria (Castle, 1988). In these shows, primitive projection devices were used to create illusory figures and spaces, layered onto physical sets. Once again, the materiality of this layering of spaces was key to the narrative content: the spirit world overlapping the real world, or the past invading the present. In combining narrative film and live performance then, these approaches suggest ways in which the viewer's engagement with the audience might not only be managed but might form part of the structure and subject matter of the work.

Practitioners in interactive media, including video games and immersive forms of theatre, have developed the concept of the *narrative environment* (Jenkins, 2007) where the details or structure of a space can be used not only to provide a psychological setting for the action but can also structure it in narrative terms. The 3D environments of video games are used not only to contain the action but to structure the way in which the player experiences it, allowing them access to different parts of the narrative at different points. In the *Bioshock* series (2K Games), the story unfolds as the player makes their way through the game's environment, each element of the action triggered by their arrival in a new part of the location. In Punchdrunk's immersive theatre productions (Punchdrunk, 2013), episodes of the drama play out in different parts of the performance space (White, 2012). The narrative experienced by each viewer is different as they make their way between episodes and experience them in different orders and contexts. In both these cases, contextual detail and even major parts of the story are provided not just by the action but by the space and its contents, as the viewer discovers landmarks and objects relating to the plot.

3.2.5 Narrative and Temporal Structures

Mainstream cinema in the early 21st Century is dominated by a single form: the feature film, which is remarkably homogenous in terms of the way it is intended to be viewed. Of the 385 Hollywood films released in 2012 over 90% were between 1:30hr and 2:20hr, over 95% were in colour and the vast majority were shown as a single presentation (IMDB, 2013). Commercial cinema in the Hollywood tradition is dominated by conventions in plot, characterisation, subject matter and exposition (Bordwell, Thompson, 1997), often following well-established structures such as the hero's journey described by Campbell (2008). Classical Hollywood narrative typically comprises a set of initial conditions, conflicts and resolutions (Bordwell, Thompson, 1997). Actions are usually presented in

temporal order and most relate to a central plot (Bordwell, Thompson, 1997). Few events are unexplained and the linear format of film means that the film-maker has control over the order in which the events of the narrative play out.

Time as well as space is mutable in cinema. Early films, such as those of Méliès, borrowed much of the trickery and spectacular effects of the preceding generation of phantasmagoria, adapting them to manipulate time in various ways (Gunning, 1990). Stop-tricks (where the camera would be stopped to allow the 'disappearance' of a character), mattes and variations in speed represent the first uses of a medium in which linear time could be constructed in a non-linear fashion without the knowledge of the viewer. In time, the familiar editing devices of modern cinema: the cut, the fade and the dissolve evolved from these techniques (Gunning, 1990).

Before the emergence of the feature film, cinema goers were often presented with a programme of films: often unrelated pictures by different directors, which would sometimes range from documentary to classical drama, to genre films of the period such as magic shows (Gunning, 1990). Again, Vaudeville's influence can be felt here, as a theatrical director was needed to 'compose' the show from these disparate elements, melding them into a structured programme of entertainment. This creative relationship between film director and cinema is of course very different to that existing today, where cinemas receive the film, its soundtrack and corollary marketing material directly from the distributor.

In early cinema, music would usually be performed live, with large cinemas retaining full time orchestras (Chion, 1994). These ensembles would, in the very early days of cinema, perform scores which their musical director would piece together from popular tunes of the time. Through this creative improvisation and re-contextualisation, film programmes of the 1920s had almost as much in common with today's VJ shows as with the fixed formats of modern cinema presentations. In these disparate presentations, music was often used as a linking device. Chion (1994) describes music's ability to function as a kind of 'auditory bath', unifying disparate imagery into a coherent whole (1994), however music was not the only way in which early cinema directors imposed narrative and structure on their productions. In some programmes, lecturers were employed to 'narrate' the programme, constructing a narrative structure in real time. King (1984) reports that in many rural communities, this practice continued until recent times, with projectionists composing improvised commentaries. In other shows, actors behind the screen would attempt to

provide a synchronised live audio accompaniment.

More recently, digital artists, film-makers and researchers have experimented with composing narratives in real time. Lev Manovich, in his *Soft Cinema* project, experimented with databases of pre-rerecorded video clips to create multiple narratives from the same dataset (Manovich, 2005). Research projects such as Canadian Film Centre's Interactive Narrative Feature Program have paved the way for interactive film productions, relying on recombining pre-shot material (CFC, 2013).

3.2.6 Relationships between sound and Image

The project described here is rooted in theories around performance which predate the digital age by several hundred years. Composers as early as Handel experimented with live music presented alongside other media. Handel's *Water Music* and *Music for the Royal Fireworks* suites were both intended as site-specific works (Hogwood, 2005), each providing a musical centrepiece for a court event. Music for the royal fireworks in particular was to form part of a spectacular show featuring music, fireworks and a specially built architectural space to house the musicians.

Much later, Wagner, in *The Artwork of The Future* (1895) theorises that in antiquity, drama, music and the visual arts were considered part of an integrated whole. In his words, in modern times, 'The drama separated into its component parts — rhetoric, sculpture, painting, music, and so on, forsook the ranks in which they had moved in unison before...' (in Schroeter, 2010: 115). Wagner's conception of the *gesamtkunstwerk*: the total artwork in which music and the visual were integrated into a dramatic presentation, informed the staging of a number of his operas, which featured elaborate costumes and stage effects. Within this theory, even architecture was viewed as a tool in service to the artist's vision, having no greater purpose than to frame the total artwork. Wagner imagined new and innovative spaces to present opera, most notably the Bayreuth Festspielhaus; a theatre built specifically to host the large orchestras and elaborate stages of his own works (Kawanishi, 2013).

In the early 1700s, the mathematician Castel, began to develop a theory of 'colour melodies' (Peacock, 1988), a system of abstract associations between sound and colour. In 1725, he developed an 'ocular harpsichord' in which small curtains opened when the keys were pressed, allowing 60 panes of coloured stained glass to affect the colour of light passing through them. Castel's work was a source of inspiration for countless subsequent

artists and scientists, sparking the development of colour organs, or light organs, well into the 20th Century (Peacock,1988). Rimington, in 1912 published the treatise 'Colour Music' which developed these ideas further (Peacock,1988). In 1915, Alexander Scriabin premiered the performance 'Prometheus, The Poem of Fire' (Peacock,1988), a musical piece scored for piano, orchestra, optional choir, and Chromola, a colour organ developed by lighting engineer Preston Miller.

This research also draws upon theories from the silent cinema which emerged from the turn of the 20th Century and was the dominant form of film until the 1920s. A notable feature of this type of cinema was, as King writes, that it was never actually silent but was, from its earliest days, narrated, accompanied or even voiced by actors behind the screen (King, 1994). In today's cinema, sound is usually considered subordinate to the image. Ironically, in the years of silent cinema, sound and especially live music was one of the major determinants of the medium (King, 1994), indeed film was considered to have more in common with music than theatre. King comments that a definition of cinema as a 'the music of light'...became an accepted term in writings about film in the 1920s'.

The development of synch sound allowed film studios to homogenise the soundtracks to the films they distributed, ending a creative industry which had grown up around film music. However, in the 1960s and 1970s, the growing psychedelic movement led to a resurgence in experimentation with live music and projected film, with rock performances increasingly augmented with dynamic lighting and film projections. 'Liquid light shows' were created to accompany concerts and night clubs, during which, visual art and light groups such as the Brotherhood of Light (Faulkner, 2006) would perform alongside musicians. The idea of a performance as a holistic experience rather than existing within the frame of a screen or proscenium was explored in events and 'happenings' where artists from different disciplines would improvise in collaboration on multi-sensory events. *The 14 hour technicolor dream* (Barry, 2010) is among the best known of these. Taking place in Alexandra Palace in 1970, this event is particularly striking in combining on a monumental scale, live music (from several acts in the same space), narrative and non-narrative films projected in parallel, light shows and theatre, the combination of which was largely unrehearsed and improvised.

This fluid relationship between live music and film has, in the intervening decades, become increasingly common as musicians and VJs compete to find ways to heighten the impact of their performances (Eskandar, 2006). Recent changes in the economic models

around live music mean that concerts are now the most commercially significant parts of many professional musicians' practice as digital distribution makes it increasingly difficult to make recorded music profitable (Smirke, 2013). This trend has led to the emergence of artists whose live shows are as much a visual as an auditory experience. Swedish duo *The Knife* for example, currently tour with a collective of visual artists and dancers, who direct a complex audio/visual show around the band's music (Fox, 2013).

The practice of VJing possibly offers the closest analogy to the project described in this thesis. VJs typically combine techniques from cinema with those of music production, however, in VJ practice, the relationship of visuals to music is often the opposite of Hollywood cinema, with artists providing a live visual accompaniment to pre-recorded music. In *Lights::Video:VJ*, Eskandar comments that in this space, the improvised combination of multiple visual languages is the norm. Much VJ practice involves remixing and re-appropriating found footage and pre-prepared material, forming new aesthetic relationships between texts. For Eskandar, the recombination of familiar visual codes is one of the VJ's main tools for engagement (Eskandar, 2006).

In a similar vein, experimental musicians such as composer Michael Nyman have explored the relationship between film and music through re-composing their own live scores for silent films. Nyman's concerts are often presented as part orchestral performance and part cinema screening, offering new interpretations of established and well-known texts. Once again these events aim to engage by combining familiar forms in new ways, however Nyman also stresses the importance of liveness (Nyman, 2010). In particular he talks of the exertion of the orchestra in difficult passages of music as provoking tension and excitement.

3.3 Interactions and Interfaces

The previous sections suggest ways of framing soundtrack-controlled cinema work in terms of space, narrative, content and audience engagement; all of which might be applied to the development of performances. Of equal importance to this research was considering how to design technical systems and interfaces to enable performers to exercise control over narrative visuals without losing anything from the embodied, in-the-moment musical performance.

In recent years, the way that people engage with media has become a focus of interest for many researchers in interaction design. Live digital performance in particular has long

been considered a fertile ground for research in human-computer interaction, as it combines multiple multi-layered transactions between people and machines (Boehner, Sengers and Warner, 2008). Consequently, literature from this field presented a set of useful and pragmatic filtering structures to understand what takes place in a digitally mediated performance. As discussed in Chapter 2, attaining a deep understanding of the complete context of a digitally mediated performance was by far the most challenging aspect of this project, as it relies on an objective understanding of a deeply subjective experience.

The motivational aspects of pleasure in music-making described in Chapter 2 can be usefully considered in terms of Mihaly Csikszentmihalyi's concept of flow (2002). Csikszentmihalyi theorises that a person's enjoyment of an experience is tightly bound up with qualities of immersion, focus and a reduced awareness of the passing of time or factors 'outside the moment'. He suggests that a number of factors make up a state of flow, several of which are qualities which musicians commonly strive to attain. Features such as an intense and focused concentration on the present moment, a merging of action and awareness and a sense of personal agency over the activity (Csikszentmihalyi, 2002) neatly summarise many of the motivations behind my own creative practice. However, Csikszentmihalyi's description highlights one of the chief problems for performers involved in research: a loss of reflective self-consciousness. In incorporating one's own creative practice into the reflective space of a research project, this presents obvious problems.

A helpful framework through which to explore the more subjective aspects of music practice was provided by McCarthy and Wright's approaches to viewing technology as experience (McCarthy and Wright, 2004). Their 'threads of experience' model involves breaking down the complete and potentially overwhelming detail of experience into 4 thematic threads. These are given as compositional (referring to the structural elements of an experience: narrative, causal relationships and explanations of actions), sensual (relating to the immediate sensory effect of the experience: how we grasp it in a visceral way before subjecting to conscious reflection), emotional (describing what emotions colour the experience for us) and spatio-temporal (relating to the way the experience is sensed in terms of space and time. During an experience, time may seem to slow down or speed up, space may contract upon us or expand away from us).

In describing interactions occurring in digital performance pieces, Dix, Sheridan et al.

attempt to map the space in which the action takes place (2005). They draw upon the concept of a Performance Frame from Bateson (1955), using it to describe the entire context in terms of its psychological components, boundaries, rules and conventions. Benford et al. takes this mapping further, presenting a number of useful framings of live media performance, exemplified in their accounts of the participatory art works, *Desert Rain*, *Uncle Roy All Around You* and *Day of the Figurines* (2002). They consider the structure of viewer experiences in terms of trajectories: four dimensional journeys in space and time, describing these as consisting of four key facets: Space, Time, Roles and Interfaces (Benford et al, 2009). The interaction between these facets determines the way in which viewers experience (in their case largely open-ended) performance works.

Benford discusses managing these trajectories to incorporate features which are often not explicitly considered in the design of performances: transitions between states (for example between queuing before a presentation and the start of the show) and how these can be managed 'in character', maintaining a sense of continuity in order to enable visitors to maintain their engagement with the work. Interestingly, Benford (2009) also suggests steering these trajectories into different types and levels of engagement to both facilitate different types of interaction and to practically manage limited resources. He stresses that full and deep engagement in all parts of the experience is not necessarily vital at all times. This opens up interesting approaches for steering the audiences' attention between screen and performer, rather than relying on a constant seamless integration.

In the context of this project, however, a voice is missing from Benford's account. Although the practical considerations of live performance (such as integrating flaws in the underlying infrastructural into the experience) are included, the effect on the designers and performers leading the experience is missing from the equation. The trajectory of the performer in relation to the audience and the feedback loop between the two (or at least how it is perceived by the performer) is not discussed.

This is particularly problematic in considering where and when the performer's trajectory through an experience begins and ends. Although Benford stresses the importance of beginnings, endings and transitions in his account, the exact position of these in both space and time seems fragile. For the viewer, his or her appreciation and apprehension of a performance may well be coloured by experiences surrounding the performance. Was it experienced as a unique piece, or as part of a festival or programme of events? Did they experience inconvenience, hardship or distraction on the way to the event? For the

performer, this is potentially even more important. Factors hidden within the performance set-up, or seemingly outside the temporal and spatial scope of the piece may have a profound effect on the work. A particularly challenging or stressful preparation phase for example, may affect a musician's performance hours later. Likewise, following or preceding another musical act might also have an effect on the proceedings. In this research then, Benford's theories would need to be extended to take into account, in the most practical terms: the place of each artwork and performance within the musicians practice as a whole.

3.3.1 Dedicated Control Surfaces

In designing a soundtrack-controlled visuals system, a number of approaches were considered for the design of an interface between system and musicians. An obvious solution to the problem of how to control videos while playing instruments was to use or adapt existing electronic control surfaces. Many multi-purpose interfaces are available to electronic musicians taking a bewildering variety of shapes and forms. Most of these comprise familiar controls - knobs, buttons and sliders - and the vast majority use MIDI to connect to other equipment. Despite being superseded in terms of functionality and flexibility by more recent protocols such as OSC (Wright, 1997), MIDI remains popular due to its unparalleled inter-operability, enabling nearly all electronic musical instruments and controllers made in the past 30 years to communicate with each other (Penfold, 1988).

Some commercially available interfaces are particularly appropriate for audio/visual control, taking advantage of the increasingly blurred distinction between live production, DJing and live instrumental performance. Some, such as the Tenori-On (Yamaha, 2005), JazzMutant Lemur (JazzMutant, 2008) and Kaos pad (Korg, 2013) rely on interaction techniques from other computer technologies: trackpads, touch surfaces of various kinds and keys. The sheer number of commercial entities marketing these interfaces coupled with musicians' desire for individual means of expression means that inter-operability and flexibility is a key concern. Technologies such as VST (Virtual Studio Technology) allow musicians to use computers to easily set up subtle and expressive control of the quality of sound and type of interaction they wish to have with their instruments (Steinberg, 1996). Commercial software aimed primarily at VJs, such as Resolume (Resolume, 2013) and Motion Dive (Motion Dive, 2013) is also widely available.

In addition to commercial solutions, there exists a thriving research community dedicated to developing new ways of controlling audio/visual media. The prototype instruments

developed by this community often offer a far greater range of possibilities in terms of sound or visual output than traditional acoustic or electric instruments. Bongers et al's *Video Organ* (2002) project in particular presents an interesting attempt to address the problem of multiple types of mapping and their specificity to an individual piece of work. The Video Organ, instead of consolidating expressive features in a single interface is composed of modules, called *instrumentlets*, each of which have a limited number of controls. A key part of composition using the Video Organ is composing the instrument itself, removing or adding affordances according to the requirements of the individual performance. Other research in audio-visual haptic control surfaces has included the *REACTable* (Jordà, Geiger, Alonso, and Kaltenbrunner), a multi-purpose interface which uses movable tangible controls to allow several artists to collaborate in performance. This interface allows flexible and emergent types of collaboration between performers, establishing spaces where artists can jam and improvise with each other.

Gesture-based interfaces have been explored extensively in recent years, used either as direct 1-1 controls or through interpretive schemes where musicians' physical gestures form the interface. An example of this approach is Hook et al's *Waves* (2013) an interface created during a long-term project working with VJs. A central problem of VJ performance as identified by the artists in his study, was legibility and the lack of communication with the audience afforded by the interfaces of the laptops they used in performance. Hook's solution was to make the composition process visible to the audience by providing a large multi-touch interface resembling an artist's easel upon which the VJs could assemble their work in real time. This interface was transparent and brightly lit, allowing the audience to see the VJ manipulating onscreen objects and composing the show (see figure 5).



Figure 5: Hook's Waves VJ interface.

Other projects have done away with tangible interfaces entirely, shifting the focus to the performer's own body. The work of Donnarumma et al (2011) uses small custom-made transducers to amplify tiny sounds made by the performer's muscles. Tanaka has explored a wide range of technologies from accelerometers in mobile phones (Tanaka, 2010) to custom built harnesses featuring sensors for galvanic skin response (Tanaka, 2000). The resulting interfaces are all designed to leverage intentional movement by the performer as a way of controlling audio.

3.3.2 Augmented Instruments

In the context of this project, most of the interfaces described above have one problem in common. All of them are designed to be used by a dedicated operator whose main task in performance is manipulating the interface. To ask musicians to substitute their own instruments for new interfaces is far from trivial. Using only the example of my own practice, the problem can be clearly seen: I would be abandoning instruments which I have nearly 30 years of experience playing, instruments that – as is discussed later on in this chapter – bring with them a host of cultural and social signifiers which are deeply intertwined with the identity of my practice. This approach would at least constitute a complete reconfiguration of musical practice for any musician considering it.

An alternative approach is to add additional features to existing instruments. The IRCAM Augmented Violin (Bevilacqua et al, 2006) and Overholt's Overtone Fiddle (Overholt, 2011) represent different slants on this approach. The Overtone Fiddle project and its predecessor the Overtone Violin is conceived as a new musical instrument, leveraging playing techniques from the classical violin. In this project, the violin's sound generating capabilities are extended via the addition of a slew of extra electronic features: magnetic pickups, a bow equipped with a directional sensor, an iPod touch for providing accelerometer and gyroscopic data relating to the instrument's movements and a transducer inside a second resonating body mounted under the instrument that allows injection of audio signals back into the instrument. The authors suggest a range of ways in which these features could be used for new musical compositions and playing.

This approach is less radical in terms of reconfiguring musical practice and offers much in terms of controls, however using these extended instruments to control narrative video raises another problem. Musicians engaged in the act of performance have their hands full, both literally and figuratively: they have a limited cognitive 'bandwidth' for performing

complex interactions. Newton and Marshall's (2011) study of augmented instruments found that adding to the cognitive load of a performer with even a small number of extra controls can cause negative effects, causing mistakes or breaks in the flow of the music. Augmented instruments allow the musician to overcome some of their physical limitations (having only two hands being the main obstacle) but would be unlikely to help a player fully engaged in music making to also consciously control video.

3.3.3 Existing Instruments as Interfaces

Upon considering various interaction schemes, it became clear that a third way was available. Musical instruments are themselves highly complex and expressive interaction devices, which musicians are expert at exploiting. Musicians' relationships with their instruments are highly complex and are rarely limited to their capability for producing sound. Magnusson and Mendieta (2007) describe an extensive survey exploring musicians' relationship to their instruments, both digital and acoustic. Their findings emphasised longitudinal aspects of musicianship over straightforward design considerations. Important features they identified include depth of understanding of the capabilities of an instrument and satisfaction in a gradual learning process. Many musical instruments take years to master and virtuosity in their playing is valued by musicians and non-musicians alike. The physical affordances of traditional instruments and their infinitely variable range of sonic possibilities means that even life-long players are still able to discover new sounds even in instruments they have owned for many years (Magnusson and Mendieta, 2007).

Music, especially in its live forms, is a social activity. Musicians and listeners are able to connect socially with each other through shared appreciation of its genres and languages (Frith, 1996). In classical music this is reinforced through an entire structure of taught convention: standardized examination systems, texts (in the form of musical pieces and seminal renderings of them by particular musicians) and conventional forms of presentation, through orchestras and other ensembles. In popular music forms also, conventions prevail in the way that music is taught, learned, practised and presented (Sloboda and Howe, 1992). Rock and blues musicians typically learn as children or adolescents through listening and watching established bands and emulating their playing and performance gestures. They extend and practice their skills through jamming with their peers in bands, the conventional structures of which have changed little since the 1950s (Bennett, 2001).

Musical instruments themselves are culturally complex artefacts (Waksman, 1995). The

instruments which dominate contemporary popular music such as the most common types of electric guitar made by Fender and Gibson along with a very few others, were mainly designed in the 1950s, using technology and materials available at the time (Waksman, 1995). A misconception held by many musicians in Magnusson and Mendieta's survey (2007) was that their instruments had evolved their modern-day shapes along ergonomic lines. Actually, the shapes of most of the string family of instruments were derived from attempts to provide stability of tone (Magnusson and Mendieta, 2007), often sacrificing ease of playing for this purpose.

This preference for particular instruments, regardless of their sound-generating affordances or how easy they are to play, depends on a mixture of convention, tradition, cultural and semiotic association and commercial pressure. Firstly, musicians taking up an instrument draw upon generations of knowledge, convention and aspiration (Sloboda and Howe, 2007), often identifying with great players and aspiring to emulate them. Secondly, the associative nature of music means that although traditional instruments might not be ideal sound-generating devices: for instance, not necessarily facilitating the production of perfect tones, this is hardly the point. In traditional genres such as rock and blues, guitarists rely on designs which have now been played by several generations of musicians. The flaws in their original design are known, cherished and often exploited in generating sound. The feedback and distortion through overdrive exploited by rock guitarists have become intrinsic to how the instrument is played, despite arising originally from the limitations of 1950s amplification technology (Waksman, 1995).

Musical instruments themselves vary greatly in their range of possible musical uses and interestingly the most complex are not necessarily the most versatile, especially in terms of usual modes of playing. The grand piano, with its hundreds of moving parts can generate notes of 64 pitches, and a huge range of amplitudes, each of which can be sustained or damped using pedals. Played with both hands, up to 10 of these notes can be combined in chords. A 20 fret acoustic guitar on the other hand, played conventionally, can generate 47 distinct notes, with up to 6 played at once. Typically, two hands are needed to produce each note on a guitar. Woodwind instruments seem even more limited as only a single note can be produced at once.

At first glance then, it would seem that even compared to conventional technological interfaces such as the mouse, instruments offer little range for control. However, in addition to these basic affordances many acoustic or acoustic/electric instruments support

not only variations in tone (accomplished on guitar by bending and pulling the string) and timbre (bowing Vs. plucking on a violin) but secondary sounds (such as striking the body of a guitar or double bass to add percussion). These sound-making affordances open up a huge range of possible controls. In addition, a range of affordable technological solutions exist which could help map the output of instruments to controls over video. MIDI pickups and converters for string instruments and affordable USB audio interfaces are all easily available and familiar to modern musicians and could be used as practical means to allow instruments to become control interfaces.

Also useful in considering how instruments might be used as interfaces to other technologies, is the standardisation of Western musical structures. The vast majority of tuned Western instruments are designed to play notes of the standard chromatic scale at concert pitch: that is to say a note of middle C, is exactly 261.625565Hz whether played on an oboe, saxophone, organ or guitar (Burns, 1999). In proposing a system for use by different instrumentalists, it makes sense to draw upon this standard specification, which in theory might allow support of a range of instruments with little or no reconfiguration.

Musical instruments then, have the potential to form flexible and expressive interaction surfaces. A large number of straightforward controls for our system could be envisaged using keys, strings or valves as simple switches or faders. This approach has the major advantage of requiring little or no new hardware for the musician and leverages haptic skills which they already possess. The digital performance piece *Yours* (Haffner, 2008) used a MIDI interface to enable a pianist to control video in real time. In this piece, certain piano keys were mapped directly to specific points in a video of a solo dancer. By playing the piano, the dancer's movements were re-edited in real time, with thousands of possible combinations. In 1987, Steina's *Violin Power* (Brew, 2006) had used a similar direct mapping using a video disc player and MIDI enabled violin to access frames directly through certain notes.

These approaches use direct 1-1 mappings of one medium to another, functioning in a predictable transparent way, along the lines of common interface devices such as mice and keyboards. However, to only consider musical instruments as simple control surfaces is to miss a huge range of possibilities. The output of musical instruments - music - comprises complex linguistic, narrative and gestural information which might be interpreted by an intelligent system as a series of high-level instructions. Using solely musical interactions with a visuals system during performance would allow players to draw upon well-

established haptic skills but also linguistic skills and modes of expression. To use a crude analogy, the difference between using individual notes as controls Vs. musical structures, could be compared to the difference between pressing a switch and running a program.

A key factor in considering high-level control as an alternative to this approach is legibility: how the link between manipulation and output can be read the audience. At face value, making the connection between visuals and music apparent might be considered a goal to aim for in designing an interface, however in this new medium, other strategies might be used. Reeves et al. provide a useful framing of public interaction with technology, characterising interfaces as secretive, expressive, magical and suspenseful (Reeves et al, 2005). Secretive interfaces hide not only the way in which the user manipulates them but also their effect. Expressive interfaces (a focus of much current HCI research) tend towards revealing or even amplifying, both manipulations and effects. In musical performance this might be used to allow the musician to display his or her virtuosity with the interface. Magical interfaces reveal effects while hiding the manipulation used to trigger them. Suspenseful manipulations tend towards hiding effects while revealing manipulations, generating a sense of expectation in the viewer.

Considering instruments as interfaces for producing music in this light, a variety of approaches could be taken, each of which might have a marked effect on the performance. As discussed earlier in this chapter, an aim in engaging the audience might be to achieve a style of viewing which oscillates between immersion in the movie and appreciation of the technical innovation involved. An interface which varied from the expressive to the magical would be the perfect support for this.

3.4 Conclusion

In considering how best to put together soundtrack-controlled cinema systems and productions a number of approaches and challenges presented themselves. Key factors were identified which might contribute to the practical development of soundtrack-controlled cinema, its content and the structure of the research project built around it. Borrowing techniques from live music and theatre, audience engagement could be managed actively by musicians, managing subtle states of engagement with the film through the music itself. The alternating states of appreciation of craft skill and immersion in narrative that Gunning (1990) describes in spectacular cinema could be leveraged here, allowing an oscillation from immersion in the narrative space of the film and its musical support with an enjoyment of the technological tricks and craft skill involved in the

production.

Whatever elements of live musical performance would be included in the new form, it was clear that a number of basic tenets of conventional cinema must also be preserved, and not lost in the translation. A suspension of disbelief and immersion in another narrative space, the transmission of the specifics of plot and character and the provoking of a visceral spectacular response to the aesthetics of the work would all be important factors.

The dimensions discussed in this chapter suggest a number of formats which could be used, in which devices from cinema could be deployed (the devices themselves are discussed in chapter 4). The principle question emerging from this discussion is whether the devices of narrative cinema would retain their legibility in a less focused setting. Taking a cue from cinema and theatre, the performance environment could assist here, scaffolding the engagement with lighting cues and careful configuration of venues. Content might also help, with the materiality of the medium forming part of the subject matter: allowing a conscious consideration of the new form, however, strategies would be needed to unpick the complex interactions taking place between various elements of the media involved, the performers and their audiences. Methodologies from performance, art and HCI could all be used to achieve a deeper understanding of performers' motivations and how they might be used in the design of systems and artworks.

From the dimensions discussed above and through the exploration of practice in Chapter 2, it was possible to establish a number of basic requirements that a soundtrack-controlled cinema system would have to fulfil. In considering these basic requirements, a wish-list of ideal capabilities for audio/visual systems, created by Franco, Griffith and Fernstrom (2004) was referred to and augmented. Any interface designed for use by musicians, would need to support the usual motivations of musical practice. A sense of liveness and immediacy is important (see Chapter 2) as is supporting flow in performance. A level of tactile satisfaction is also crucial: the interface should be fun to play and should ideally allow learning and progression, supporting the longitudinal relationships that practicing musicians have with the tools of their trade. The system must return significant value for the amount of time spent learning to operate it. Support for expression and communication of a musician's ideas would also be important as would an apprehension on the audience's part of the performer's craft skills and this must be reinforced by a sense on the performer's part that this virtuosity and expression was understood. An interface should support the realisation of the kind of different compositional structures which form the

backbone of both music and film. It should offer high-level control over these structures in a way which is flexible enough to allow improvisation and modification for different performances.

In designing systems and interfaces to support soundtrack-controlled cinema, various approaches were considered. The advantages of using musical instruments to provide as much control as possible in this case outweigh the benefits of other approaches. The decision was made that wherever possible, instruments already in use should form the control surface and that the interaction scheme involved in operating the system should fit seamlessly into the musician's playing. In practical terms then, we already had the tools necessary to begin to develop soundtrack-controlled cinema systems, tools that other musicians would also have access to, avoiding the need to invest in new equipment. If these systems were designed well, our own instruments should have the capacity to form flexible, subtle control interfaces for the new works, while retaining their normal capacity for music making.

This approach in many ways builds directly on the digital live art pieces discussed: *Yours* and *Violin Power*, however, what was envisaged here was not simply a single piece but a flexible system which could be easily adapted to a number of works and potentially to different musicians. The manual mappings and 1-1 connections in the pieces mentioned would be inadequate for such a concern, requiring in the one case a huge amount of manual configuration and in the other a constant intentional focus on the video element at the expense of musical flexibility. It was decided therefore that an interpretive scheme should be attempted, where musical conventions would be used to form a high-level interaction scheme. The system would ideally, rather than dumbly react to individual notes, be able to reason over what was being played and decide on appropriate responses from a palette of cinematographic devices. Approaching this task and isolating precisely which structures to draw upon forms the subject of the next chapter.

4 Devices from Film and Music

4.1 Introduction

The research described here relies on the intersection not just of multiple disciplines but of multiple spaces: the illusory space/time of the film, its 2D container: the screen and the space of the performance venue in which it is situated. This chapter addresses the first of these spaces, and the structures and language of film. It attempts to isolate, using examples, conventions from cinema and its music that might be formalised as rules in a software system. The ideas discussed in this chapter hinge on the connection between stories told in cinema and the techniques used in the telling.

A number of conventions from film soundtrack are suggested as possible devices that could be linked to cinematographic actions. These devices are all taken from classical Hollywood cinema and its music. As with the examples from film, these are decomposed into individual devices. A number of possible ways by which they might be linked to cinematography devices is also discussed. The decision to use them as the basis for the approach does not stem from a particular ideological standpoint: rather it represents both a starting point and a practical response to the challenges at hand: drawing upon conventions that are widely used and therefore easily read by audiences (Murch, 1995).

In narrative film, each sequence of shots must not only be legible in terms of spatial continuity but must support and expose the greater narrative, allowing the film to be read as a whole. In the case of soundtrack-controlled cinema this is complicated by the possibility of changes occurring within the narrative as it happens, meaning considerations of pace, continuity and the legibility of settings, characters and plots become ever more important. Canonical texts, such as Arijon's *Grammar of the Film Language* (Arijon, 1976), document cinematographic idioms and allow for the construction of sequences of shots that adequately describe spatial relationships between characters in a scene. Arijon also documents how the prominence of individual characters in the narrative might be emphasised through framing and camera placement. Film-makers also use camerawork and editing to establish complex narrative relations between characters and the worlds they inhabit.

To place the devices in context, a scene from an existing film; Michael Radford's *1984*, (Radford, 1984) is used as an example. The traditional notions of "action" that are the focus of research in much interactive cinema studies are mostly incidental here, and for

this reason the scene selected - a conversation between 3 characters over a meal - was chosen for its heavy reliance on dialog. In this case, the subtleties of the characters' interactions with each other and the details of the environment are the principal means by which the relational and emotional information in the scene is conveyed and consequently cinematography (choice of shots and edits) is the director's principal vehicle for achieving this.

Filmic 'devices' are discussed in the context of their possible use in soundtrack-controlled cinema pieces. An attempt is made to restate both Arijon's simple collections of idioms and other more subtle means by which the narrative is achieved in Radford's film, as constraints for an interactive cinema system. Directorial style is discussed as a way of selecting which of these constraints might be deployed in directing interactive film performances, where computer controlled editing or camera control might take control of the direction.

4.2 Music and Film

In his writing on the emergence of sound in early cinema Chion (1994) remarks that 'Sound Cinema is Chronography...We are indebted to synchronous sound for having made cinema an art of time'. Prior to synchronised sound, time in film was fluid, mutable and subject to the control of both the camera operator and (later) the projectionist. Moreover, audio in film served to anchor the image to a specific time. Unrelated shots could now be understood as playing out a narrative (Chion uses the example of footsteps linking static shots along a corridor: the audience understands that this is now a trajectory from one place and time to another). Within the structures of classical cinema, sound is often used to support the filmed image, a process Chion describes as added value:

'.. the expressive and informative value with which a sound enriches a given image so as to create the definite impression, in the immediate of remembered experience one has of it, that this information or expression "naturally" comes from what is seen, and is already contained in the image itself.' (Chion, 1994)

This capacity for sound to seamlessly support the image without announcing its own presence is problematic when attempting to consider its effect on the viewer/listener. Chion also warns that:

'Added value is what gives the (eminently incorrect) impression that sound is unnecessary, that sound merely duplicates a meaning which in reality it brings about, either all on its own or by discrepancies between it and the image.' (Chion, 1994)

Brown describes film music as functioning on at least 3 levels: as a '*wallpaper soporific to allay fears of darkness and silence*' (Brown, 1994) as an aesthetic counterbalance to the iconic/representational nature of the cinematic signs, which, although they do not require music to validate the language they create as artistic, get that help anyway; and as a co-generator of narrative affect they skew the viewer/listener towards a culturally determined reading of the characters and situations.

Although, film music has not been subjected to anything approaching the level of theoretical attention that has been paid to cinematography (Kalinak, 1992), a number of composers and theorists have helped to establish and identify techniques and devices which are commonly used to support or subvert meaning in the film. Modern audiences are highly educated (often without being aware of it) in the languages of film music, being able to read the narrative structure of the score almost as clearly as the plot of the film (Kalinak, 1992).

A large proportion of the musical conventions applied to visual media today derive from techniques first described by film composers in the 1930s and 1940s (Kalinak, 1992). The outbreak of World War 2 caused the emigration of large numbers of classically-trained composers from Europe to the USA, where they found work in composing new music for the rapidly expanding film industry (Bruce, 1985). The particular schooling of these composers, along with the highly structured Hollywood studio system with its standardising effect on film production, lead to the dominance in film of 19th Century symphonic styles of composition which still form the basis for most film scores today.

Initially, composers applied a range of conceptual frameworks to the newly emerging need for musical accompaniment. The most dominant of these was Wagner's idea of the *gesamtkunstwerk* or total art work (see chapter 3), in which he demanded that each aspect of a production (staging, music, dialog) should contribute to an integrated whole (Brown, 1994). In film composition, this meant that the principal task of the soundtrack should be to support the vision of the director, through complementing the image track. In contemporary cinema, orchestral scores still dominate the soundtrack of most Hollywood films, using a range of commonly used conventions discussed below.

As the Hollywood studio system imposed its own rules and conventions on mainstream film-making, many directors took different approaches, in many cases reacting against American domination of the industry on ideological grounds. The *gesamtkunstwerk* was viewed with suspicion by Adorno, Eisler and Eisenstein, who saw it as an attempt to seduce the audience with an immersive and anaesthetic form of cinema (Adorno & Eisler,

1947). In direct opposition, they established a system based on counterpoint and subversion where the score would assert an opposite effect to the image track. Calm or static images were set against stirring martial music, battles were juxtaposed with slow orchestral scores (Adorno & Eisler, 1947). The intention was to cause a dichotomy in the viewer, forcing them to question the content of both image and soundtrack and take a far more critical standpoint than the type of passive consumption fostered by Hollywood films. This technique is occasionally employed by Hollywood directors in contrast to mark out a passage of the film as different and therefore significant. In *The Lord of the Rings (Jackson,!!!)*, the violent death of the character Boromir is underscored by a quiet choral piece, while the volume of the film's foley track is reduced almost to silence. The effect is to disinvolve the viewer from the action, forcing them into a less immersed, reflective position.

Other composers such as Philip Glass, Michael Nyman and more recently Clint Mansell's scores for the films of Darren Aronofsky use classical ensembles but incorporate modern musical techniques, for example, *Requiem for a Dream's* (Aronofsky, 2001) score performed by the Kronos Quartet uses constantly repetitive and evolving passages in-line with Aronofsky's repeating high speed montages to highlight the cyclic processes the characters undergo over the course of the narrative (Kulezic-Wilson, 2008).

4.3 Devices from Film Music

4.3.1 Orchestration, Style and Allusion

Most Hollywood film productions are scored according to symphonic conventions: they are composed of several or more movements around 1 or more themes and are arranged for large orchestras comprising woodwind, string, brass and percussion. Typically scores are written by a composer, and recorded from a live studio performance before being mixed down and synchronised with the image track.

Themes and movements can be used both used to separate passages in the drama (changing from one movement to another at the end of a scene can suggest a change of context) or to unify disparate elements (maintaining a theme between scenes at different locations can imply continuity of plot). Contrasts or transitions between solo instruments and ensembles can be used to imply isolation or togetherness. In the film !!!! the is used to emphasise the loneliness of the main character as he sets off on his quest. This is contrasted against the !!!!! which is played by a full orchestra.

Although working within a classical symphonic tradition, film composers often allude to

particular styles of music to support the narrative. This may inform their choice of instrumentation and orchestration, rhythmic, melodic and harmonic structures and motifs. Allusion is used extensively in the work of many composers either to reinforce the image track or to subvert it by offering an alternative reading (Kalinak, 1992). By working a recognisable phrase from another piece of music into the score, or even using an original recording, the composer can quickly reference a theme (such as a character's background) or reinforce a sense of period or location. In *Ferris Bueller's Day Off* (Hughes, 1987), a slow motion shot of the priceless borrowed Ferrari flying through the air and over the camera is juxtaposed with John Williams' score for *Star Wars* (Lucas, 1977). The allusion to a familiar musical score reinforces an allusion in the image track (*Star Wars* famously begins with a similar shot with a spaceship flying overhead) to comedic effect, also referencing a more abstract sense of excitement, adventure and fantasy. Trevor Jones soundtrack for Michael Mann's *The Last of the Mohicans* (Mann, 1992) although performed by a conventional orchestra is based on a Dougie Maclean song, *The Gael* (Maclean, 1992), written in a style reminiscent of Scottish folk music, reinforcing the film's period setting.



Figure 6: The visual allusion to Star Wars (right) is reinforced by a passage from its Soundtrack in Ferris Bueller's Day Off.

Allusion can also be applied to the selection of individual instruments or groups of instruments. Particular instruments can be associated with characters or events in the drama, for example the high brass passage used in John William's scores for Spielberg's Indiana Jones films is used almost exclusively to reference the hero. In *Indiana Jones and the Temple of Doom* (Spielberg, 1984), the hero's recovery from a hypnotic trance and consequent return to the action is emphasised by this passage.

4.3.2 Leitmotifs

Leitmotifs are distinct musical phrases, recurring throughout the score of a film, the principal purpose of which is to reference a particular theme or character within the diegesis (Kalinak, 1992). A popular technique in the works of many 19th-century composers, the leitmotif is used extensively in opera (Kalinak, 1992). Leitmotifs may range from a few notes to whole passages and may be repeated on different instruments, in different keys and in different meters throughout the film. Crucially, leitmotifs are not only used to reinforce a character's presence onscreen but can be used to refer to that character when he/she is absent. In John Williams's soundtrack to *Jaws* (Spielberg, 1975), a simple two-note motif announces the presence of the shark at various points in the narrative. This is established during the opening titles with an extended theme, dominated by the repeating sequence of notes <C, D> (see figure 7).



Figure 7: *The Introduction to Jaws* (Williams, 1975)

Certain composers apply this approach so consistently that the music becomes a constant commentary on the image track, mimicking the individual movements and expressions of characters, a technique known as 'Mickey Mousing' (Brown, 1994). This technique was particularly common in films of the 1930s and 1940s. In Willis O'Brien's *King Kong* (1933), the score closely follows the action, mimicking the characters movements exactly. In the scene pictured below (see figure 8) every swipe Kong makes at the hero is synchronised with a single orchestral stab.



Figure 8: In King Kong, the score exactly follows the action on screen. In this scene, staccato notes emphasise each stab of the hero's knife and each swipe and roar of the giant ape.

4.3.3 Pitch, Discord and Harmony

Since the Common Practice Period (1600-1900), Western music has been dominated by the tonal system, a hierarchical approach to pitch, that places an emphasis on each note's relationship to a tonic or central pitch (Brown, 1994). In the vast majority of western popular and classical music, major and minor scales are used to determine which notes are included within the structure of the piece (i.e. in the same key) and which should be considered outside it (Brown, 1994).

At the most simple level, major and minor modes can be used to suggest emotional states or expose the emotional result of dramatic elements (Kalinak, 1992). Minor modes are often used to suggest negative elements: sadness, tension, fear or danger. Major modes imply happiness, release, closure, safety or comfort. In the film *E.T. The Extra Terrestrial* (Spielberg, 1982), the main theme transitions several times between a solo piano movement in a minor key, which is used to underscore the isolation and fear felt by the characters E.T. and Elliot and a triumphant orchestral movement in a major key which emphasises the successful resolution and release from tension as E.T. returns home.

Consonance or dissonance within this system is a powerful tool for suggesting harmony and discord, tension and release in a narrative. As the major and harmonic minor modes are so dominant, use of other scales, even by conventional ensembles can be powerful tools of allusion. Relationships between pitches can be used to create specific effects or to refer directly to spatial elements of a drama, for example, slowly rising glissandos can generate tension while descending notes can mimic a character physically falling (Kalinak, 1992). In the murder scene in *Psycho* (Hitchcock, 1960), a staccato series of dissonant chords underpins the stabbing in the shower, mimicking the action of the knife and heightening the uncomfortable quality of the image (see figure 9).



Figure 9: The theme from Psycho (Herrmann, 1960), using dissonance and volume to produce unsettling effects.

In John Williams score for Spielberg's *E.T.* (1982), mode and discord are used to signpost a dramatic change from tension and struggle to resolution and success. This device is used time and again throughout the score (see figure 10).



Figure 10: In E.T. The Extra Terrestrial, the score transitions from discordant brass and strings to harmony as Elliot's bicycle takes to the air.

4.3.4 Volume

Rises and falls in the relative volume of parts of the soundtrack or the soundtrack's volume in comparison with dialog and sound effects can be used to intensify or highlight particular themes and is effective in generating tension. Complete silence can be used in contrast with scored sections of the film to lend an immediacy and heightened sense of realism to a scene (Brown, 1994). In the opening scene of *Jaws* (see figure 11), the swimmer's death in the water is accompanied by variations on the main theme at high volume. At the climax of the sequence, this is intercut with an almost silent shot of the swimmer's boyfriend asleep on the beach, with no accompaniment. When the action cuts back to the shark attack, the sudden jump in volume serves to renew the sense of shock and violence central to the sequence.

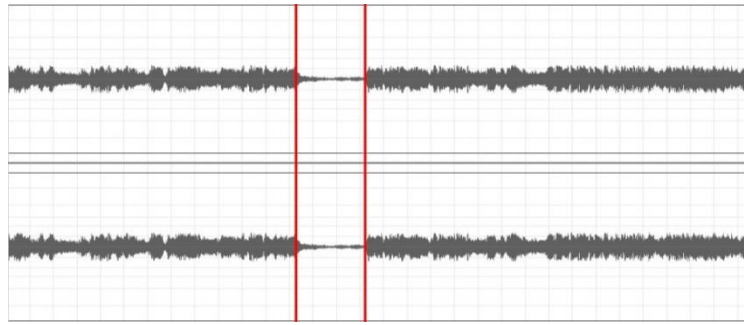


Figure 11: Excerpt from Jaws (Williams, 1975): the volume of the soundtrack drops abruptly as the swimmer's death scene is intercut with her boyfriend sleeping on the beach

By contrast, a gradual fall in volume can be used to generate tension, partly by allowing ambient sound and foley effects to come to the listener's attention. In *House on Haunted Hill* (Castle, 1959), the score gradually fades to silence, suddenly returning with a discordant blast of brass and strings as the witch character appears.



Figure 12: The heroine's screams in House on Haunted Hill are synchronised by the sudden return of the score.

4.3.5 Tempo

Changing the tempo of the score can radically affect the viewer's perception of the pace of the film and in conjunction with editing can be used for a variety of effects. Rhythm and meter can often achieve similar results: for example doubling the speed of the percussion from $\frac{1}{2}$ notes to $\frac{1}{4}$ notes. In *Jaws*, the main theme begins slowly played as $\frac{1}{4}$ notes switching to $\frac{1}{8}$ notes as the shark approaches the swimmer. Although the tempo remains constant, the impression created is one of increasing speed and tension.

Increasing or decreasing the tempo can also lend emphasis to passages in the drama. In Francis Ford Coppola's *Dracula* (1992), the score accompanying the scene in which Harker realises his host is a vampire, gradually slows and increases in volume emphasising both Harker's shock and the importance of this moment in the narrative.

4.4 Basic cinematographic devices

The techniques specified in this section may be considered as a set of components that can be assembled to bring a story to the screen in a way that allows the viewer to easily understand the spatial make-up of each scene, and the sequence of actions occurring within it. Included are idioms for dealing with camera placement and movement in a variety of settings involving two or three main characters in dialog – the goal is to characterise these sufficiently to allow their articulation as constraints and objectives to be solved by an automated cinematography system. As discussed briefly at the beginning of this chapter, examples here are taken from Michael Radford’s film *1984* (1984).

4.4.1 Framing

As described by Arijon (1976) and Katz (1991), particular framings of characters can be used to cover specific situations. Close-ups allow a character’s facial expression and eyes to be emphasised whereas medium and full shots allow physical actions or attitudes involving the whole body to be read. To avoid aesthetically awkward compositions, the body is usually cut below the armpits, chest, crotch, waist or knees (see figure 13). Beyond fulfilling requirements such as legibility of physical attitude and visibility of facial expression, exact frame selection is largely a matter of style, with different directors favouring certain framings. In the example scene from *1984*, Radford uses close-ups for most dialog shots, cutting to medium or close shots for sequences involving movement (Radford, 1984).

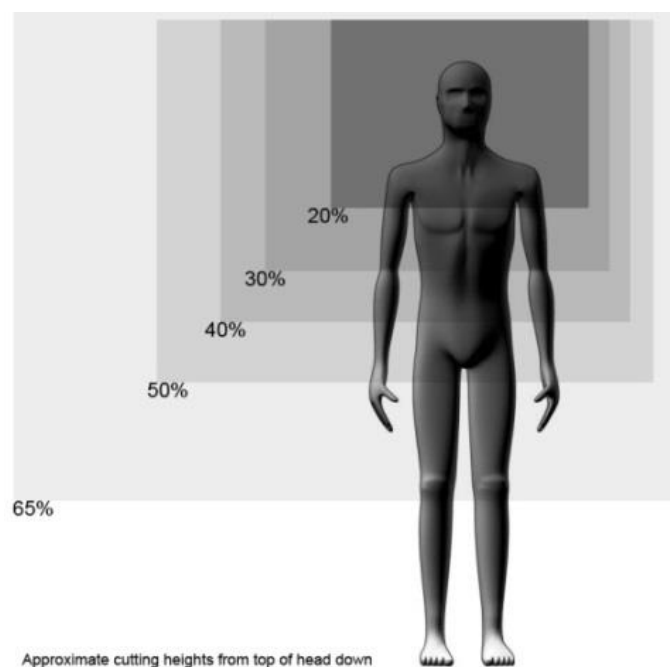


Figure 13: Conventional cutting heights



Figure 14: Smith and Syme occupy opposite portions of the frame, mirroring each other.

Balance and composition is also an important factor that affects a viewers' reading of a scene. Two characters engaged in dialog with each other are typically represented in paired shots (see figure 14). A character's speech is accompanied by their image, followed by their conversational partner's reaction or response. A set-up in which characters occupy an equal proportion of the frame in each shot establishes each character in space without giving the impression of one's dominance over the other. Again, the exact composition of dialog shots is a matter of directorial style. As an example, in Radford's *1984*, each character in the canteen scene dialog occupies roughly 40% of the frame (see figure 15). In a dialog where two or three characters are at roughly the same elevation, maintaining a consistent eye-level across shots helps maintain spatial legibility. In the canteen scene in *1984*, the eyes of each character in the dialog are at roughly the same height on the screen.



Figure 15: Typical close-up framing in 1984

In staging a scene, directors typically establish a line of interest, which connects the gazes of two characters engaged in dialog to orient the camera and consequently the audience's position in relation to the action. It is considered a hard-and-fast rule of cinematography, that the line of interest is inviolate and that cameras must be placed along one side of the line or the other but never both (Katz, 1991). In certain circumstances characters engaged in dialog may not be looking towards each other. The line of interest still joins their heads, regardless of gaze (see figure 16).

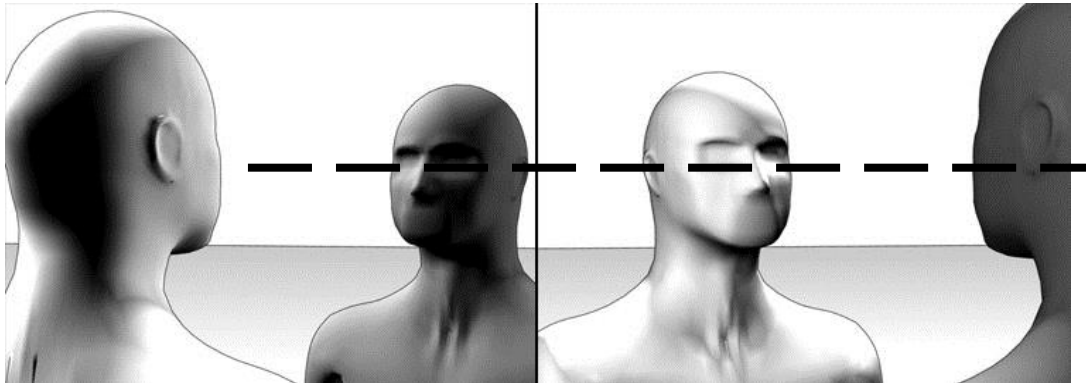


Figure 16: Eye-lines consistent across reverse shots.

Characters in dialog generally look off camera, as looking directly out of the frame tends to have the effect of placing the viewer in the action. The exception to this is during a POV (point of view) shot, where direct gaze into the camera allows the viewer to understand that their own gaze has become contingent with that of a character (Arijon, 1976). Conventions such as following a character's gaze with a POV shot capitalise on this. In figure 17, Smith's attention has been caught and the camera cuts to follow his gaze. As Julia is staring directly at the camera, we (as the audience) understand we are looking through Smith's eyes. Through the act of looking at an object or other person, a character automatically ascribes significance to it. Conversely, by following a character looking away from a dialog, for instance to a part of the frame where the viewer knows no character is located, the camera can indicate lack of interest on the part of a character (Murch, 1995).



Figure 17: Cutaway POV from Smith to Julia.

Commonly used setups for shooting two characters in dialog are shown below (see figure 10). First and foremost, each shot of a particular idiom reinforces the relative positions of the characters for the viewer. The advantage of using external camera positions (where the camera is placed outside the space occupied by the characters (see figure 18) is that spatial description of the characters takes place in a single shot: the viewer is presented with both characters (Arijon, 1976). However, it is important that in each shot, characters are presented in a consistent portion of the frame. Internal reverse shots allow characters to occupy a larger proportion of the frame. Internal and external reverse shots can be used either consistently or alternately. For example, an external reverse shot can be inserted into a sequence of internal reverse shots to remind the viewer of their relative positions in space. Maintaining both the line of interest and characters' positions in the frame are vital regardless of the characters' exact locations and orientations with respect to each other (Katz, 1991).

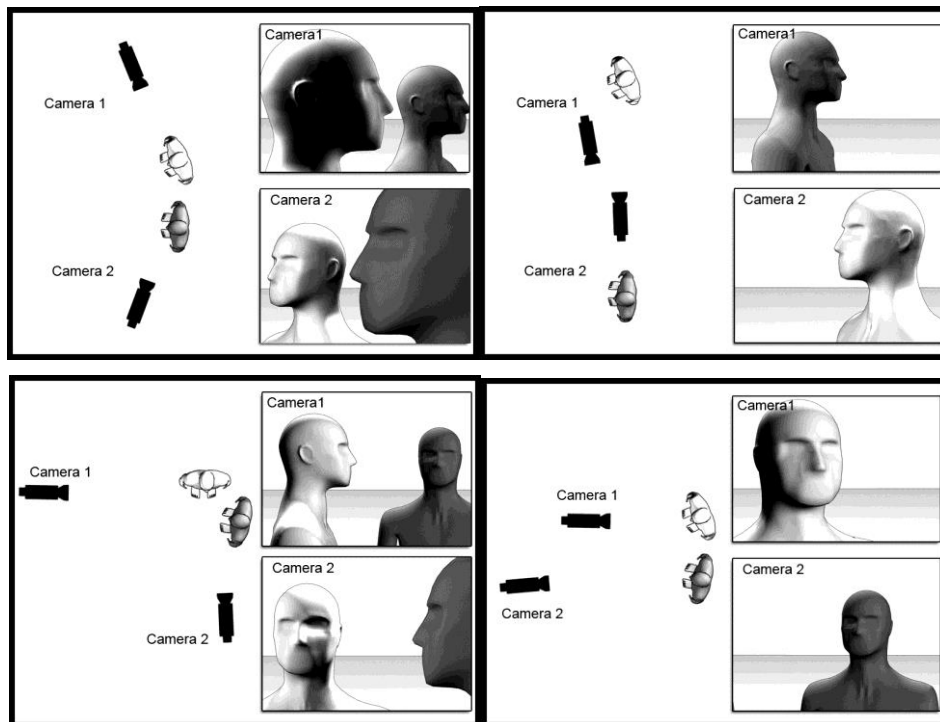


Figure 18: Covering figures side-by-side using external reverse (left) and internal reverse (right) shots

In most Hollywood cinema, the camera in dialog is usually static (Murch, 1995). Panning from one subject to another, rather than cutting can be distracting to the viewer as it produces incidental footage between subjects. In the canteen scene in *1984*, camera movement is used as a dramatic device, to add a sense of anxiety and restlessness to the dialog. The camera constantly makes small panning and tilting movements, emphasising the uncomfortable tension between the characters. However, these movements are small enough not to change the framing of the scene. In other situations, panning shots may be used to simulate a subjective view. For example when preceded by a shot of a character gazing off camera, a conventional reading of a panning shot is that the character is surveying the scene.

Conventional camera idioms are used in cinematography because of their ability to arrange the narrative in space in a way that can be easily read by the viewer. Cutting between cameras is also a highly formalised process. Traditional continuity editing techniques (Bordwell, Thompson, 2006) often use dialog to structure editing. During each utterance the speaker is pictured, and cuts occur when another character replies or reacts. If other actions occur within the scene, it may be necessary to cut from one camera to another to follow the action.

4.4.2 Composition

Composition, in addition to establishing space, can also be used to imply relationships between characters. Used simply, framing a character so that he/she appears tiny in relation to the whole frame can emphasise his or her vulnerability or insignificance. In dialog shots, framing one character to appear larger than the other, implies dominance (Arijon, 1976). By slowly increasing the amount of screen-space a character inhabits in subsequent shots (either by narrowing the field of view or moving the camera towards them) this sense of dominance can be gradually increased. An example of this occurs in the *1984* scene, in which the camera tightens slowly on Syme increasing the amount of screen space he inhabits (see figure 19). This has the effect of making him appear more enthused about his subject and gives his utterances more importance. However, as he still occupies slightly less screen space than Smith, the viewer still identifies Smith as the central character in the narrative.



Figure 19: Tightening the frame slowly on Syme

Composition can be used to introduce or revisit narrative threads (Murch, 1995). For example, including significant objects within the composition of a shot, even if they are only seen peripherally, can keep particular themes present in the viewer's mind.

Throughout the canteen scene in *1984* the presence of the telescreen over Smith's shoulder reinforces the idea that Smith is being watched (see figure 20).



Figure 20: The telescreen is visible over Smith's shoulder

A shallow depth of field can also be used to ascribe prominence to characters and objects, especially within visually busy or cluttered shots (Katz, 1991). This technique can counter the distracting effects of objects or characters moving between the camera and subject. By pairing a shot in which one character is alone with a shot in which multiple characters are present, even in the background, a sense of the first character's isolation can be emphasised. Obscuring the face of a character, whether through framing or through use of an occluding object, can communicate to the viewer that they are secondary to the plot. This is used in *1984* to make clear that the background characters are incidental to the plot (see figure 21).



Figure 21: A zoom lens with its characteristic shallow depth of field distinguishes subjects from their background.

4.4.3 Exposition

The conventions discussed so far serve to make action and dialog legible in terms of spatial and temporal continuity; however, these concerns form only part of the techniques needed to tell a complex story. In the case of Radford's *1984*, cinematography is used to expose and emphasise the characters' motivations. In the canteen scene in particular, the dialog itself has little bearing on the narrative: the conversation mostly revolves around day-to-day and seemingly mundane themes such as food and work. The characters are developed mainly through Radford's employment of cinematographic devices to expose and amplify subtle actions that would otherwise pass unnoticed, such as Smith glancing around furtively, or the proles in the background, staring.

Clearly, many actions such as dialog make sense and contribute to the story only when presented in a particular sequence. In *1984*, Smith enters the main space of the canteen and notices that Julia is watching him. The timing of this encounter early on in the scene is crucial as through this sequence of events, the viewer is introduced to Julia and prepared for her participation in later scenes, reminded that surveillance and watching one's peers is a central theme of the narrative and alerted to the fact that Smith is more interested in the people around him than his friend Syme. All of these factors affect the viewers' understanding of all subsequent dialog. This is conveyed to the viewer through framing and editing rather than by any single action on the part of either character; in fact both characters are almost motionless during the sequence.

In addition to these key pieces of information that relate to the main arc of the narrative, the way a scene is shot often includes incidental or background action, sometimes as

cutaways or establishing shots (Murch, 1995). This information could be considered a series of discrete facts that are drip-fed into the action over the course of the film, serving to support and enrich the narrative as a whole rather than form integral parts of its structure. This supporting narrative information can be exposed through the actions of characters other than the main protagonists or through the inclusion of particular objects and spaces. An example of this in 1984 is the establishing shot in which an anonymous extra watches the telescreen for several seconds (see figure 23). The viewer learns from this that the omnipresent telescreens are significant to the society in which the film is set.

4.4.4 Editing

In continuity editing, dialog is edited using match-on-action pairs of shots, where a character is pictured speaking and his/her dialog partner is seen reacting in a shot that is roughly a mirror image of the first. Figure 22 shows the length of each shot compared to each utterance in the canteen scene in 1984. Overlaps where cuts occur demonstrate the pattern of shot and reaction-shot used to cover both speakers.

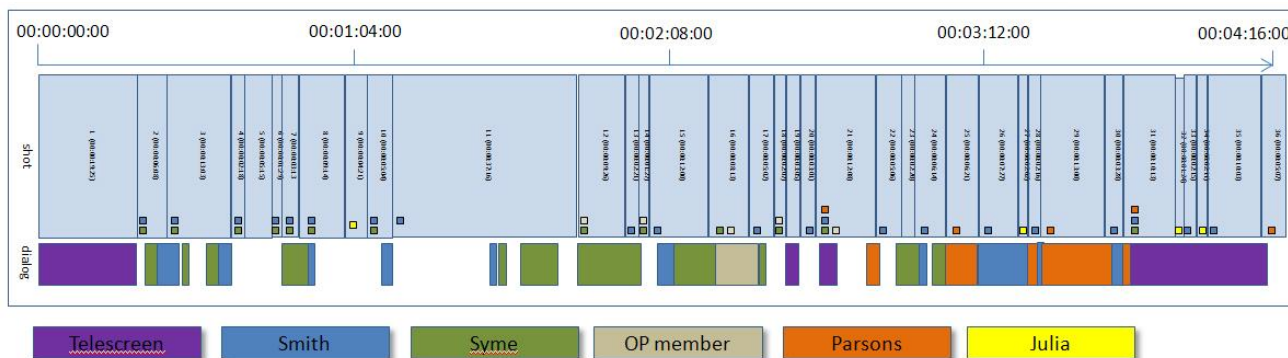


Figure 22: The Canteen sequence divided into its component shots. Colour bars at the bottom indicate which character is speaking. Colour squares indicate which character is onscreen

This pattern can adequately convey the sense of a conversation with the viewer following much as he/she would in real life, but can also be subverted in order to achieve specific effects. By failing to cut to a character speaking and instead remaining on another character, the attention of the viewer can be diverted away from a dialog. This can be used to indicate disinterest on the part of the character pictured or their sudden interest in something else within the scene. This is often accompanied by a drop in the volume of the dialog and can be followed by a cutaway to the new source of interest.

Several easily legible techniques can be used to distinguish between actions occurring ‘in real time’ and actions which are to be read as happening in the past or the future. Use of transition effects such as dissolves or fades, as opposed to straight cuts, are usually read as

signalling either ellipsis or the introduction of a new temporal or spatial context (Arijon, 1976). Simple measures such as increasing the average speed of cutting can enhance a sense of dynamism or chaotic action within a scene. Using a moving, rather than stationary, camera can also have this effect: a slightly moving frame implying a sense of unease. In *1984*, the camera constantly shifts slightly, enhancing the viewer's impression of the Smith's anxiousness, however when the telescreen speaks, the camera halts completely, reflecting the stillness and tension of the characters. When Smith sits and gathers his thoughts at the table in the canteen scene, the camera lingers on him for 34 seconds, emphasising his isolation and unease.

4.4.5 Special Cases

Establishing shots are often used at the beginning of a scene to introduce characters, spaces or objects to the viewer. They often function as an overview of the space in which the action takes place, locating the characters and their spatial relationship to each other (Arijon, 1976). Movements such as slow tracking or panning of the camera are often used to encompass as much of the scene detail as possible. Once again, in addition to functions of spatial description, establishing shots perform a vital narrative role in that they allow the viewer to establish the visual components of the scene before dialog occurs. In introducing particularly complex or unfamiliar scenes, sequences of establishing shots can be used (see figure 23).

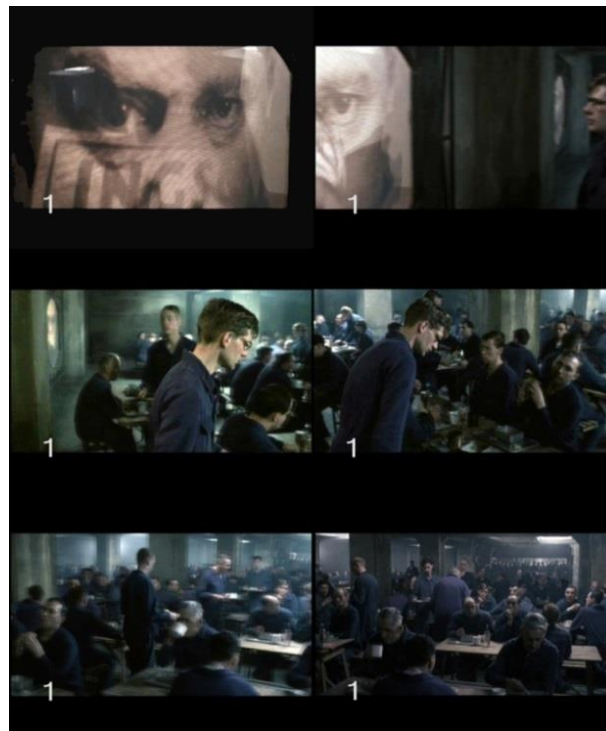


Figure 23: Establishing shot panning around the room

Generally, cameras move only to track the action in a scene. An exception to this rule is the POV (point of view) shot, which has several unique properties. By moving the camera forward at eye-level (especially if some secondary movement such as camera-shake is discernible) the shot can be read as looking out through the eyes of a character (Mascelli, 1965).

Montage techniques can be usefully employed to impart narrative information to the viewer in contexts where the psychological or intellectual content of the narrative is more important than the spatial legibility of the sequence. The juxtaposition in subsequent shots of two sequences can be used to emphasise meaning or affect (Mascelli, 1965).

4.4.6 Style and Allusion

The devices described above are generic, and even considered as hard and fast rules, still leave a huge range of choices to be made by the director. Many of these choices are governed by issues of individual style and genre. Films play out over time with each sequence of shots requiring a set of decisions from the director over which events to cover and which shots to select. Some practitioners work from a rigid palette of camera setups and edits (Murch, 1995) in order to maintain consistency throughout a film or across an entire body of work: for example John Woo's thrillers are characterised by set-pieces covered by slow motion, low-angle shots (Hanke, 1999). Genre also informs a film-maker's choice of camera setups and edits. Action films are often characterized by rapid cutting (Bordwell, Thompson, 1997). Action sequences in adventure films may be composed of shots lasting only a few seconds, whereas dramas often use long takes to maintain tension (Murch, 1995).

Modern cinema, as an art form popular for over 100 years constantly refers to itself. Depending on a common vocabulary negotiated over many decades, film-makers commonly use references to other styles of films as a short-cut to a set of associations: for example Quentin Tarantino, borrows characters, costumes and in some cases entire sequences directly from older movies (see figure 24) (Woods, 1998).



Figure 24: The 'Bride' character from the Quentin Tarantino film Kill Bill. The costume references the well-known martial arts film, Enter the Dragon (Tierney, 2006).

An extreme example of this is the 'Found Footage' genre of cinema. By substituting conventional 35mm film cameras for non-professional technology such as home video cameras, film-makers can distance themselves from the familiar production styles of Hollywood and achieve a greater sense of immediacy and 'rawness'. *The Blair Witch Project* (Sanchez, 1999), is an example of this. Shot on Hi-8 video and 16mm film, the movie purports to be assembled from rushes shot by a documentary film crew who disappeared in the backwoods of New England. The cameras are supposedly operated by three film-school students, who, in between presenting pieces directly to camera, routinely speak to the cameraman, and pass the camera between them. The camera is rarely locked down and is often shaky and unstable (see figure 25).

Cloverfield (Reeves, 2008) takes this trope even further. Apparently shot on low-quality digital tape, the film begins as a home-video of a house party, which is overtaken by the arrival of a monster which destroys the city. The action follows the characters from the party, shot from the POV of one of the characters. Few cuts are used and the camera is never locked down: the audience are constantly reminded that the camera operator is also a character (see figure 26).



Figures: 25, 26, 27: The Blair Witch Project (left): camera operator checks his footing, Cloverfield (centre): characters often appear partially cropped, tilted and out of focus. Likewise in District 9 (right).

In *District 9* (Blomkamp, 2006), the greater part of the action is presented using conventional dramatic structures, however, in certain sequences characters appear to be taking part in a documentary about the events unfolding within the drama (see figure 27). These sequences are seamlessly integrated into other scenes, with key cues constantly reminding the audience that they are watching a film within a film. These cues include characters speaking directly to the camera, handheld camera movements, characters talking to other characters outside the frame without cutting and also graphical cues such as news idents, and changes in picture quality (see figure 28).



Figure 28: A 'news' item from *District 9*

4.5 Discussion: Towards a Soundtrack-Controlled Cinema

In considering how to devise soundtrack-controlled cinema pieces, the cinematographic devices above could be considered as rules and constraints for a computer system directing the action, furthermore, by considering a particular director's style as a subset of these rules (for example his or her choice of internal over external close-up, quick cuts over long takes), such an interactive cinema system could be given a finite set of constraints in the form of standardised compositions, framings and edits. Returning to the canteen scene in *1984* (Radford, 1984), it is possible to describe a basic rule-set which might be used to cover dialog in a similar style to Radford's film. These basic rules however, taken out of context do not allow for the complex process of narrative and exposition which directors use to shoot a scene. As discussed above, the main events in the narrative are often complemented with cutaways and establishing shots, which not only place the action in spatial context but also root the action in the world in which it is taking place.

In the Canteen scene in *1984*, it is possible to break down the huge number of actions taking place (including cinematographic events such as placing a character or object onscreen) into a number of facts. Some of these facts are presented in a single shot and in the case of minor details (such as the prevalence of Victory Gin advertisements in *1984*) may not even be the subject of the shot (see figure 29).



Figure 29: Julia is watching Smith, while contextual detail is presented in the form of the 'Victory Gin' poster behind her.

In order to construct an edit that has the same narrative result as the original film (in terms of imparting the same information to the viewer), all these relational facts need to be presented to the viewer over the course of the scene. To incorporate this information in the editing process it is useful to consider the proportion of the scene through which the information is presented, so for instance, a simple fact such as '*Smith and Syme are eating in the canteen*' needs to be restated in the vast majority of shots in order to maintain the sequence's sense of place. The omnipresent telescreen also need to be included in a large number of shots, regardless of the length of the sequence. By changing these proportions the meaning of the narrative may be modified. For example, if Smith's nervous reactions to Syme's statements were omitted in favour of the camera staying on Syme, their relationship might appear quite different.

From these considerations it is possible to apply certain properties to the construction of multiple edits of the same scene, regardless of its length or spatial configuration. If the dialog between Syme and Smith took place in a different part of the canteen (for instance, they remained in the queue) it would still be possible to create a scene with the same meaning). So long as the proportions of information remain the same (for instance: around 13% of all shots include dialog or coverage of actions which reinforce the idea that Parsons is unquestioningly supportive of the regime) the meaning of the scene should remain intact. This approach also allows for the modification of the outcome of a scene. If these proportions are changed, the contribution of the scene to the overall narrative progression may change. If Smith's looking at Julia is only presented once, the viewer may well consider it to be of far less importance to the plot than in the original edit.

A breakdown of the *1984* scene might then be described as these rules.

- The main character must appear in 70% of shots.
- Characters entering the dialog should be covered by the camera immediately
- Shots during dialog must follow the speaker and then cut to reaction.
- Dialog must be covered using internal reverse shots where possible.
- If an action occurs involving a character's gaze, a POV shot should cover it.
- At least 1 shot of the telescreen must be included in the edit.
- Camera should be static: changes of view should be covered by a cut.
- Shots less than 30 degrees apart should be consolidated.
- Shots should be between 1 and 10 seconds in length.
- The scene should begin a few seconds before dialog begins and finish a few seconds after it ends
- Beginnings and endings of scenes should be covered using a fade.

This approach, although simplistic, could represent a useful first step in creating soundtrack controlled cinema systems. An automatic 'director' could be envisaged which, given a constantly updated awareness of the position of each subject in the scene and the requirements of the narrative, could decide when and how often to cover them, instructed by listening for the musical devices above. A leitmotif in this case might trigger a cut to a particular character, whereas a crescendo might signal the system to select a cinematic device to suggest tension, such as a slow zoom.

Consideration however, must be given to the context of the musical devices themselves, in repurposing them for a live performance practice. Over a century of cinema, the musical devices described have been developed with a specific relationship with the film in mind (Brown, 1994). Pre-recorded and synchronised to the image track, film-composers usually score a film during the post-production phase and are therefore usually able to plan exactly how their compositions will connect to the film both moment-to-moment and over the course of the narrative. In many cases, combining devices of the type discussed here with cinematic devices can yield a variety of outcomes, depending on the context and exact implementation. A number of possible connections between cinematic and musical devices, with resulting psychological effects are offered overleaf (see figure 30).

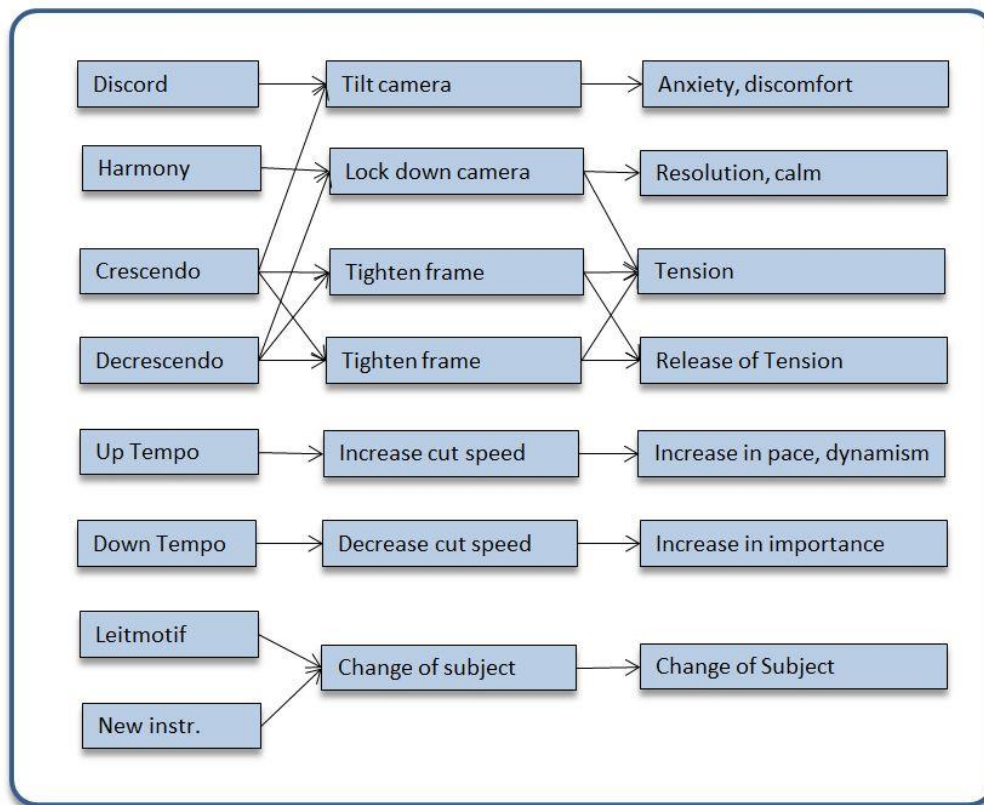


Figure 30: Possible connections between cinematic and musical devices and their psychological results. Note that certain combinations can be used to create opposite effects, depending on narrative context and exact implementation.

When considering how to apply conventions from Hollywood symphonic soundtracks, intention is a key factor. As discussed by Brown (1994), film music is often written with a particular set of narrative goals in mind, which are absent from other forms of music. In applying these devices to a practice based in rock music this raises a number of issues. Firstly, rock music is rarely narrative in the same sense as cinema (Moore, 1993). While some forms of music deal in storytelling as well as abstract musical terms (for example story-telling in folk music), pop, rock and dance music often resists definition in these terms. Moore (1993) describes the many accounts that have attempted to apply straightforward communicative or narrative readings to traditional rock songs and points out that most break down quickly under scrutiny as they often rely simply on assumptions from classical music. Moore's view is that the most credible of these take into account the complex cultural and semiotic positioning of rock musicians: that rock music is often more about the projection of a particular persona than a straightforward act of narrative communication. It is a risk then, that in attempting to use rock music in a more conventionally narrative role, some of these transactions might be reduced in power.

Having said that, a number of purely narrative examples of rock music (such as the rock operas of the 1970s) suggest that rock or dance music certainly has the capacity to lead the storytelling in narrative multi-media settings.

Many of the devices described in this chapter rely on changes in tempo, volume, instrumentation and arrangement that, although easy to accommodate with an orchestra in the controlled environment of a concert hall may be difficult to translate using other forms of music. Rock music in particular relies for much of its expressive and affective power on pace and rhythm (Moore, 1993). Disruption of these elements may necessitate a change in approach if the music is to maintain these powers. Some of the devices described, also depend on precise temporal relationships with the visual conventions they are meant to accompany (Brown, 1994). If the cinematography is to be driven by the music in real time, this temporal relationship becomes in a sense fixed. When the music precedes a cinematic event, this is not a problem; however some devices such as leitmotifs depend on absolute simultaneity of musical and cinematic device. Certain devices then might rely on a soundtrack-controlled cinema system being able to anticipate events before they fully occur: a substantial technical challenge. To determine which devices and connections would survive this change of context while retaining their original meaning, we would have to develop a basic system and evaluate their effect.

4.6 Conclusion

The devices discussed above were considered in the context of soundtrack-controlled cinema performances. Combined with approaches from Chapter 3 and evaluated initially against the goals identified in Chapter 2, a complete context for exploring controlling narrative visuals using live music was provided. This research is continued in the form of a practice-led inquiry through the creation of a number of performances and software systems, an account of which forms the subject of the next chapters.

5 *OverWatch*: A Scoping Study

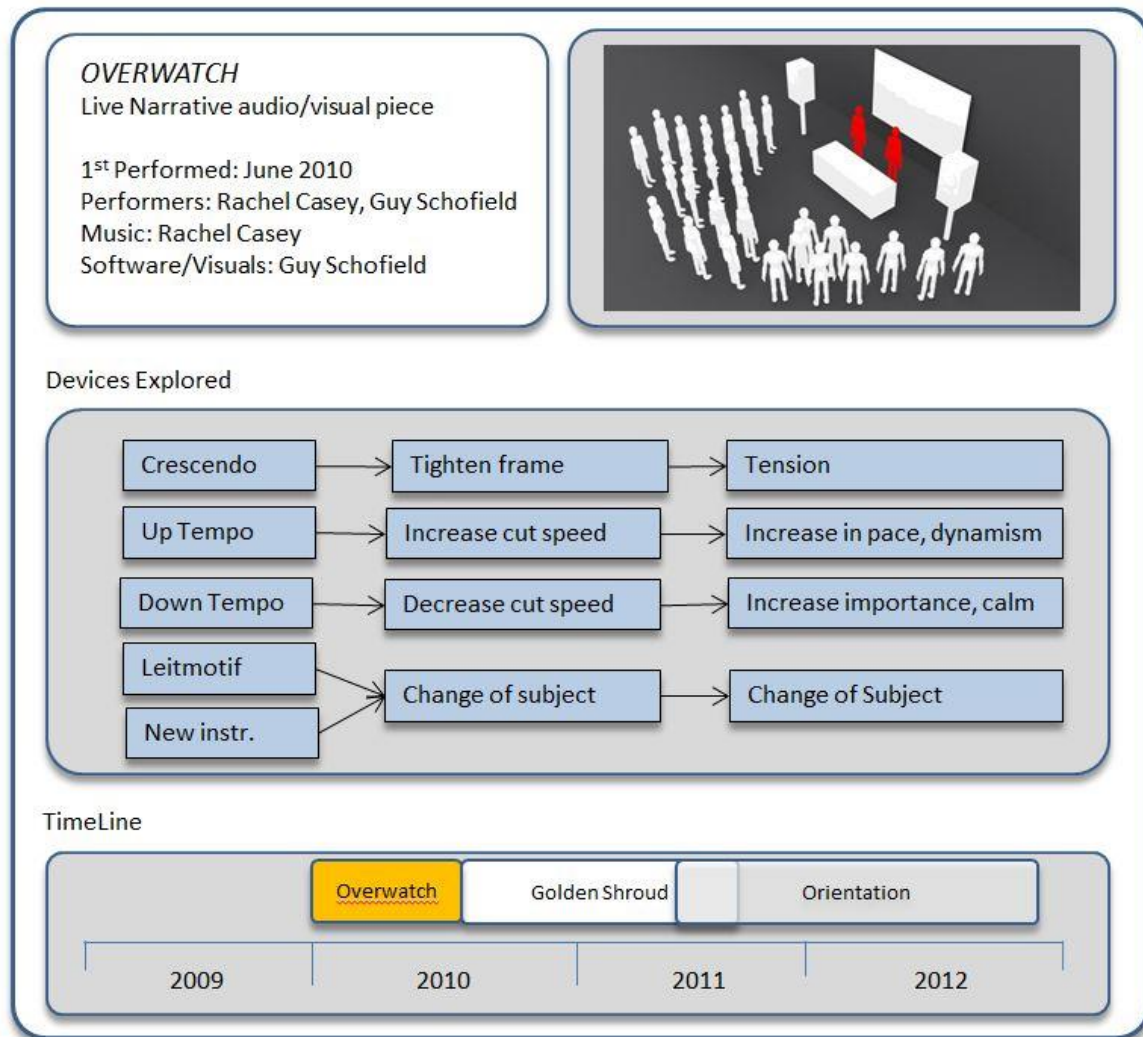


Figure 31: A Summary of the *OverWatch* Project, discussed in this chapter.

5.1 Introduction

In the previous chapters, various approaches to connect music with cinematic devices were explored and factors were suggested which might be considered when planning soundtrack-controlled cinema performances. Conventions from film soundtrack, considered as individual devices, were discussed alongside comparable devices from Hollywood cinema. Ways of using musical instruments as controllers were also discussed.

In this chapter, and in the following chapters, three studies are described which address different aspects of the research questions laid out in Chapter 1. Each of these was designed to explore connecting music and narrative visuals and using musical instruments as controllers, through the production of soundtrack-controlled cinema performances and

systems. Each of these studies was self-contained, with design requirements and precise research goals particular to each. They were scheduled in sequence, with insights gained from one, fed into the next.

The first phase of the work would be a scoping study, using as a starting point the values, properties and requirements identified from reflecting on our own practice (see Chapter 2). This study would be used in two distinct ways: as a technical experiment to assess the feasibility both of using particular instruments as interfaces and linking specific cinematic to musical devices, and as a demonstrator and point of discussion for engaging other musicians in later phases of the research.

5.2 Configuring the research

Structuring the research around a performances require careful consideration of a number of factors. The context of the practice (in this case our own) in terms of its applicability to exploring the research questions was particularly important. Isolating the specific goals and properties of the planned performance would also be necessary in order to establish the scope of this phase of the research. The exact configuration of practice and research would need to be planned carefully in order to maximise the benefit of situating the work within a creative practice.

5.2.1 Practice Context

As discussed in Chapter 2, the motivations and workflows involved in creative practice are often seen as subjective and difficult to generalize (Boehner, Sengers and Warner 2008), consequently criteria for success against which performances can be judged can be difficult to establish. The generic criteria for success in *The Turing Test* performances established in Chapter 2: aesthetic satisfaction, flow and ‘groove’ and a sense of connection with the audience were based entirely on our own musical practice and were intended to form a point of discussion against which other creative practices could later be compared. To begin to explore control of film through live music in practical terms, it was logical to use our own creative practice as a ready-made platform for beginning to explore the research questions. The initial performance piece would then be framed by the requirements of our own performance practice.

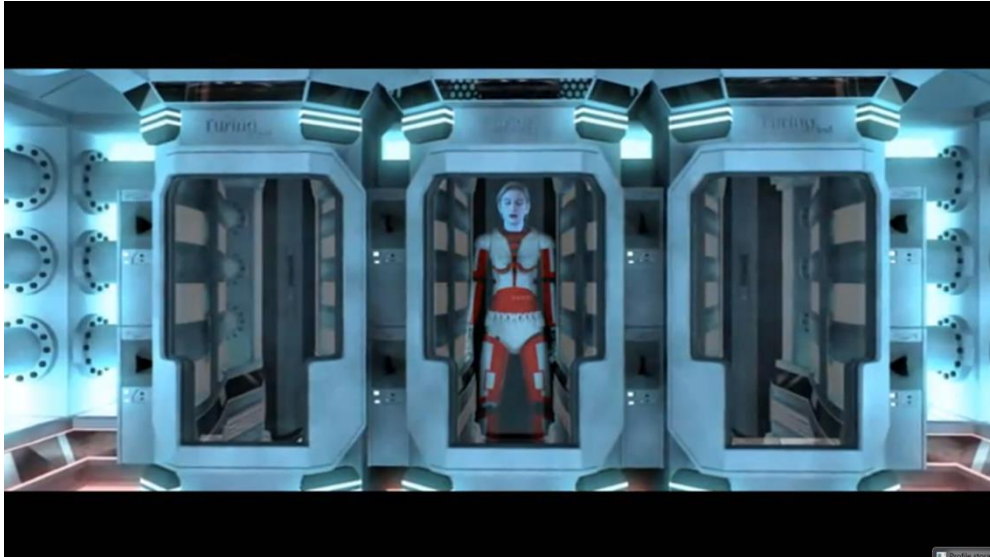


Figure 32: Still from a The Turing Test music video

As discussed in Chapter 2, the practice in question, *The Turing Test*, was an electronic rock band, which had already had a visual and sonic identity established through recordings, videos and a number of live shows, through which ran a number of recurring threads, often expressed through theatrical and kitsch imagery. Much of this imagery was futuristic, or at least retro-futuristic and included references to well-known films such as *Stalker* (Tarkovsky, 1979), *Tron* (Lisberger, 1982) and *Mad Max* (Miller, 1979). In some cases this imagery had already become very detailed, with recurring characters and landscapes appearing in our visuals and videos (See figure 32). This could be drawn upon to establish a particular type of narrative and a coherent visual style in planning soundtrack-controlled cinema performances.

Performances by *The Turing Test* typically involved a variety of electric and electronic instruments, from guitars, to synthesisers to electronic drums; in some cases, chosen as much for their visual impact as their sound-generating capabilities. Aiming to support multiple instruments in planning soundtrack-controlled works would allow exploration of a range of possible controllers. *The Turing Test* performances were structured around short rock songs, usually composed collaboratively. These songs were fixed simple structures, pre-rehearsed before each show, but designed to permit a certain amount of improvisation during performance. This seemed a feasible platform to build upon in composing flexible audio/visual schemes.

Live, responsive visuals had never been used in *The Turing Test* shows, however pre-recorded synchronised visuals had been used to emphasise features of the music in order to heighten their effect, for example, synchronising flashing elements with drum beats. The tension between this purely supportive connection where visuals enhanced the music, and a

proposed scheme where visuals were the main focus would need to be considered carefully in composing the performance.

5.2.2 Configuration of research and practice

As discussed in Chapter 2, laboratory-based approaches to designing performance tools often overlook crucial aspects of the performance experience as it is lived (Benford et al., 2002). Buxton's joke (that there are three specifications for design of interfaces: standard spec, military spec and musician spec, of which musician spec must be the most robust and reliable (Buxton, 1997), highlights the demands for stability, robustness and fitness for purpose placed on technology for stage environments.

This suggested that the design process should be situated 'in the wild' as much as possible. If the resulting tools were to later be used by other musicians, it was imperative to not only take into account the unpredictable, stressful and often visually and aurally confusing environment of the concert stage but also to consider the ways in which musicians prepare their shows, through jamming, solo practice and group rehearsal.

To develop the performance, a process was planned that built on our own established patterns of musical composition as described in Chapter 2. The performance would be developed as an integrated whole, with musical content, visuals and supporting software developed simultaneously. This would ensure that each design decision was appropriate and feasible, through instant testing and feedback. In particular, the process of software development would be taken outside the laboratory and carried out in the rehearsal room and on stage. This approach would have the advantage of leveraging the productive workflows already used in our own collaboration while also allowing constant testing of the work in authentic conditions. By developing the artwork, music and underlying software 'live' in this way, ideas could be rapidly sketched out, evaluated and refined in context, in an extremely rapid iterative development cycle.

A challenge in evaluating the work would be to unpick the tightly interwoven strands of the research. This process would be documented throughout by extensive note-taking and audio and visual recordings but this would have to be carefully managed in order to allow the emergent processes of flow and 'groove' discussed in Chapter 2 to take place.

5.2.3 Performance Context

Planning the initial performance involved balancing an exploration of the research questions with the specific requirements of the creative practice involved. The design had

to not only allow development of musical instruments as controllers and connect live music and visuals but must achieve both these goals while also fulfilling the goals identified as important to our practice.

The piece would mimic the physical configuration of a silent cinema presentation, with live musicians performing in proximity to a projection screen. The interaction between the various elements of the performance: the simulated environment of the visuals and the real space occupied by the musicians would be explored especially with reference to its effect on engagement and coherency. Drawing only on conventions from Hollywood cinema and film soundtrack still left a huge range of possible mappings and connections, which would need to be developed and trialled if their use was to be explored through the work. For the initial piece, devices would be chosen which would have particularly legible effects: editing in the form of cuts, changes in lighting and changes of subject being selected as the main cinematic events. These would be controlled by a simple electronic score, which would use changes in overall amplitude, tempo and recognizable phrases as inputs to the system.

A range of musical instruments would be explored as controllers, these would be chosen with reference to our own practice. Our Turing Test performances often featured 6 or 7 instruments played over the course of a 30 minute show. This would be limited to 3 or 4, in order to adequately begin to explore the research questions without adding an overwhelming level of technical complexity.

5.3 Design

Having structured the research, an iterative cycle of simultaneous planning, rehearsal, composition and development was scheduled in order to develop the piece. As discussed, this took place mainly in our rehearsal space, where sketches, notes and musical ideas were ‘jammed’ until coherent sequences were produced. Software was developed in the same space. Typically as Rachel played, features would be implemented to instantly exploit the musical structures being produced. Regular periods of reflection were used to ensure the design’s connection to specific elements of the original research questions.

5.3.1 Controlling Visuals with Music

As discussed in Chapter 3, the way in which we would be attempting to engage the audience would be very different from our usual concerts. In particular, the success of the piece would ultimately hinge not on the musicians' direct communication with the audience but on the coherency of the piece: the way the visual and narrative elements interacted with

the audio and live performance elements of the piece. To make this integration as seamless as possible, it was decided that the narrative content of the visuals should support the format of the performance wherever possible: put simply, the narrative should reference the materiality of the technology involved. Technical peculiarities of the medium itself were therefore envisaged as a source of subject matter. The live and the recorded, obsessive shifts in vision, ideas of repetition and remixing were all discussed as possible themes, as were ideas of editing, control through technology and the hyper-real. This focus on the materiality of the medium was a tactic borrowed from digital live art and theatre practice (as discussed in Chapter 3) and would - we hoped - assist in creating a coherent audience experience.

The genres and recognizable cultural references present in our work were intended to make the process of engaging with the narrative as simple and intuitive as possible for the viewer, something especially important as the work would be presented within a novel format. These ideas were developed into a simple narrative: a science fiction fairy-tale about a world overwhelmed by surveillance cameras, to the point where all human activity had withered and vanished. In this world, strange mechanical creatures went about inscrutable tasks and figures were seen fleeing through labyrinthine corridors. Some of these motifs were taken directly from our previous work, while others were borrowed from films or other media. In general style, many referenced 1920s expressionist cinema; a tactic used to reinforce the piece's connection with silent cinema. The piece would be called *OverWatch*.

An important decision to be made was how to structure the narrative in time; whether events in the narrative should be structurally altered by the music, or whether the system's effect should be limited to cinematography or lighting. This decision would have an effect not only on the scope of the interaction but the way that the performance would play out over time, affecting how it could be programmed for public viewing. For this reason, rather than being structured around a linear story, *OverWatch* was developed as a *narrative environment* (see section 3.2.4), an open world populated by events which might unfold in different orders and locations when shot by a flexible camera scheme. These environments would form a fixed point, determining the possible content of the final performance but the structure of the piece and the combinations of content shown would be determined by musical inputs. The overall structure of the music would provide a narrative arc in terms of providing periods of tension and release and establishing features such as pace and atmosphere.

In order to combine logistical simplicity with flexibility, it was decided to use a real-time computer graphic engine to form the visual output of the piece. This decision would allow us to realize surreal and fantastic content which would be difficult to assemble on video and the necessarily stylised feel of real-time CGI would both contribute to the aesthetic already discussed and also signpost the interactive nature of the visuals.

To build the visual environments, models would be built in 3D Studio Max (Autodesk, 2013) and Blender (Blender, 2013), which would eventually run in Blender Game Engine. This approach was chosen as Blender's 3D engine is closely integrated with its modelling package, meaning environments and models could be adjusted and tested without exporting or compiling to another program. Blender also offered a basic but efficient visual programming environment which could help us script animations and control cameras quickly in rehearsal. The final environments could also easily be packaged into a standalone executable which would be quickly installed on most PCs, allowing us to change elements of the performance rig at short notice. A downside of the approach was Blender GE's relatively poor specification: in particular, the version used for *OverWatch* supported a limited number of UV channels per object meaning texturing models would be challenging and its skeletal animation tools were basic compared to other packages, restricting the potential for complex character animation.

5.3.2 Instruments as controllers

Although some acoustic/electric instruments would be used, MIDI instruments would form the main controllers. This would enable us to focus initially on experimenting with mappings and interfaces without having to contend with complex audio processing issues. From the range of instruments used in *The Turing Test*, electric guitar, vocal microphones and keyboard synthesisers were selected. These presented a range of technical challenges, such as how to interpret chords from the keyboard and how to scale amplitude in audio streams so that useful ranges could be established.

To process and analyse the musical content, Max/MSP/Jitter (Cycling '74, 2013) would be used. Again, this was chosen for its appropriateness for performance and rehearsal due to its programming interface. Max uses a library of code 'objects' which are represented in diagrammatic form on-screen, with connections between them clearly indicated by lines. This would allow us to make changes to code live and monitor constantly how the system was processing audio and MIDI and the decisions it was making. Max's standard library of objects was already well-equipped to deal with basic MIDI and audio processing and

analysis, this was extended further by a number of plugins. Of particular use was Puckette's *fiddle~* object (Puckette and Apel, 1998); a set of algorithms for audio analysis and extraction of pitch, amplitude and features such as attacks or sudden peaks in audio.

5.3.3 System description

The final system consisted of 2 distinct parts: a standalone CGI environment running in Blender Game Engine and a Max/MSP/Jitter patch which would both analyse audio and MIDI inputs and use them to trigger scripts for pre-determined cinematic actions in Blender. Max would communicate with Blender via a script which would allow it to control Blender over a UDP connection. This would allow Max to send simple control messages over a virtual port or Ethernet connection to trigger events in Blender. This would enable us to select cameras, start and stop animations and make lighting changes in the 3D environments. As a final step, Ableton Live would be used to host virtual electronic instruments, to provide the audio output of the piece (see figure 33).

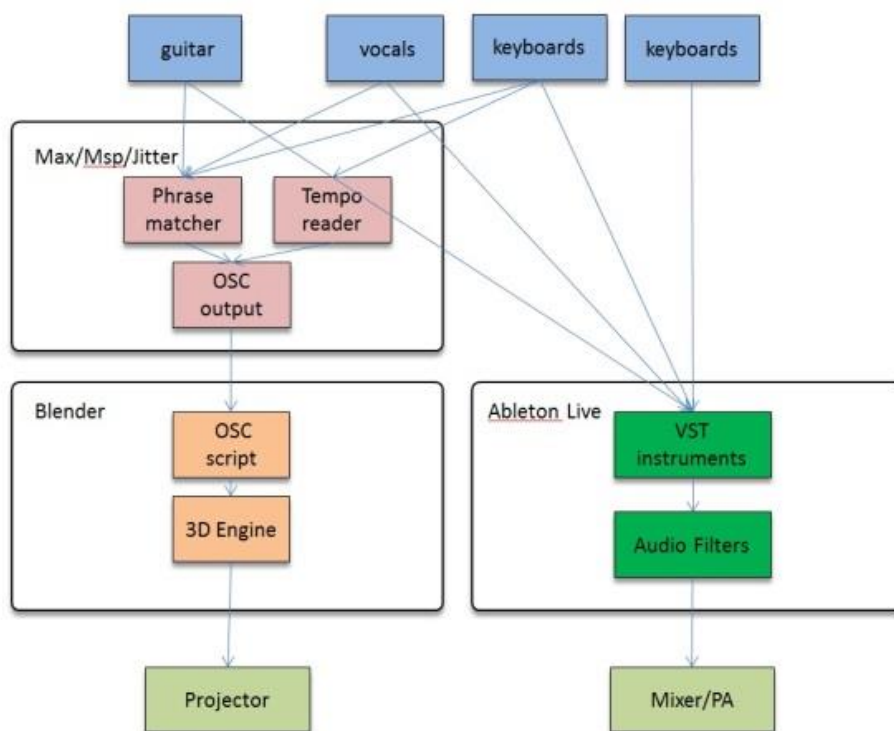


Figure 33: Diagram of the software and hardware setup of OverWatch

The Max patch (see figure 34) was designed to be easy to read during performances, with indicators at each trigger and meters to report on the state of both inputs and responses. Audio inputs were passed through a gain control and then into a pitch tracking object (*fiddle~*) (1) object which would report pitch, amplitude and attack information. Outlets of this object were connected to several modules which listened for particular sequences of

notes (2), rises in amplitude (3) and number of notes per minute as a basic measure of tempo (4). These modules were then connected to message objects (5) which were sent to the UDP connection and passed to Blender. .

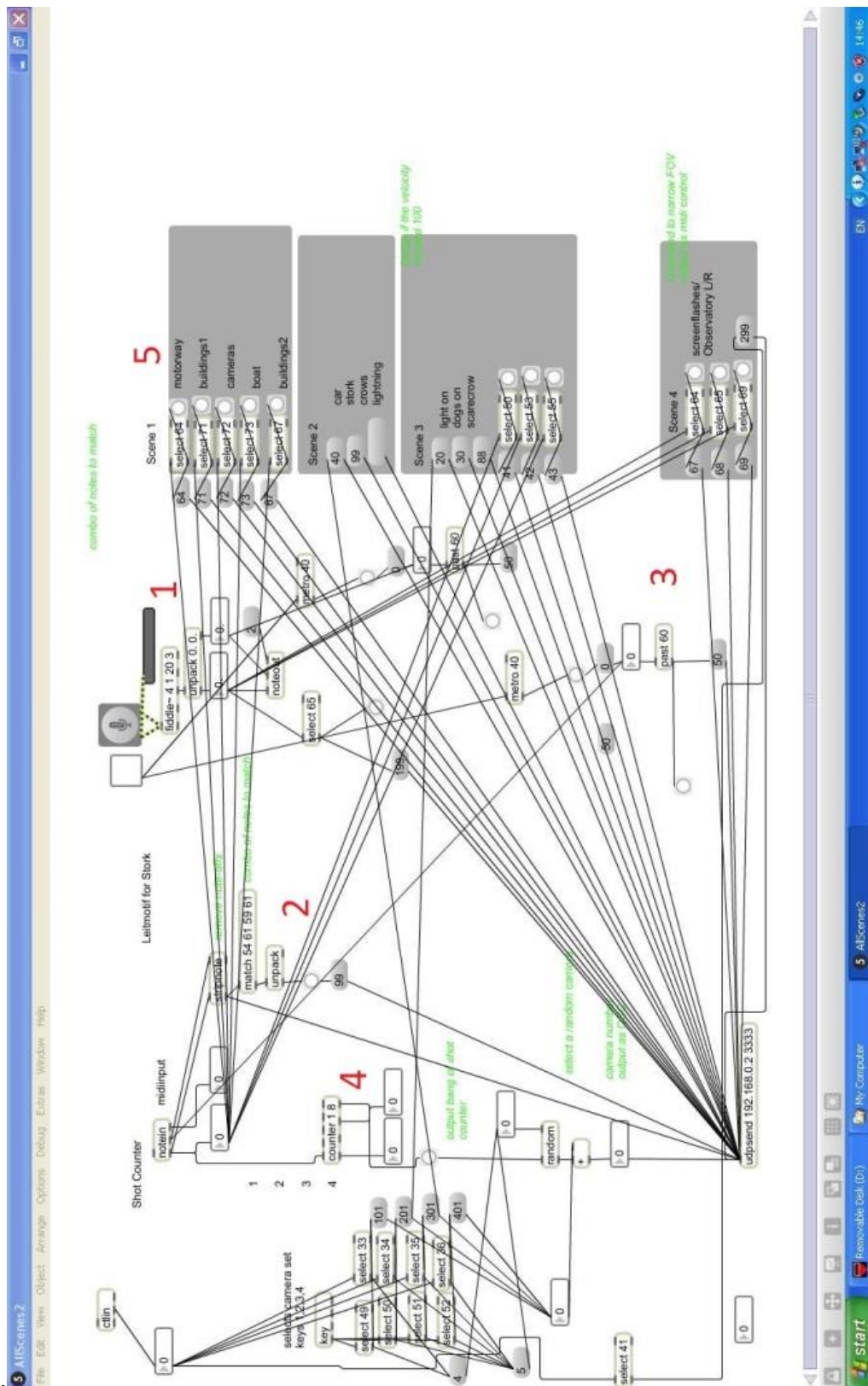


Figure 34: The Max patch used to translate musical inputs into cinematic actions in *OverWatch*

To perform *OverWatch*, two keyboard MIDI controllers, a microphone and an electric guitar were connected to a PC laptop via a single USB audio/MIDI interface. The laptop was loaded with Max/MSP/Jitter and Ableton and would handle all the music analysis. It was also connected via a mixer to the PA system to provide amplification for the instruments. Another laptop loaded with the Blender environments was connected via an Ethernet cable to the first machine. This separation was largely a matter of redundancy, meaning that failure of the visuals system would not halt the performance as the machine could be restarted without interrupting the music. This setup also provided a second on-stage monitor allowing us to see what was happening on the screen behind us.

5.3.4 The piece

The piece was divided into 4 separate sequences or scenes, each staged in a different environment and featuring different characters. Each scene was accompanied and affected by a different musical track, providing an overall trajectory for the performance but also affording a level of freedom for improvisation within each scene. This decision was informed by Benford et al's 'trajectories' model (2009), in that rather than attempting to plan a moment-by-moment passage through the work, *signposts* were used: individual events and set musical phrases which we could use to plot a path through the narrative, between which, the music could diverge into improvisation and experimentation. This approach was also connected to habits from our practice: *The Turing Test* performances had always been structured around individual and separate songs, separated by pauses which allowed us time to communicate directly with the audience, adjust technical details and reflect quickly on how the performance was progressing. This decision was intended to allow brief spaces for reflection throughout the resulting *OverWatch* performances.

Each scene involved slightly different mappings and control mechanisms, enabling us to explore a range of interaction schemes (see figure 35). Scene 1 (see figure 36) involved a slow gliding trajectory through a stylised cityscape, introducing the viewer to the world we were creating. Several types of building were spawned off-screen, controlled by a melody on Rachel's synthesiser. Mapped directly to individual notes, buildings, roads and landmarks emerged from a thick mist created using a particle system. Variations in the melody would directly generate changes in the city's structure, changing the composition of the resulting shot. Variations in tempo would alter the speed of cuts to several different

camera angles. This movement was around 4 minutes long and culminated in the emergence of a bird-like character, which was spawned by a simple motif of 4 notes played on Rachel's synthesiser. This bird was one of a number of recurring characters which would feature later.

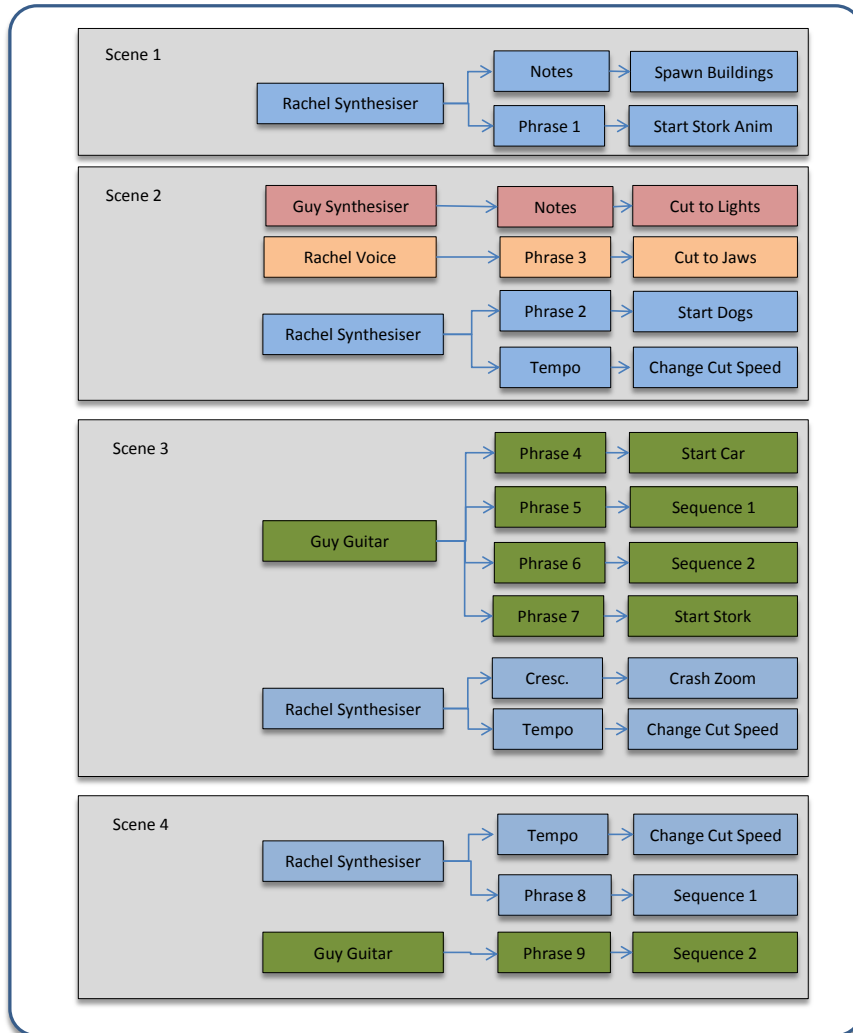


Figure 35: Instruments and mappings throughout OverWatch



Figure 36: Scene 1 from OverWatch.

Scene 2 comprised a number of POV shots from cameras which tracked through a dark forest (see figure 37). The speed of playing (measured as the number of notes played per bar), was linked directly to the average speed of cutting. In the opening part of the scene, synthesiser notes were mapped directly to coloured lights which would fade up when played, illuminating different parts of the scene. A phrase played through a drum machine was used to trigger a second sequence where guard dogs appeared to be chasing the viewer through the woods, linking the resulting change in instrumentation and tempo to a change in the pace and tempo of the visuals. At this point an audio input from the microphone was used to enable discordant notes from Rachel's voice to trigger cuts to extreme close-ups of the dog's jaws on certain notes, a device borrowed from horror cinema.



Figure 37: Scene 2 from OverWatch.

Scene 3 was the most elaborate in terms of camera control featuring 4 sets 4 of cameras which were enabled in 3 stages during the scene (see Figure 38). An arpeggiated synthesiser was used to control cutting speed. Sudden crescendoes, measured as notes above a certain average velocity, would trigger a crash zoom on CCTV cameras. A number of phrases were used as triggers for launching changes in lighting and subject. The first of these responded to synthesiser phrases and launched a clockwork car character, along with cameras which would dolly alongside it and track its movements. 3 particular guitar phrases would also begin animations and cause cuts to satellite dishes and other paraphernalia attached to the car. A final phrase would trigger the flight of the bird character seen briefly in the first scene causing it to glide overhead and settle to feed on a building.



Figure 38: Scene 3 from Overwatch.

The final scene (see figure 39) was less complex with 2 sets of 3 cameras used in 3 stages. The scene began with slow tracking shots around the interior of an observatory. Phrases played on a synthesiser and electric guitar, were used to trigger changes in the entire scene, as the environment gradually fell apart. A particular synthesiser phrase would trigger a final animation and gradual lighting changes as the observatory roof opened.

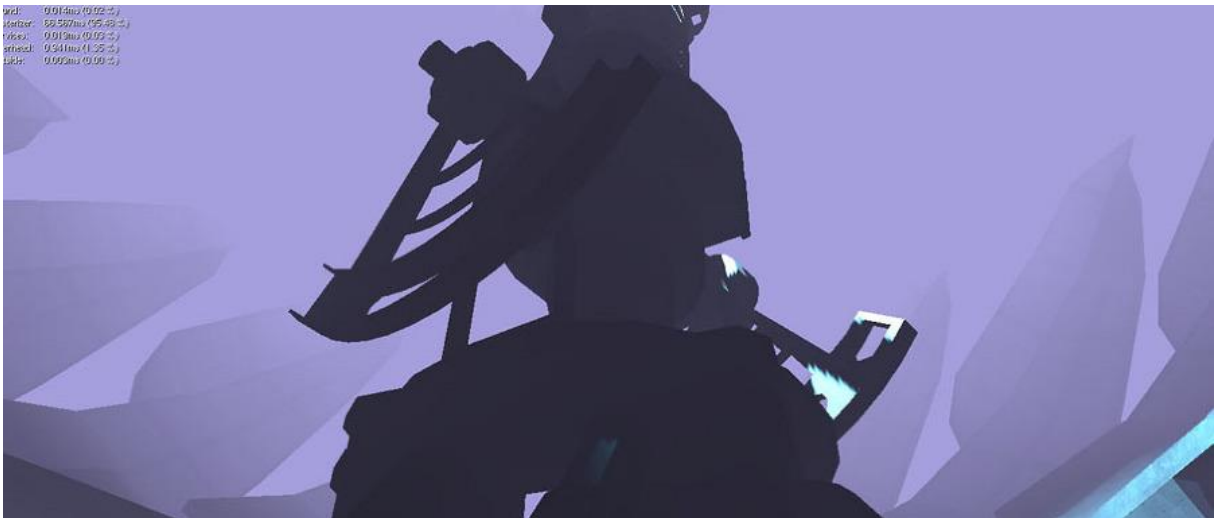


Figure 39: Scene 4 from Overwatch.

5.4 Evaluation and Reflection

5.4.1 Rehearsal

OverWatch was developed during 3 months of composition, rehearsal and coding during which Rachel and I would meet at our practice space several times a week to work on the piece and its technical supports simultaneously. The focus in these sessions would be jamming: we would play over the pieces, making changes to the visuals system, graphics and music and noting down more complex changes which would be needed later. In

between sessions these developments would be refined and major changes implemented. Using this model we were able to develop the system, visuals and music quickly and in synch, without having to wait for each to become ready. By working on the system live we were also able to instantly assess the effects of our developments in a way which a conventional episodic development system would rule out.

The chief challenge in this process was the importance of flow and momentum. As discussed in Chapter 2, the live composition/rehearsal sessions we usually undertook to create performances for *The Turing Test* relied on a momentum developing during the writing process: a sense of flow and progression which was key to our sense of whether a piece was developing well. In the development of *OverWatch*, maintaining this flow was more difficult and was exacerbated by the common problems of developing new software: periods of fault-diagnosis and rebuilding. Often, we would have to stop playing and sit down to adjust, reconfigure or re-program, breaking the flow of the session which would sometimes lead to losing a musical idea.

Diligent recording and note-taking were of limited use here as they would also stall the process: for the most part, processes of short-term memory and following the 'groove' were key to the success of a sequence. Crashes, both of software and hardware connections, which necessitated rebooting computers or re-launching programs could be destructive here, on several occasions leading to musical ideas being lost. Rachel in particular found this a source of stress commenting,

'I suppose the frustration of when it wasn't going particularly well or if you weren't sure what was wrong because it was a new thing you were developing or we weren't quite sure why it wasn't working or why it had just shut down or why it was broken'.-Rachel

This however was mitigated by effect of the tight development loop on the collaborative aspect of the work. An important motivator in our practice was collaboration and the pleasure in shared creation. Rachel commented..

'playing with it and actually the music being part of the visuals and it responding to what you were playing and having different elements to the score that I'd written, controlling different elements in the soundtrack, that was really good to see that process'. -Rachel

5.4.2 Performance

OverWatch was debuted as part of the art track of the 2010 International Symposium on Smart Graphics, where it formed part of an evening of public performances (see figures 40 and 41). This allowed the performance and its underlying software to be evaluated in the

context of a real live show. Due to the fact that our equipment would have to travel from the UK and be set up in a short space of time, this also presented an opportunity to evaluate how well the system performed under challenging and stressful conditions. The performance itself was video-recorded and I interviewed Rachel on our return to the UK. The aim here was as much to evaluate the success of our working methods as it was to judge the final performance, the central motivation being to surface aspects which could be taken forward into the next iteration.

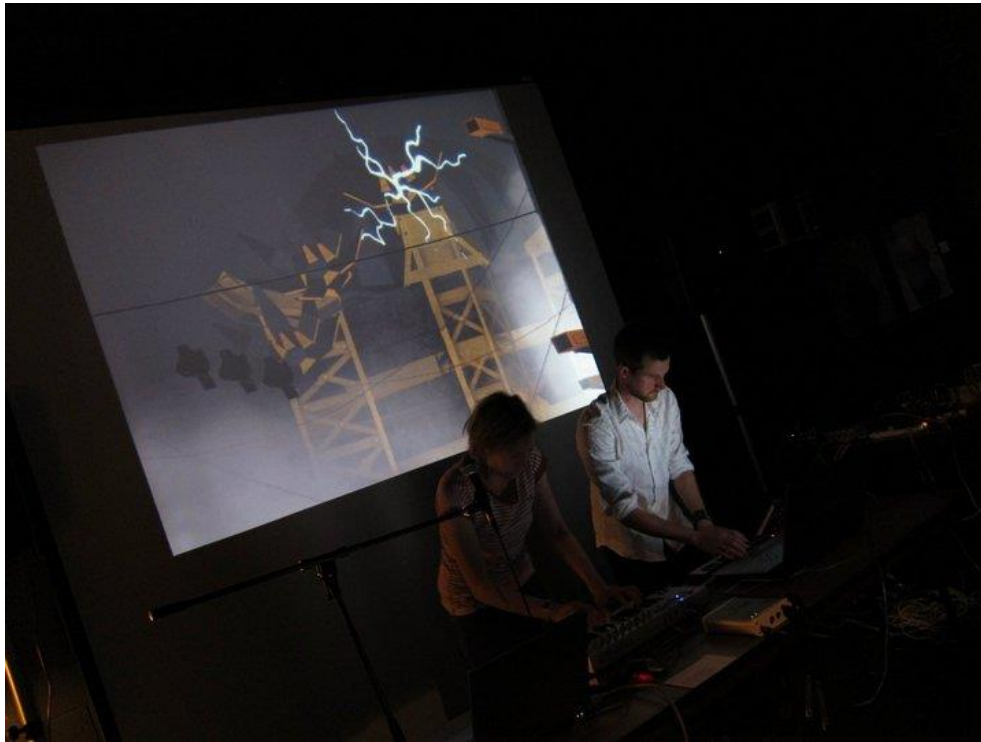


Figure 40: OverWatch, performed live in Banff, Canada.

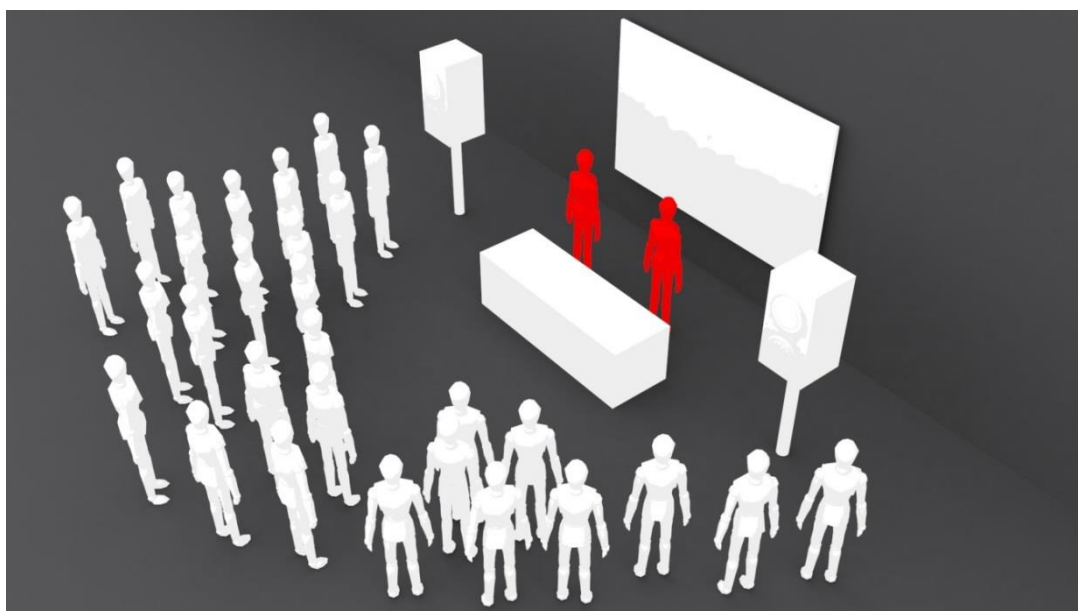


Figure 41: The configuration of the performance space during OverWatch. Musicians are shown in red.

5.4.2.1 Controlling Visuals with Music

The performance was presented in an area of the art exhibition which had been reserved for performances. However, this was not a traditional raised stage and the size of the room meant that the audience arranged themselves on 3 sides of the performance.

Over the course of the 20 minute performance, without prompting, most of the audience sat down and watched in silence. Video of the event shows very little conversation taking place. As the previous event in the programme had been an electro-acoustic music piece throughout which the audience had stood and conversed, this implies that they identified *OverWatch* more as a piece of cinema than as primarily a musical performance.

There was little direct interaction between performers and audience as each movement was presented without introduction. At the end of the piece however, the audience applauded enthusiastically and several audience members approached us and asked questions. This suggested that the audience had been engaged and that at least some of our ideas had been communicated. Discussing the work with audience members made it clear that they had identified the themes present in the work and had been able to follow the simple narrative; however it was also apparent that they had been unable to read the precise connections between the music and visuals. It was difficult to determine whether this might be problematic in other soundtrack-controlled cinema pieces. This question would need to be explored in further work.

In creating a new audio/visual performance, both of us felt that we had created a coherent work which had communicated the themes running through our work. Rachel felt that the piece had been successful in the context of our practice commenting,

'I think it kind of embodied what we tried to do in our gigs. It had, you know the music matched and the visuals matched and they both worked well together. It created, I hope, well I felt that it created an atmosphere and I felt that it created a particular mood' –Rachel

Choosing to use a narrative environment as a way of establishing spatial continuity worked well, however the lack of a central character made it difficult to tell a complex story.

The simple devices used in the performance had been successful in translating some of the musical elements of the score in cinematic action. Mapping tempo to the speed of the editing in particular, allowed changes of pace in the score to be reflected clearly in the visuals. For us, this helped develop a sense of groove throughout the performance. Using phrases to trigger particular events, including cuts to changes of subject was also useful in establishing a sense of narrative progression through the performance. This helped us

navigate the piece and largely took over the role that verses and refrains had in our usual practice: that of structuring the piece in terms of tension and release.

Other devices were less successful. Linking non-cinematographic devices such as lighting changes to music seemed arbitrary in the final performance and neither helped the coherency of the piece nor assisted in communicating our ideas.

5.4.2.2 Instruments as Controllers

A central goal of the work had been to design a system which could be operated while fully occupied playing instruments. Using simple triggers as an initial step was successful in providing consistent and predictable responses to our music and during the performance, I had a strong visceral sense of the connection between the music we were playing and the visuals. I found myself consciously returning to phrases that I knew would trigger particularly satisfying visual responses.

Interestingly, Rachel did not share this experience during performance, despite having found it compelling during rehearsal. When asked about how the connection felt, she commented that she had been so involved in playing the music, that she hadn't registered what the visuals were doing.

'I wasn't looking at it because I was too busy playing the instruments that we were playing'. I was kind of relying that you were doing it (laughs)'. -Rachel

This is particularly interesting as in the video of the event Rachel can be clearly seen watching the monitor. Seemingly, either her state of concentration had meant that she was looking without seeing, or that she was unable to recall what she had seen afterwards. In either case, it was clear that for her, her own role was clearly delineated at performance time: playing and performing to the complete exclusion of controlling the visuals: a factor that would have to be taken into account in further designs.

The decision to implement many of the systems responses as simple triggers, rather than varied responses, had meant that in many cases precise combinations of notes were necessary to keep the action moving. It was planned that the partly-improvised score would have to return to rehearsed structures at a number of points, a solution which we were both familiar with from our usual practice, however, an unexpected consequence was our anxiety around those passages. In some sequences, I found myself focussing my entire attention on triggering an animation, camera-movement or lighting change. I would then feel compelled to check the monitor to confirm that it had indeed been triggered. This made elements of the piece feel rigid and restrictive, with undue emphasis placed on perfect playing, at the expense of improvisation and expression.

Once again, Rachel had not felt this anxiety, suggesting a tension between narrative and musical control that was partly due to our slightly different roles: she saw her role primarily as a musician, whereas, during the performance, I was focussing as much on the visuals as my own playing. This suggested that to be satisfying to play for different players, the system would need to take a more active, interpretive role, involving more high-level control at a range of levels.

Solving this issue presented a dilemma: whether to attempt to design a system that was completely automatic and required no conscious input from the player, or to support active and conscious control. As even within our own collaboration, a difference of opinion had already emerged on this key element, it was clear that additional perspectives and use cases would need to be explored before we could confidently design a tool for other musicians.

5.4.3 Evaluating the research process

The integrated process of development and rehearsal, where software, music and visual content had been created collaboratively using intuitive and iterative processes drawn from our creative practice was extremely effective in quickly building a coherent piece of work. By continually trialling the music and visuals against each other, it was possible to ensure that – at least according to our own subjective view – the connections between the features we had selected were meaningful and aesthetically satisfying.

Dispensing with separate development and testing time meant that errors were generally detected immediately, before they could be hidden by subsequent developments. Sketching the software in Max/MSP enabled us to quickly determine if controls were viable or not, avoiding dead ends and unnecessary development. The transparency of the process, where visible code objects could be discussed between us was also useful in enabling us to communicate during the development process and avoid misunderstandings. This process would clearly be useful in future work with other musicians.

Over the course of the development, using *The Turing Test* as a research platform to develop *OverWatch* had a mixed effect on our practice as a whole. Not only did it represent our first use of interactive visuals but was also the first time we had attempted to create a narrative piece of music. This was a creatively stimulating process in itself as it focussed the collaboration on a single coherent project. Rachel commented that this had been rewarding in itself.

'I enjoyed that it wasn't something normal, like a normal kind of gig that we were doing as well, I really enjoyed the fact that it was kind of a one off exhibit'. -Rachel

The development and performance of *OverWatch* had opened up new models of performance for us which were quite different from our usual performing practice: a process that was exciting and liberating.

The writing and rehearsal of *OverWatch* was the only time during this project that our work as *The Turing Test* was dedicated exclusively to the research work. Having worked together very closely for several years, this process was interesting and enlightening for us in highlighting some of the strengths and weaknesses of our partnership. The technical complexity of the project and the creative energy required to realise it had however meant that the main body of our practice had suffered somewhat, allowing us to play fewer concerts and reducing our output of new songs. During the *OverWatch* project (Late February-June 2010) we only played one concert of songs, with all other work dedicated to programming the system, writing the score and preparing the visuals. This was a problem in terms of our continuing collaboration and would have to be managed carefully in future projects. This was however largely balanced by the satisfaction gained by creating radically new work.

The technical legacy of *OverWatch* for continuing work as *The Turing Test* was a functional system and workflow for controlling real-time 3D CGI visuals through music, using Blender, Max/MSP/Jitter and Ableton live together. Partly due to stylistic considerations and partly to the limitations of our hardware and Blender Game Engine's rendering capabilities, *OverWatch* had relied on a consciously retro-futuristic visual style, with crude textures, NPR (non-photorealistic rendering) shaders and simple models. A more subtle effect on our practice was an increased desire to make more experimental, immersive live shows and we began to plan more elaborate interventions using costumes, lighting and set-dressing.

5.5 Conclusions

OverWatch represented an attempt to consider the two main research questions in the context of a creative practice. The development and performance of the piece suggested a number of specific avenues to explore in further work. In considering the connection of music to visuals, it had been possible to create a coherent and legible narrative using controls derived from live music. The exact connection between the devices chosen in *OverWatch*, was not clear to the majority of the audience: however they had been able to engage with and apparently enjoy the performance. As it was unclear whether being able to understand the causal link between music and visuals was a factor that might affect

audience engagement in other soundtrack-controlled pieces, more work was needed to explore different levels of legibility.

Using a narrative environment to site the action had added to the coherency of the piece, suggesting that establishing a sense of spatial continuity could be used as a structuring device, however this was only one way of exploring narrative and others could be usefully explored. A few basic cinematic devices had been used in *OverWatch*: cuts, changes of subject and simple camera movements, however, again many others were available that might add to the articulacy of a performance system. The edits and changes of subject used in *OverWatch* had adequately established a sense of pace and a basic narrative structure but more subtle psychological effects might be possible.

In developing instruments as controllers, a more intelligent, less direct interaction scheme would need to be developed, requiring less direct attention on behalf of the user. Our different experiences during *OverWatch* (a distracting level of attention on my part and a total disregard on Rachel's) suggested a range of possible configurations would need to be explored in creating user interfaces. It was also clear that a less rigid and more interpretive scheme of mappings would need to be developed if other musicians were to use the systems developed. If the work was to draw on more subtle and expressive devices, the simple system of triggers used to control the visuals would have to be reconsidered and more fine-grained responses implemented.

'Playing' the visuals through music had been satisfying in terms of our own practice and was able to support the development of flow and groove that was a central criterion in how we judged the success of our work. Whether this 'playability' would be an important factor for other musicians and whether it could be developed in other performances was a question to consider in developing the research.

To further pursue these questions, the research would need to be reconfigured. The clear danger in setting the aims of the project as specific to a single creative practice was that it could not be assumed that our motivations, goals and constraints were the same as other musicians, meaning any system resulting from the work might be too specific to be of use to others. A way of remedying this would be to draw upon collaborations with other musicians in order to provide a mix of perspectives on the work, using our own practice as a point of comparison. This approach has much in common with Hook's work with VJs (2011) in which he built bespoke tools for his individual participants' practices, rather than attempting to design more general tools. The development of these systems formed the focal point of a dialog between the VJs whose practice he was exploring and his own

research, allowing the unpicking of intuitive and previously unarticulated working practices, which could then be used to make more general claims. To continue the research, collaborations of a broadly similar type would be pursued through which the questions raised in the development of *OverWatch* could be put to other practitioners.

6 *Golden Shroud*: Live Visuals for an Album Launch

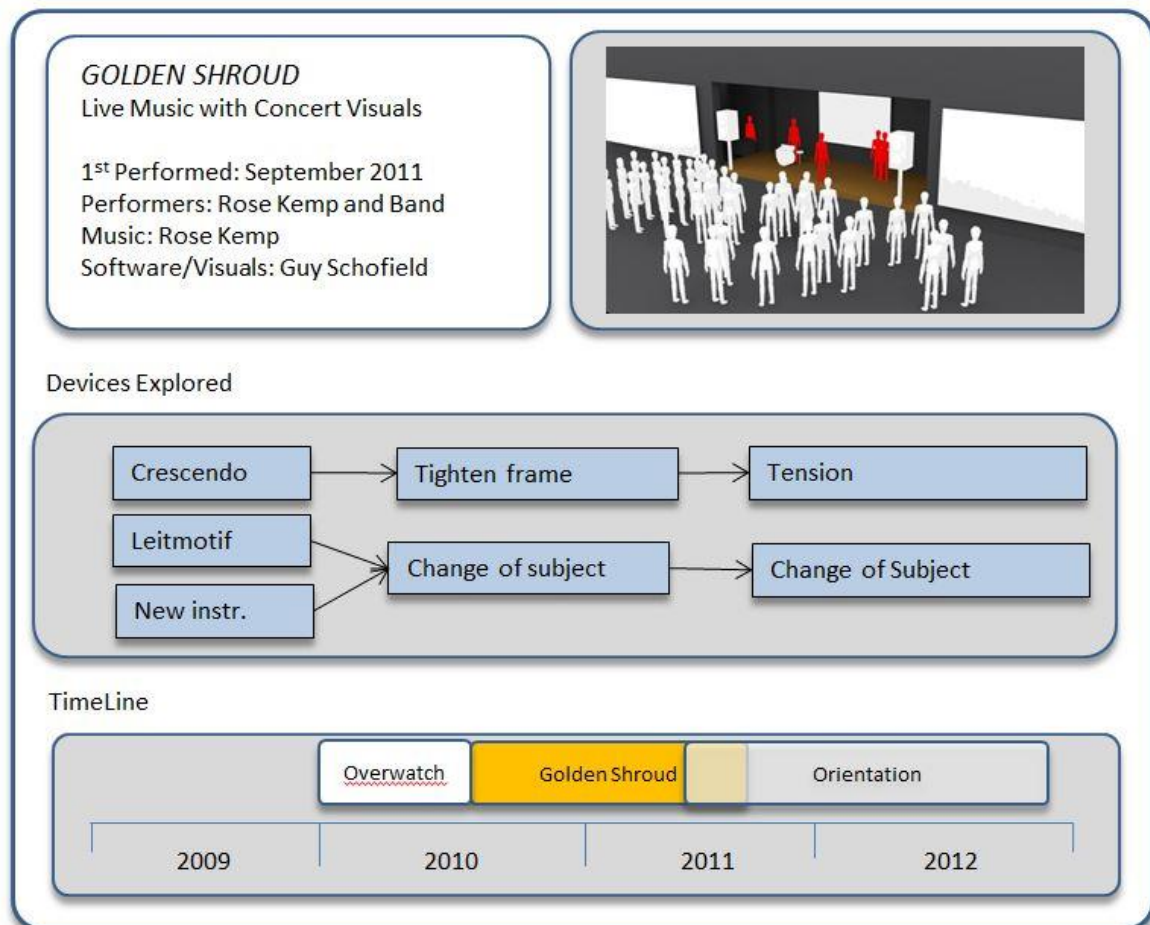


Figure 42: Summary of the Golden Shroud project, discussed in this chapter.

6.1 Introduction

In this chapter a phase of the research is described where findings from the scoping study *OverWatch* were used to frame development of the research. The previous project had resulted in a soundtrack-controlled performance which had been successful measured against the requirements of the creative practice in which it had been situated. It had been appropriate to the aesthetic already established in our previous work as *The Turing Test* (see Chapter 2) and had – in our own subjective view – successfully communicated this aesthetic to the audience.

The interaction scheme using instruments as controllers had been satisfying to play but somewhat rigid and inflexible, requiring a level of attention on the musician's part that could potentially detract from his or her playing. The use of simple triggers as inputs to the visuals system had the capacity to provoke anxiety in the performer as actions would either

be triggered or not, with little room for error or subtlety on the player's part. More work was needed to explore how this might be improved with more fine-grained controls. The system had used several devices from cinema and film soundtrack, however many others remained that could add depth and variety to soundtrack-controlled pieces.

The greatest challenge in gaining reasonably generalizable insights from *OverWatch* was the self-situated nature of the project. In order to ensure that insights gained from the work could be applied to other musicians' practices, a better understanding was needed regarding how other practitioners considered their performances. A number of specific questions had arisen from our findings, some of which concerned fundamental aspects of creative practice, such as the motivations behind the making and performance process; which were crucial in establishing criteria for the success of a performance. Of particular relevance was how other musicians considered the visual component of their work in terms of communication and narrative. How they considered their music in terms of narrative and structure would be important in considering features, devices and mappings. Lastly, in order to ensure the practical feasibility of the research, it was necessary to consider what logistical constraints impacted on their work.

In order to explore these questions, it was clear that the next phase of the work should involve collaborations with other musicians. The first of these would continue to explore the key questions of controlling visuals from music and using instruments as controllers but would be focussed on their context of use: how soundtrack-controlled visuals systems could be used to support and augment an existing creative practice. To this end, a project would be structured in which questions raised in the development of *OverWatch* were further explored through design of a bespoke system to provide concert visuals for a professional musician. This project would focus more fully on the interaction scheme, developing more robust, useable and expressive control systems. If this was accomplished, further work on exploring more complex narrative schemes could be carried out, secure in the knowledge that the research was appropriate to and usable by other musicians. The following account describes the planning, performance and evaluation of another performance, in which these issues are addressed.

6.2 Practice Context

In selecting musicians with whom to develop the project, a number of criteria were considered. First among these was identifying artists who were interested in developing their stage shows using narrative, visual elements and who were therefore in a position to

benefit from contributing to the research. Musicians who already had an articulated position on the aesthetic and communicative aspects of their work would be especially appropriate as their views could be compared with our own. Musicians working in ensembles were sought in particular as this represented an opportunity to address technical and logistical issues around multiple instruments. Lastly, musicians involved in the project would ideally be able to provide a ready-made test platform of venues and shows of their own through which to develop and evaluate the work.

The process of engaging successfully with other musicians was far from trivial as complete access to their working lives would be required. Consequently much attention would be given to establishing a rapport with the artists involved and gaining their trust. Our own backgrounds as musicians and performers were crucial here in not only reassuring the artists by displaying an insiders' understanding of the domain but also demonstrating that each design iteration was stable and reliable through parallel trials in our own shows.

After negotiating with several musicians, a collaboration was established with Rose Kemp, an established singer/songwriter who wrote and recorded music involving elements of British folk music and Doom metal. Rose's practice encompassed a range of approaches and venues, ranging from solo performances with a guitar in small bars, to large festival shows, involving a full backing band. A second-generation professional musician, she had been writing and performing music for over 10 years and had extensive experience of orchestrating live shows.

Rose had never used interactive video in her live shows but had experimented several times with playing her own videos as projections, an experience she said had been aesthetically unsuccessful due to her own inexperience with the medium. At the time of our initial contact, she was planning to launch a new record and was keen to construct a coherent visual identity around it using complementary visual artwork, including projected visuals.

Rose mentioned on several occasions that the visual supports to her music such as record artwork had until recently been something with which she had felt uncomfortable. She spoke of avoiding using photos of herself on record covers; indeed she had only recently begun to use a consistent logo and typeface to identify her work.

'Until this album I'd never thought it through. I just bought black dresses: that was as much thought as I put into it. But I was anti-logos, anti-consistency really until it got to Unholy Majesty (Rose's previous album) and then I realised what a cover could do.' –Rose

This new experimentation with the visual had led to elaborate costumes and make-up designed by Rose and her friends beginning to feature in her live shows (see figure 43).



Figure 43: Rose Kemp performing with custom-made costume.

6.3 Configuration of research and practice

As in *OverWatch*, in order to best explore the research questions, it was decided to draw upon the methods and venues of her own practice. An initial planning phase would first attempt to establish through discussion, Rose's conception of the aesthetic content of her work, the goals and motivations behind her practice and how she put together a show. A visuals system and supporting content would be developed from this discussion. Taking a similar approach to that used in *OverWatch* this take place mainly during rehearsal with the band. I would develop ideas, adjust and tune the responses of the system and configure mappings live wherever possible, with the result projected on the rehearsal room wall. After each rehearsal the design would be firmed up and new features implemented. These sessions were designed to make the best possible use of my time with Rose, not only in terms of developing features and observing how she used her instruments but also helping to make clear the dynamics of how Rose planned and prepared her shows in narrative terms and how this could compared to our own experiences using visuals. During the development of the work, data gathering exercises were planned. The most formal of these were, once again, conversations, scheduled at the beginning and end of the project. Initially, these would be used to confirm a set of common goals and conditions around

which the work would be structured.

A particular challenge was how to structure the evaluation of the final performance and how to ensure Rose's continuing involvement in this phase of the project, after the shows had already taken place. To facilitate this, it was agreed that we would allow video of the event to be used as source material for a DVD which she could distribute to her fans.

Evaluation would be conducted during editing of this video, allowing lengthy discussions of the concerts. The results of these conversations would be subjected to analysis using McCarthy and Wright's threads of experience model (McCarthy and Wright, 2004), allowing us to consider each part of the performance according to specific themes.

At each step, the research process would be as transparent and open as possible and Rose would be made aware of the exact goals of the research. This was particularly important to clarify for everyone involved, the scope of the project and in purely practical terms, what would and would not be possible. This clarity and honesty was vital in establishing a position of trust, especially as the research would rely on our collaborator's own openness in communicating the very personal motivations behind her practice.

6.4 Performance Context

Through negotiation with Rose, a schedule of live shows was planned for which the visuals and supporting system would be developed. Importantly these were determined by Rose, an approach which both guaranteed the authenticity of the setting and minimized the cost to her in time of her involvement in the project. The shows would feature Rose and her current band which consisted of a drummer and two backing singers. The performances ranged from small bar gigs to outdoor festivals and presented a wide variety of settings which would likely present a range of technical and logistical challenges. The overarching purpose of the shows for Rose was to promote an entirely new body of work: a new record called *Golden Shroud*. Video content for the show would be produced in response to an initial set of ideas by Rose. When considering developing a visuals system, Rose was clear about its practical purpose in her show, seeing it primarily as a tool to maintain engagement with the audience over the course of a long and challenging series of musical pieces. She summed it up in the following way:

'So what you're doing for me is just another way of making them (the audience) keep the focus...Not wander off to the bar too much.' -Rose

In particular, she considered its possible use as a way of maintaining audience engagement through 'weaker' (in terms of pure amplitude) parts of the set. Her goal was to use the

visuals to maintain a constantly varying but consistently high level of sensory input, where dips in the energy of the music would be compensated by increases in visual interest.

A key point here was the link in her view between aesthetic decisions and practical considerations. She was careful to point out that the details of each of her own visual supports were determined by the practical requirements of her performances.

'I mean, everything I do visually is built for practicality. I've got to have a waist belt because I've got to have a pack. I've got to have a headband because I don't want my hair going in my face...I've got to have a dress that means I can put my guitar strap over my shoulder. Everything is worked out around practical stuff.'

-Rose

6.5 Design

The design of a visuals system for the *Golden Shroud* concerts forced not only consideration of a different use-case for a soundtrack-controlled visuals system but allowed a restatement of questions raised by the design of *OverWatch*. When considering each design feature of the new system, the requirements of both use-cases were considered, the goal being a system which could support a range of activities. This approach was adhered to throughout the design.

6.5.1 Controlling Visuals with Music

Through discussions with Rose, a visual scheme was designed. In many cases her ideas were quite specific, for example black feathers and runes were suggested as recurring motifs, however, the narrative element to her visual ideas was far less explicit than in conventional cinema, being more concerned with establishing atmosphere and evoking certain emotional states than using characters and plot. For her, visual motifs were used to establish specific atmospheres, reinforce her musical identity and most importantly, in long and complex pieces of music, clarify distinct movements and themes. Responding to this, the visuals were designed to function as a background or virtual set, rather than a fully narrative cinema piece, with the audience's attention carefully balanced between visuals and performers.

From these specifications, video material in the form of animations was produced.

Architectural elements figured heavily, which took advantage of the set-up of the stage.

The beginning of the show for example, opened with flashes of flame and lighting changes on a landscape of black stone pillars. As the visuals would be front-projected from ceiling to floor, this meant that Rose and her musicians were in the beam of the projector and

would be lit mainly by these flames, establishing emphasis on certain parts of the track (see figure 44). Most scenes featured a single fixed or tracking camera angle. Elements were faded in or out, accompanied by slow zooms and pans according to phrases or combinations of notes.

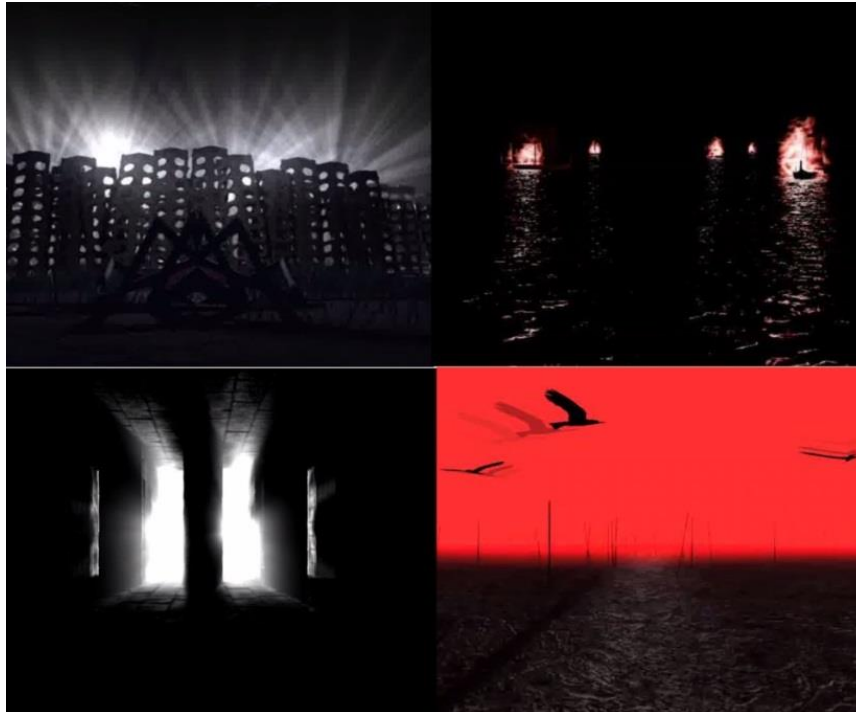


Figure 44: Visuals for different sections of the Golden Shroud concerts

As discussed in Chapter 2, in composing visuals for our own shows, we had previously linked individual actions to changes in the projection. By contrast, Rose proposed using visual imagery to establish the overall narrative arc of her stage show, without necessarily directly responding to individual actions, stating that there were 'peaks and troughs' in the performance. Key moments were identified as landmarks within the piece, for example:

'We're starting it three part a cappella, so we need something that's going to burst'. -Rose

In *OverWatch* a 3D engine had been used to provide the visuals; an approach which, for Rose's show, presented problems. Although Blender's visual programming environment had been perfectly suited to the live development process, its lack of native support for advanced lighting techniques, multiple material channels and depth of field effects, meant that even if we were to further develop the system, the results would probably still be unmistakably reminiscent of a computer game. This was perfectly appropriate to the aesthetics of a *The Turing Test* performance but was completely at odds with the visual style of Rose's work. Also problematic was the aesthetic quality of the content compared to the work required to realise it, in fact, creating the scenes, characters and animations had

accounted for over ½ of the development time.

To be able to incorporate a wider range of visual styles, video would be used for Rose's system. This decision would mean that more elaborate visuals could be used in the project but would also mean that later projects would be able to use human actors: an important consideration for future narrative projects. Additionally, by using multiple video tracks in parallel and by utilizing the high resolutions of 1080p HD video, it would be possible to not only cut between video tracks in real time, but by cropping and panning across the image, reframe shots. This approach was initially hindered by MAX/MSP/Jitter's relatively poor video performance.

To this end, a standalone output module to handle video output was developed that could be controlled from Max. Using the gains in performance afforded by SFML (Simple and Fast Multimedia Library), a multi-track MIDI-controllable video player was developed which would support up to 4 channels of full HD1080p video on a mid-range PC laptop (2.4ghz, 8Gb RAM, 1Gb Video Memory). Real-time video transformations, including mixing, panning, zooming and rotation could be accomplished by configurable MIDI controls while an OSC connection to Max was used to read and set frame numbers. An easy-to-read text configuration file could be used to quickly preload video tracks and control configurations. The video player, rather than choosing cameras in a 3D scene, could run up to 4 video tracks simultaneously, not only cutting or fading between them but cropping, rotating and panning across them. In this way a large number of possible results could be taken from just a few tracks of footage.

The Max/MSP/Jitter patch used in *OverWatch*, with its complex web of objects, was redesigned as multipurpose application to support a more logical arrangement. Named *Cinejack* it used Max's inbuilt send and receive objects to allow multiple connections and configuration to be quickly set up. To overcome the issues of flexibility encountered in developing *OverWatch*, named modules were developed to handle individual actions. Input modules were designed which monitored audio input and extracted pitch and amplitude information. Other modules listened for particular features such as tempo or key and could be connected to others, which carried out video transformations such as cropping or tilting the image.

New cinematic and musical devices for the system were selected with reference to how they might support a changing set of virtual backdrops for the show. The overriding goal in the selection and implementation of these devices as modules was exploring how consistency, versatility and fine-grained adjustment might be achieved through different

inputs. Once again, each innovation was considered in the context of how it might be used in a narrative show such as *OverWatch* or in a supporting role such as in Rose's *Golden Shroud* project. Many of the resulting modules could be used in different ways through different connections: for example, a *cut/fade* module could be used either to perform edits by switching from track to track, or - in the case of Rose's show - perform partial fades between different backdrops.

Zoom and *Shake* modules had been implemented to simulate camera movements on the video, by cropping or panning across the image. In different contexts these could either be used in conjunction with *cut/fade* modules to reframe the image, or – as in the case of Rose's performance – disturb the video image slightly through being mapped directly to the output of instruments. *Leitmotif* modules were designed to listen for particular phrases. These could be used to trigger *cut/fade* modules. An *Intensity* module was also developed to keep a running average of notes above an adjustable amplitude threshold. This could be used to detect crescendos.

6.5.2 Instruments as controllers

Cinejack's modular system was designed to be quick and easy to configure during rehearsal and composition sessions. Simple indicators were provided to give the user a better awareness of the state of the system. However, like Rachel during the performance of *OverWatch*, Rose was keen to avoid having to look at the monitor while playing. Her system was therefore designed to run completely 'hands-off' if necessary with no manual control required. A *Manual* module was implemented to allow starting and stopping the system during performance via a MIDI controller, which would also allow manual override in the event of technical failure was implemented.

Rose's band's equipment was very different from ours, being entirely electric-acoustic, without any electronic instruments. The line-up for *Golden Shroud* was a drum-kit, electric guitar, effects pedals and amplifier and 3 vocal microphones. This difference was a considerable challenge, not least because of problems caused by the sheer volume of the music. Whereas it had been previously possible to accurately monitor most of our instruments cleanly and independently using MIDI, it was now necessary to incorporate multiple audio channels, any of which might affect the others. The vocal microphones in particular were prone to 'spill'(sound from the guitar amplifier and drums, being also picked up by the microphones). This led to the development of new features with which to average and compare audio inputs in a way which would enable the system to reason

whether the sound in one microphone was actually a voice, or simply the sound of the rest of the band.

Stability was once again a crucial consideration. During the development of OverWatch, the system had been prone to crashes during development, which had slowed the rehearsal process considerably. In the case of another musician's practice, this was unacceptable, so consideration was given to routing audio inputs in ways which would separate the system from the band's PA. This meant that if the visuals system crashed, the audio would not be affected and the rehearsal could continue. In practice, this meant providing Rose with a second set of microphones, leaving her own performance rig untouched.

6.6 The Piece / System Description

The final system, now named Cinejack was used in two concerts, the first at the Brickyard nightclub in Carlisle, the second at Equinox Paradox, a progressive rock festival in Cumbria. The configuration of equipment for each concert was broadly similar. In each, a single laptop running Cinejack was sited off-stage, connected to projection systems provided by the venue. At the Brickyard, projections were on a 4m by 2m screen at the back of the stage (see figures 45 and 46). At Equinox, a projection screen at the back of the stage was replicated by two projectors aimed at exterior walls, (see figures 47 and 48).



Figure 45: Rose Kemp performing Golden Shroud at the Brickyard Carlisle,



Figure 46: Stage setup at the Brickyard with musicians in red. Rose centre stage. Computer was located offstage (to the left).



Figure 47: Rose Kemp at the Equinox Paradox festival.

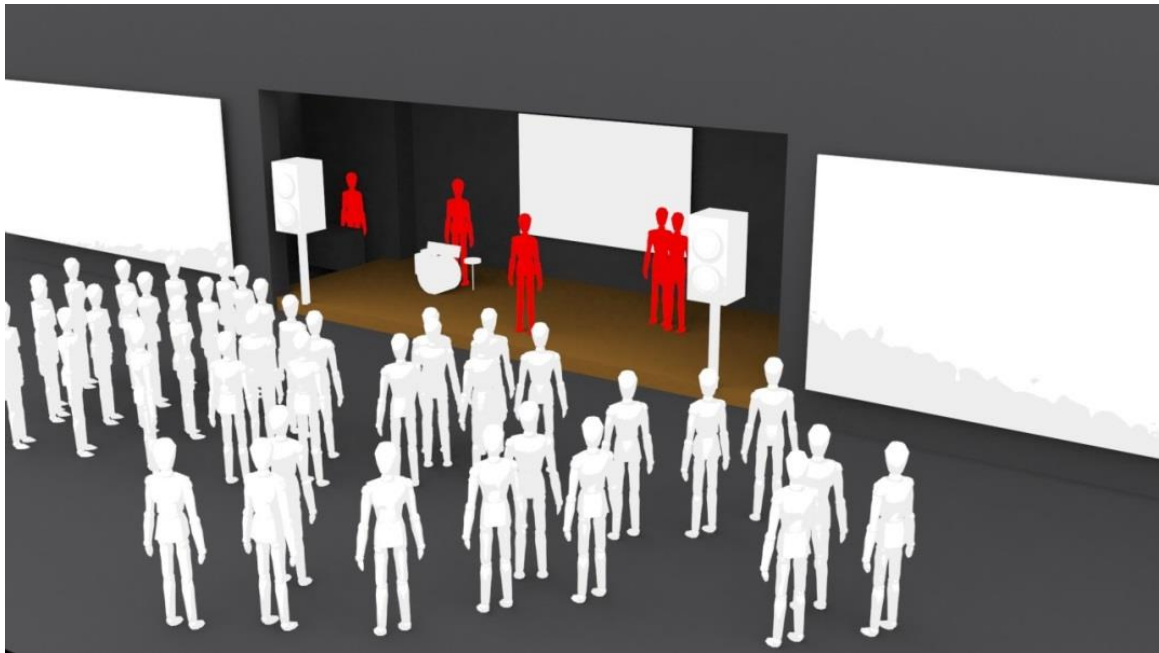


Figure 48: Stage setup at Equinox Paradox with musicians in red. Rose centre stage. Computer was located offstage (to the left).

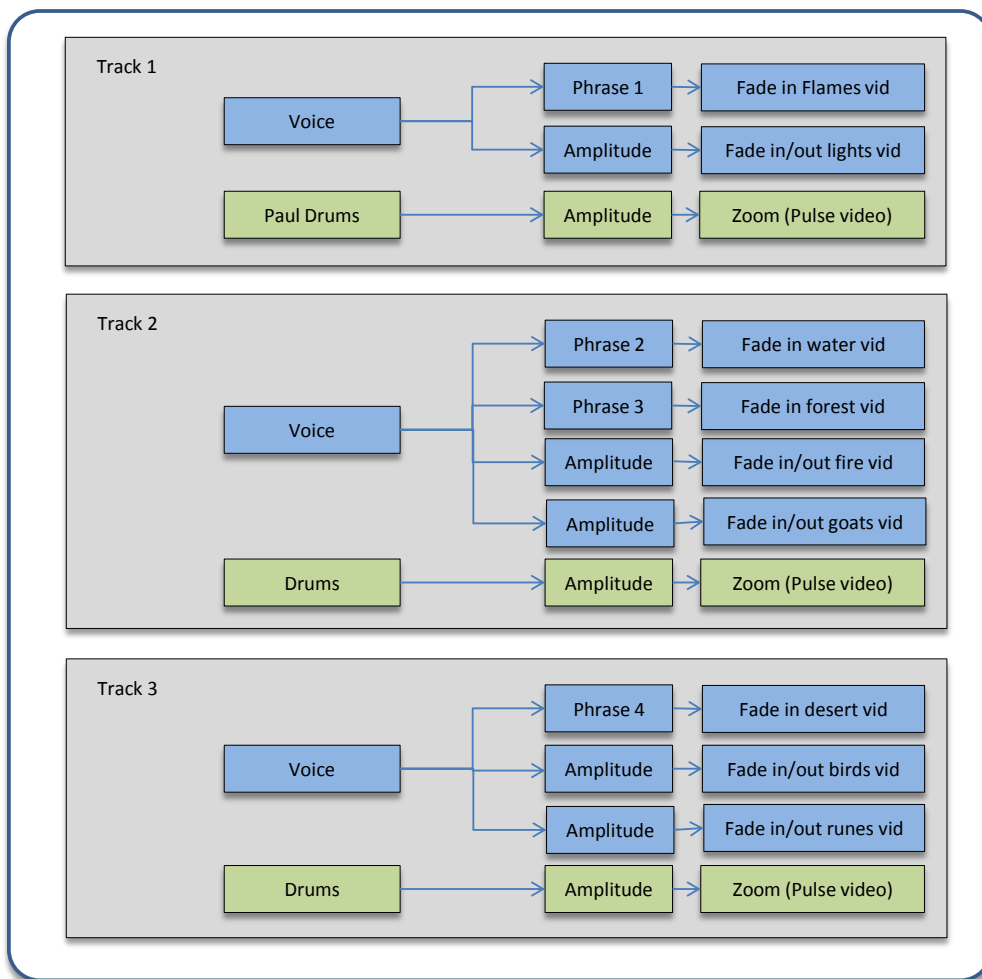


Figure 49: A track by track breakdown of mappings between instruments and devices in Golden Shroud.

Each concert consisted of three long pieces of music, each of which was accompanied by corresponding visuals. Rose's configuration of the software (see figure 50) was controlled by 2 audio inputs: a vocal microphone and an instrument microphone attached to a drum kit monitored by separate *AudioListeners* modules. In each track, cut/fade objects on 3 video tracks were controlled by the amplitude of Rose's voice, causing different elements to be faded up. Several *Leitmotif* objects were used to respond to vocal notes and phrases to generate effects such as sudden fades to bursts of flame. An *Intensity* object mapped to *cut/fade* objects caused the video tracks to crossfade in particularly loud passages in the track. This was used to partially fade in video tracks, creating movement across the visuals. A *Zoom* module was also mapped directly to the amplitude of the signal from the drums. This caused the whole video image to pulse rhythmically during various points in the show.

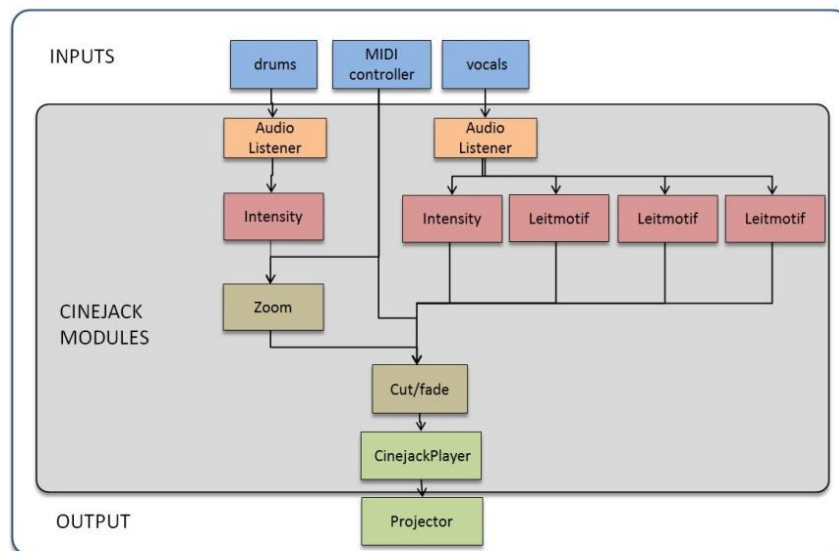


Figure 50: The configuration of hardware and software for Golden Shroud

The interface for this version (see figure 51) was designed to run 'hands off', needing no adjustment by the musicians, and merely contained audio input meters so that the initial volume levels could be set. As an emergency measure however, a Korg NanoKontrol MIDI controller was set up offstage to function as a manual override for the main actions, in the event of technical failure. Using this controller I monitored the system from behind the laptop and was able to intervene manually if necessary. Between each piece, I also faded the projections down manually and loaded a new set of visuals and controls. To aid later evaluation, during the performance, a 3 camera video crew covered the stage show and notes were taken while the band played.

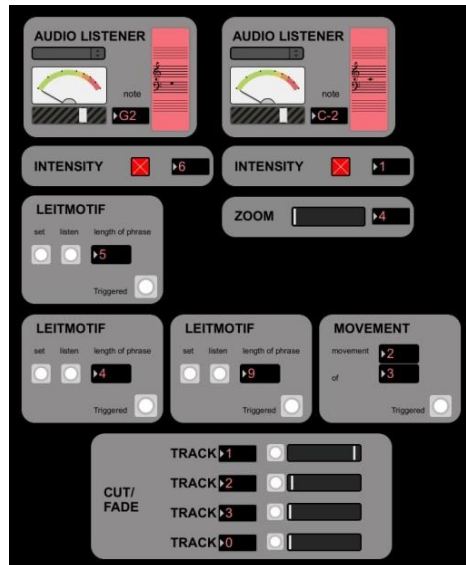


Figure 51: Screenshot of modules assembled for Golden Shroud in Cinejack's UI

6.7 Evaluation and Reflection

6.7.1 Rehearsal and composition

While working with Rose, a number of surprising side effects developed, partly as a result of the rapport which had developed between the development team and the musicians. Highly conscious of her role in a research process, her evaluation of the system was almost completely positive and without criticism. This 'good participant' effect is not uncommon in studies of this kind (Nichols, Maner, 2008) and we were able to discount some of these statements as they arose by asking more specific questions.

Another byproduct of the research configuration was the growing emotional investment of the development team in the design process as it related to the success of the planned shows. While presenting new footage and new iterations of the system to Rose's band, we felt exactly the same nervousness and stage fright we would expect to feel playing music for the first time with other musicians. Although challenging, this aided the development as it was found that stress and the difficult technical conditions of borrowed rehearsal rooms and stages led to inadvertently making mistakes in setting up the system, highlighting design flaws that might otherwise have gone unnoticed. Also this fear of failure in front of musical peers led to a sense of authenticity and immediacy in rehearsal that was less present in design sessions involving our own rehearsals. The pressure of 'performing' each iteration in rehearsal led, on the one hand, to a deeper understanding of Rose's practice in its proper context and, on the other, to a more authentic method of testing the system. A slight drawback which emerged was the lack of space in rehearsal for

more formal discussion given the necessary focus on playing. This necessitated the scheduling of reflective sessions in which we would show video of previous rehearsals and discuss them with Rose, hoping to prompt an external perspective on her practice and her relationship to the developing system.

6.7.2 Performance

When interviewed after the event, Rose commented that the combination of the stress of performing a complex piece and the stage lighting at the two venues had meant that in both concerts she had little recollection of what had taken place. When asked what she remembered about the shows, she answered,

'No memory of any of it. I met some lovely fans afterwards, but that's pretty much. All went by in a blur.' -Rose

She also stated that due to the stage lighting, she was largely unable to see the visuals during much of the show.

'I can't see anything. I can't see my frets when I'm on stage to be honest.' -Rose

As discussed, footage had been taken by a camera crew at both events which was to be released as a DVD by Rose. This prompted the scheduling of several sessions during which editing of the video formed a focal point for reflection on the performances.

6.7.2.1 Controlling Visuals with Music

In terms of supporting the narrative arc of the performance, Rose felt that the visuals had been entirely appropriate in aesthetic terms, and had allowed the various visual elements of the performance to be cohesive. She expressed some surprise at this as she had worried that the various visual elements she had suggested might be too disparate to include together.

'Everything is in there, the moons and the feathers and whatever else I asked for and somehow, you've made it look like a thing!' -Rose

The configuration of the visuals in relation to the stage had led to a number of inadvertent effects which had added to this coherency; in particular she was delighted with a sequence where glimmering water effects had made the band seem a part of the projection (see figure 52). This blurring of the screen space with the live performers reinforced the narrative arc of the show, commenting

'It's appropriately eerie. It's a journey, but it's a journey to an end isn't it?' -Rose



Figure 52: Projections overlapping the stage added coherency to the narrative.

This effect had capitalised on the approach of using virtual sets as a Narrative Environment suggesting using devices to link real performance and screen space (as discussed in Chapter 3) and establishing a spatial continuity throughout the work (see chapter 4) could be used as a way of ensuring the coherency of a performance. Rose was satisfied that the system and visuals had successfully supported and emphasised the structure of the 3 pieces and had allowed the development of a clear narrative arc through the performance, supporting her musical decisions in an appropriate fashion. On the visual scheme as a whole, she commented,

'I think it absolutely adds to it...I think it adds to not only the mood but the continuation of the pieces. Because, you know, you want it to feel like every track is part of a joint venture to one purpose.' -Rose

She felt that the system had allowed her to communicate her ideas successfully to her audience, stating that,

'It felt that I was saying relevant things to relevant people in a relevant place.'
-Rose

She also felt that the legibility of the interaction between her music and the visuals added visual interest to the performance. A number of low-level mappings proved particularly effective. Effects such as shaking the camera by mapping the zoom function directly to a scaled amplitude from the drums gave a particular dynamism (in her opinion), to parts of the show where the musicians themselves were fairly static. Rose also singled out particular a cappella sequences where the rising volume of her voice had been mapped

directly to cut/fade modules, allowing images to fade in partially.

'This was great, something was swelling with my voice at the beginning bit as well.'

-Rose

She felt that this visual emphasis compensated at least partially for the drop in volume during the quieter passages in the work, answering directly one of her initial requirements for the system.

6.7.2.2 Instruments as controllers

The core approach of appropriating users' own instruments rather than developing a custom interface was successful in terms of overcoming the traditional learning curve associated with learning a new mode of interaction. Rose found that in the moments when she was able to see the visuals, being able to directly control them with her voice had added a sense of dynamism to her playing which heightened her enjoyment in performing.

'I noticed actually, maybe it was on the fellfoot one, because I could see the projections happening on the outside wall, I could see when my voice was activating it. It was cool'. -Rose

In terms of augmenting the performance without distracting or inhibiting the performers, *Cinejack* had also performed well. Rose had been able to place sufficient confidence in the system that she could (during the few moments that she could see them) 'play' the visuals but also forget completely that the system was working and concentrate entirely on performing in her usual way.

'It didn't distract me, I think if anything, it was, it was like another band member, it was like somebody joining in'. -Rose

This change in the mode of operation was seamlessly incorporated into the performance, suggesting that a range of orders of interaction could be supported. The major exception to this success was the necessity to reload *Cinejack* between each of the three pieces. This was accomplished manually, and although only required a few seconds of intervention, would certainly have broken the flow of the performance if I had not been able to operate the system from offstage.

Work on handling audio inputs had been largely successful in allowing the system to disregard extraneous sound in the monitors. Comparing multiple audio inputs now allowed *Cinejack* to make better estimations of amplitude from audio signals, however the performances had uncovered a number of new technical issues. During Rose's shows (due to the excitement of performing), the music would often become gradually louder over the

course of the performance, meaning that some of the system's features would be triggered increasingly often. Clearly, more work was needed regarding how the system handled audio signals, to incorporate changes in overall amplitude throughout a show.

6.8 Conclusion

The aim in developing software and content for Rose's shows had been twofold: to further explore questions that had arisen in developing and performing *OverWatch* and also to provide a focal point and concrete examples around which to discuss Rose's experience as a professional musician. In both respects it proved extremely fruitful: from a purely practical perspective, it had afforded the opportunity to spend many hours developing, configuring and testing the *Cinejack* system with musicians in their own rehearsal spaces, something that would have been difficult to achieve otherwise.

In exploring connecting live music and visuals in the context of an existing practice, developing *Golden Shroud* had confirmed the importance of narrative coherency and establishing a trajectory through a concert using music and visuals to support each other. Comparing Rose's approach to visuals with our own in *The Turing Test* had allowed experimentation with more fine-grained controls and had suggested the development of multi-purpose modules which could be used to achieve mappings of different orders.

In experimenting with musical instruments as controllers it had allowed us to face and overcome technical problems which were not encountered in the development of *OverWatch*, such as multiple audio streams. It had also raised others which would certainly need to be addressed in further work, such as dealing with changes in amplitude across entire performances.

The benefits of a second testing space in the form our own practice were also confirmed. Throughout the development process, using the system separately in our practice allowed gradually stress-testing of the system in development. This increased testing time limited the risk of failure (and consequent real damage to the other musicians' practice) during the live shows. These side-effects seemed at this stage to support our choice of approach and suggested ways in which we might further change our working practices.

The *Cinejack* software now met some of the initial design constraints derived from our own practice, in being simple to integrate into musicians' own practices and having the potential to add significant value to their stage shows, however tailoring the development of the project to the precise requirements of another creative practice had emphasised certain aspects of the research at the expense of others. Through the work we had already

completed for *OverWatch*, the system was capable of dealing with fairly complex cinematic structures such as edits, camera changes and changes of subject; however, the scheme we negotiated with Rose was relatively simple, mainly involving responses to simple rhythmic and vocal characteristics. This meant that although some parts of the system were now fully developed, other questions raised in the making of *OverWatch* which might be potentially useful to other musicians, were still unanswered.

Complex narrative control, reasoning over content in video and deployment of more subtle cinematic devices were all yet to be explored, as were a number of musical devices such as harmony and discord. This suggested that a final phase of development would be useful, once again drawing on collaboration and outside perspectives, but focussed on fully narrative performances. This project would need to be structured differently from the *Golden Shroud* work, allowing more control over the direction of the research and enabling specific limitations to be addressed. The structure and results of this final project are described in the next chapter.

7 Orientation: Soundtrack-controlled Cinema

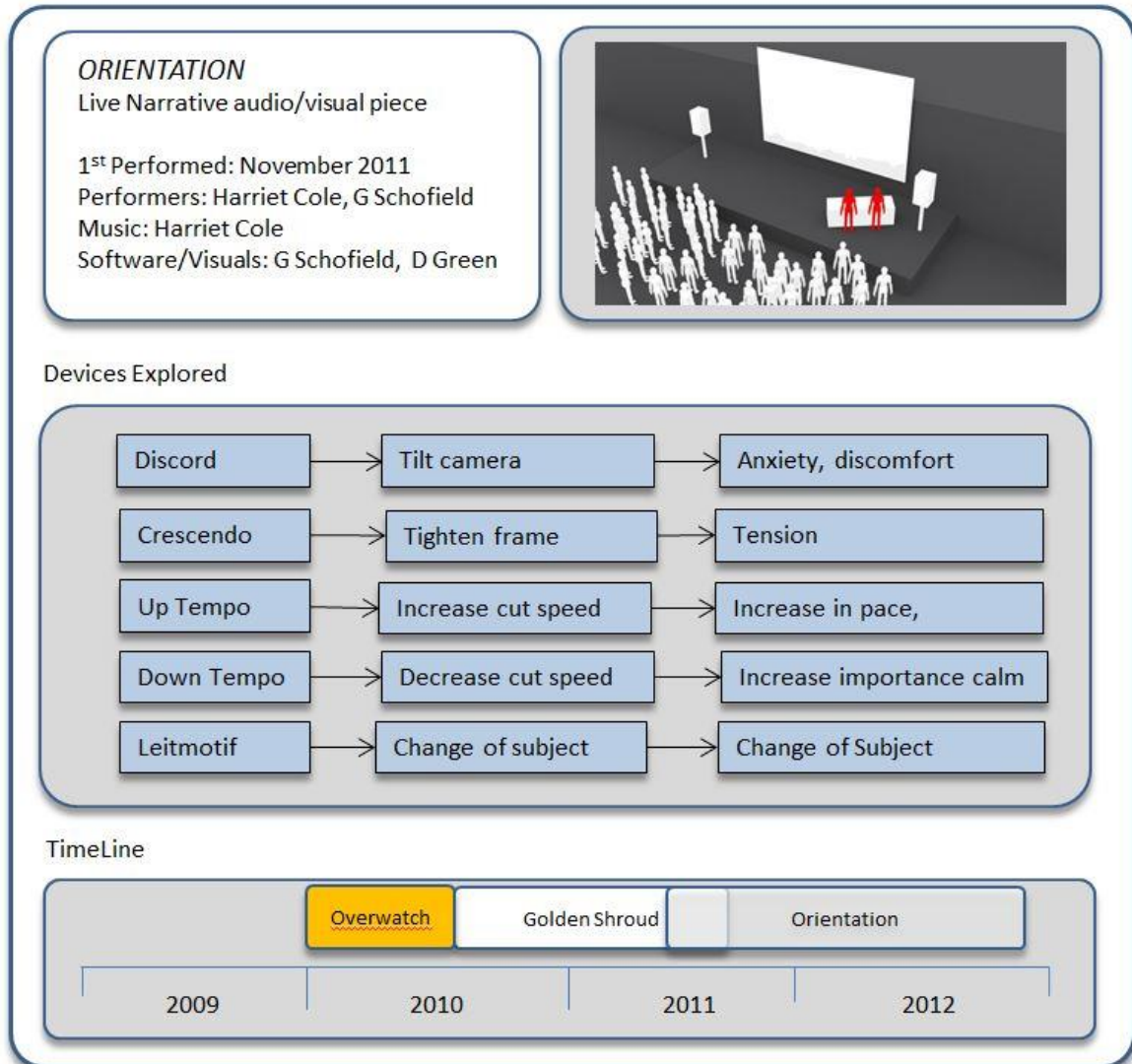


Figure 53: Summary of the Orientation project, discussed in this chapter.

7.1 Introduction

In this chapter the final phase of the research is described, in which insights gained and questions raised in the development of *OverWatch* and *Golden Shroud* were further explored. This phase was structured around the development of a final performance piece, a soundtrack-controlled cinema piece entitled *Orientation*.

In the previous studies, research questions had been explored through the creation of two performances, each with their own supporting software. Designing a visuals system for the *Golden Shroud* concerts had allowed direct comparison of two performance practices: our

own and that of another musician, Rose Kemp. The project had allowed exploration both of alternative models of narrative and multiple types of engagement. The aesthetic requirements of Rose's show had prompted development of a MIDI-controlled video player to allow a greater range of visual content to be used. It had suggested technical innovations to better support soundtrack-controlled pieces including a modular interface designed to allow different cinematic devices to be incorporated quickly into the visuals scheme. Rather than providing set responses, these modules were multi-purpose, allowing different orders of mapping and different types of response. Developing and evaluating *Golden Shroud* had also allowed exploration of different orders of interaction, including completely hands-off use. It had raised practical and technical issues such as dealing with 'spill' in microphones and had provided a test-bed environment in which these issues could be solved. It had also provided additional testing and development time in which the stability, reliability and usability of the software being developed had been ensured.

During development of *Golden Shroud* the research had deliberately been situated in service to Rose's practice. This had been a successful strategy in guaranteeing the project's authenticity; however, developing the piece around the requirements of her concerts had focussed the development on a relatively small range of features. This had meant that a number of interesting questions raised in the development of *OverWatch*, which had been considered irrelevant to her practice, were still unanswered.

Golden Shroud had used only a small number of cinematic and musical devices. Using harmony and discord, had not yet been attempted, neither had cinematic devices such as tilts and different framings to achieve alternative narrative results. Support for more complex narrative devices such as the changes of subject used in *OverWatch* would need to be implemented in the new video-based system if it was to be used for fully narrative performances. The circumstances of Rose's performance (she had been largely unable to see the visuals) meant that the visceral experience of playing the system that had been partly explored in *OverWatch* had only been partly addressed during *Golden Shroud*.

In addition to the issues raised during *OverWatch*, *Golden Shroud* had also prompted additional questions relating to both research themes. Through performing *Golden Shroud*, more technical challenges had been raised such as dealing with changes in amplitude across a whole performance. The system's ability to structure an entire performance needed more work as it currently required reloading if new mappings were to be deployed. Other factors such as the overlap between physical and screen spaces had also yet to be fully

explored.

A final performance project was planned which would further address these issues. This phase of the project would be structured around collaboration on more equal terms: a stand-alone project separate from both my own musical partnership *The Turing Test* and that of any collaborators involved. The terms of this collaboration would be negotiated between myself and other musicians based on a proposition in the form of an existing body of work: narrative content which could form a focus for the development. This approach was intended to focus the research on questions which had arisen from the previous projects while still allowing space for genuine creative input from collaborators. To this end the decision was made to embark on a full scale film project, producing a dedicated set of narrative footage for *Cinejack* to use.

7.2 Practice Context

For this phase of the research, a musical collaborator was sought with specific skills and interests. To be able to provide a varying score which would extend the system's capabilities, this musician would need to be a skilled improviser, able to work creatively around a set of basic musical structures during performances. Ideally, in order to provide a range of possible interactions, he or she would also be confident in several musical styles and genres. A musician with little experience working with film would be ideal, as it seemed likely that a non-expert viewpoint would provoke discussion around the connections between music and visuals. Rather than recruit an ensemble, a solo musician was sought, in order to explore a simpler and more legible relationship with the visuals. Once again, rapport and trust was an important factor, as developing the performance would necessitate not only a significant commitment in terms of time but also a level of creative risk-taking.

Harriet Cole, a classically trained pianist, singer and oboe player with whom I had worked previously was enlisted to develop the project. Harriet was approached because of her preferred way of working, tending to work from a framework of rough notes and ideas when composing music, rather than writing and rehearsing note-by-note compositions. Another advantage was the variety of genres and styles she could draw upon, having worked in a wide range of musical projects, from classical orchestras, to gospel ensembles to country and western bands. Harriet had never worked on a project involving music and visuals before and had little experience in working with video in general. Most importantly, as I had worked closely with Harriet before, the collaboration would begin from a position

of mutual trust and an awareness of each other's abilities.

In addition to the musical collaboration necessary for the research, another project would also need to be planned: creating a film for the music to control. For this, at least one other collaborator would be needed, with skills in low-budget film-making. Due to the logistical and economic constraints of the project, this individual would have to possess (in addition to photography skills), an ability to share all the tasks necessary to produce and direct the film, including location scouting, prop-building, direction and lighting. David Green, a colleague with a background in film-making was recruited to co-produce and co-direct the film. David was chosen due to his extensive experience not only of linear film projects through having worked as a documentarian but also of unusual interactive film forms, gained through participating in a number of film research projects.

7.3 Configuration of the Research

The project would be structured as follows: questions would be consolidated from the previous phases of the project and the film would be written, produced and directed specifically to explore them. Harriet would then be enlisted to create a live score for the film, which would connect to the footage using devices of her choice. The intention here was to create a shared design space, through developing a project which would require a level of investment on both parts and would enable the sharing of goals and rewards. The two parts of the project: film making and performance would be kept largely separate and would be developed in sequence.

The design of the film was structured using approaches from various disciplines. Standard film approaches would be used to design the production and organise the shoot: a script would be written and used as a blueprint from which to generate set-ups and shots, which would be planned meticulously using storyboards and drawings. However, at each stage, it was necessary to also consider how the film would work in the context of a stage setup: in particular how the physical space of the stage and the world of the film would connect as a coherent entity.

After the film had been shot and the footage collated, Harriet would be brought into the project. An initial meeting would be arranged in which she would be shown the footage, in the form of a rough linear edit of the film to which she would attempt to compose a score. As with the 2 previous projects, a regular programme of development and rehearsal sessions would be scheduled within which this score would be refined, as Harriet brought

the piece together over a linear version of the film. During these sessions, extensive notes would be taken and questions asked, the aim being to ascertain why she had made particular decisions and how they might connect with the film. In each case, devices would be chosen or developed in line with her reading of the footage. If she judged that a particular scene should be slow and tense, devices would be deployed which would instruct the system according to her playing. These would then be fed into the development of new versions of *Cinejack*, in the form of new mappings, controls and modules affecting editing, framing and subject. It was hoped that by placing Harriet's score in constant dialog with the film during rehearsal, a connection would develop that would not only be satisfying for her to play but would create engaging versions of the film.

7.4 Performance Context

The performance of the piece was also carefully planned in order to fully explore the research questions. To address different types of engagement, the final performance would need not only to be supported by the film but the venue would need to be configured in a way which permitted different viewing models to take place. The length of the film when considered as a live performance was also an issue. It is conventional for short fiction films to rarely exceed 10 minutes in length; however, it is uncommon for live music concerts to have a duration of less than 30 minutes. These conventions are due to the structures which support the production of both media (Ruoff, 2012): film festivals rely on showing large numbers of short films, while it is logistically difficult for live music venues to show many artists in a single programme. To allow audiences to adjust to the form, to allow experimentation and also to enable the musical structures in the piece to be fully explored, it was decided to make a relatively lengthy piece, which would run over 20 minutes or so: an ambitious plan for a micro-budget piece.

The festivals and bar concerts previously used as test-bed venues with Rose Kemp and *The Turing Test* had provided a variety of unpredictable real-world situations to experiment with. For this final phase, it was decided to launch the planned work without a pre-determined context, through a dedicated performance. An evening was planned in which the film would be the main performance, followed by a short set from *The Turing Test*. The performance took place in Space 5 at Culture Lab, a 200 seat theatre space with a large projection screen and conventional raised stage. In order to leave the audience with choices as to how to engage with the work, it was decided to remove the front rows of seats and to allow audience members to stand if they wished.

In order to attract an audience, advertisements would be placed in local events guides and posters put up in music and arts venues in the local area. The content of the evening was kept deliberately vague, the piece being presented as 'an experiment in live cinema'. This was in order to allow audience members to arrive without having a clear idea of what they were about to see and to ensure that our evaluation of their reading of the work was untainted by prior knowledge on their part.

7.5 Design

Producing the film was particularly challenging, as a number of factors would have to be carefully balanced. The principle purpose of the project was to provide a flexible body of footage for *Cinejack* to exploit, however the film itself would need to be engaging on its own terms. The success of the performance would depend as much on the quality of the film as an artefact as the quality of the performance. For the performance to work, the film would need to be well shot and well-acted, with an engaging narrative.

To allow real-time re-editing and re-framing, the film would be a multi-track production, with each scene composed of several camera angles. Loaded into *Cinejack's* video player, these video tracks would provide in every scene, a range of subjects, potential shots and - through editing - narrative outcomes. For this reason the themes and motifs present in the film should once again relate to the format in some way. As the research behind the project was essentially about causality, editing and the subjectivity of vision and used technological means to explore them, the film would follow similar themes. The manipulation of space and time via technology, the relationship between text and action and the agency of the individual were also important factors in the research and are also common themes in several genres of cinema, particularly science fiction and psychological thrillers.

The decision was made therefore to position the film within a genre. As discussed in Chapter 3 genre is a particularly powerful tool in cinema, allowing the deployment of a range of specialized conventions through creating particular types of engagement. In presenting a form of art where the audience would not necessarily know how to engage with the work, genre was therefore judged to be an appropriate way of leading viewers in. The horror genre was chosen as it offered a number of easily identifiable archetypes and conventions which might not only assist audience engagement but would provide clear and powerful mappings for the *Cinejack* software.

As discussed, a theme throughout the research was constructing space in film and the linking of various types of space through hybrid performance. This approach is not dissimilar from that of a number of film directors. Ridley Scott for example, speaking about the making of *Blade Runner* suggested that the setting of a film could be thought of almost as a character in the drama, affecting the plot on similar terms as the actors (Lauzirika, 2007). In the previous phases of the work, narrative environments had been used as structuring devices. In a short piece with a mutable narrative, an environment which lent spatial and temporal continuity could be useful in helping to plot the film. It was decided therefore to use a journey through a single location as both a setting and narrative structure. To reinforce the references to silent cinema (and also keep the sound-effects and dialog track of the film uncluttered), the narrative would need to support keeping dialog to a minimum. A simple solution for this was to structure the narrative around a single character.

A plot was devised which involved a lone female character attempting to find her way through an endless maze of tunnels under a scientific installation. On her journey, she would find landmarks and clues which would gradually explain her presence and would be pursued by a mysterious figure. At the end of the piece, it would become apparent that the figure was her and that the tunnels were distorting time. This basic story seemed to fulfil all the requirements discussed above. A professional actor was engaged to play the main character 'Rachel' and the film was entitled *Orientation*.

The principle challenge in planning the production was how to plan shots which would be sufficiently flexible for *Cinejack* to use. In order to give the system freedom to make its own edits, cuts would have to be kept to an absolute minimum during shooting: if at all possible, each sequence would need to be covered by multiple cameras in a single take. A rigid and complex plan would be needed to ensure that from each shot *Cinejack* could select wider or tighter framings. Covering movement during each long take would be particularly difficult as the camera operator would have to negotiate the hazards of the location, stay out of view of the other cameras and also keep the subject in a fairly constant position in each shot. The scale of this part of the project was daunting, as the multi-track format would require 2 or 3 times the amount of final footage as a conventional single-channel film.

7.5.1 Controlling Visuals with Music

In order to connect the music and visuals for *Orientation*, *Cinejack* was extended and modified. A number of new devices in the form of modules were implemented. Two modules, named *Keycheck* and *Discord* were designed to explore harmony and discord. The first allowed Harriet to tell the system what key the piece was being played in and would register notes outside the key signature. The second would provide a constantly updated average of the number of recent notes outside this key. This could be used as a simple measure of discord and harmony and associated with corresponding cinematic devices such as Dutch tilts or slow zooms. The *Leitmotif* module was improved so that it could be used to record sequences of notes to listen for, rather than having to be programmed by hand.

The system designed for *Golden Shroud*, although able to cut and fade between shots, had no way of knowing the content of the video tracks. To allow reasoning over the subject matter of each video, a notation system was needed whereby the video tracks could be tagged with information about the content of each shot. In deciding how to implement this, formats such as XML were considered but rejected as it seemed unnecessary that non-expert users should have to learn complex syntax for such a simple task. Standard formats such as EDLs (Edit decision lists) were also considered but again required some prior knowledge of film industry conventions. It was instead decided to implement a simple scheme which required no training to understand. To this end a text based system was implemented which used Max's existing *text* objects (these allow reading of .txt files and extraction of information from them in the form of symbols, messages and lists). Using this system, numerical codes were used to register events in the form of changes of shot, composition and subject. These could be used to update a constantly changing record of the state of each video track. The frame number, the video track on which the event occurred, the subject, the region of the frame it occupied, (top, middle or bottom and left, middle or right) and the type of shot (from very wide to extreme closeup) could all be added or omitted according to the user's needs. Comments could also be included, either to describe the shot or to add contextual notes. The example below demonstrates this:

4500 1 1 2 3 3 Rachel enters from left (At frame 4500, on track 1, Rachel appears in the middle lower region of the frame in a medium shot.)

At any point, the system could then check whether a subject was visible or not, and if so, in what position and on which video track it occurred. This scheme could also be used to

cover parts of the film where there was no good footage. In this case a simple statement such as 6000 2 0 0 0, (at frame 6000 on track 2, no subjects were present) would cause the system to exclude that track from the cutting scheme. An OSC connection to the video player which would allow reading and setting of frame numbers was also implemented at this point. Again, although built primarily for use with Max, this was platform independent to allow maximal flexibility, requiring only that the user prefaced frame number messages with a character.

7.5.2 Instruments as Controllers

To protect Rose's audio setup from crashes while *Cinejack* was being developed, her system had used separate audio inputs. As *Cinejack*'s stability had been proven through the *Golden Shroud* shows, this was now unnecessary and inconvenient, requiring extra hardware and a more complicated setup. A *Rewire* connection (a standardised music protocol allowing music applications to pass audio between them) and audio player was implemented which would allow not only control of the audio output of the music from *Cinejack* but also allow a separate audio track for the film to be controlled by musical instruments. Again, this could be connected to other modules, for example allowing a musical phrase to silence the audio of the film. The *Intensity* module was also redesigned to take into account gradual changes in volume that occurred naturally throughout a performance. This was achieved by keeping a number of running averages of amplitude from different points in the piece and using them to establish a threshold against which to measure crescendos.

When playing the score against the film, Harriet - like Rose - was keen to work without using the monitor, preferring to watch the main projection screen. A persistent question throughout the development was therefore how to enable Harriet to include notes and cues which would not distract her from playing. As the film's setting looked similar across the whole film, Harriet found it difficult to keep track of when specific events would occur. To solve this problem, the *Content* module was modified to include cues through the editing: by introducing a setting whereby the system would always cut to a new subject when it appeared on the video note track. To aid rehearsal, a better play control system with a simple progress bar which allowed skipping to particular parts of the film was also implemented.

During *Golden Shroud*, the system had to be reloaded between pieces to reconfigure the

entire set of mappings, requiring the user to close and reopen *Cinejack*. This meant that the system could not take into account different configurations which might occur in different movements or episodes in a longer performance. A *Movement* module was therefore designed to permit different configurations of states to be loaded onto each module. This could be either triggered by the video reaching a certain frame, or by triggering through another module, for example by playing a phrase through a *Leitmotif* object. This meant that more complex narrative structures could be supported.

A new phenomenon that had not arisen in either *OverWatch* or *Golden Shroud*, was the inclusion of silence in the score. Harriet was insistent that some passages should be sparse, with few notes and long periods of silence. The *Tempo* object was redesigned to accommodate this, with a control which would vary the effect of inputs upon it. This control could be adjusted to vary the weight of *Tempo's* responses. At one end of its range, only subtle changes to its output speed would occur even if musical passages varied wildly in tempo, at the other, tiny variations would cause significant changes. This could be used in a variety of ways, either connected to the *Cut/fade* object, or used with a *Shake* object to allow unsettling micro-movements of the frame.

7.6 System Description: *Cinejack*

The development of *Orientation* allowed a more comprehensive and configurable version of *Cinejack* to be developed. The full list of modules and their functions is described below (see figure 54).

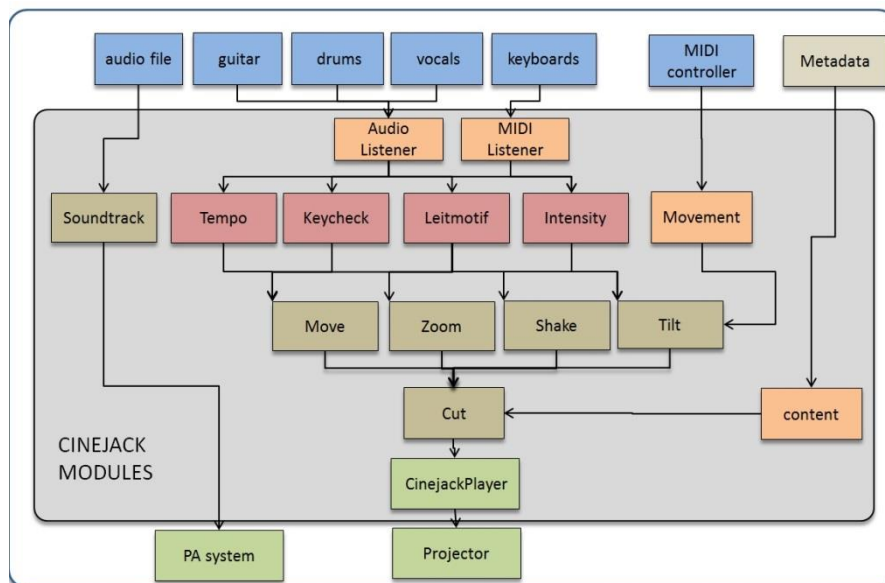


Figure 54: *Cinejack's* modules showing some possible connections.

Cinejackplayer is a stand-alone multi-channel video player which can be operated via MIDI. Video mixing is accomplished by configurable MIDI controls and the player can also rotate, pan or zoom on the image. A simple text file, written by hand can be used to preload video tracks and controls.

AudioListener takes audio signals from the soundcard input and passes them first through stereo gain controls (which can be quickly mapped to a MIDI controller) and then to a *fiddle~* object which extracts fundamental pitch, amplitude (in dB) and attacks (sudden peaks in amplitude). Its pitch and amplitude outlets are pre-set to send information to the inlets of any listening *Intensity*, *Keycheck*, or *Tempo* modules. A further audio output can be connected to a *Rewire* output allowing master control of audio from another application. *MIDIListener* functions in a similar way to *AudioListener*, but uses a configurable connection to a MIDI port and a MIDI volume control.

Keycheck is a simple look up table to identify notes outside the key signature of the music. Accidentals are reported as simple bang messages and can be used as measure of harmonic discord and mapped to effects for instability such as tilts or small camera movements. The results can be sent as inputs to *Tilt*, *Zoom* or *Shake* modules.

Tempo takes incoming MIDI notes and, after filtering out chords (using Max's *thresh* object) counts notes per bar. This number is used to increase or decrease cutting speed, by comparison to a constantly updated average. Its output is a bang message, which can either be passed to a *cut/fade* module to cut to specific tracks or used in parallel with *content*, *tilt* or *zoom*.

Content, as discussed earlier, allows filtering of cutting and framing decisions according to the content of each video track. *Content* constantly keeps track of its position in the film by receiving its frame numbers via an OSC connection to *Cinejackplayer*. *Frame* enables video tracks to be reframed on-the-fly, by cropping of the video image. Used in conjunction with *Content*, *Frame* can assess which type of shot a video track is currently displaying and reframe as a closer shot, for instance rendering a wide shot as a medium, while taking into account placement of the subject.

Intensity is used to monitor average velocity or the force with which an instrument is played. Taking input from the outlet of *MIDIListener* or *AudioListener*, it attempts to detect crescendos.

Tilt takes inputs from *Keycheck* and, based on the number of accidentals, applies a value to the rotation of the image by sending a MIDI control value directly to *Cinejackplayer*. The

result is a Dutch tilt, the angle of which is updated at each cut. *Shake* takes discord messages from *Keycheck* or amplitude messages from either listening module or *Intensity* and applies them to simulated camera movements. These can be set according to speed and range to either manifest as tiny drifts or handheld style camera shake.

Soundtrack is a simple audio-player which can be synced to *Cinejackplayer* by a periodic resynching by frame number. This allows real-time syncing of audio to video while maintaining independent control of both tracks. Soundtrack comprises a simple audio mixer (ready prepared for break-out to a MIDI controller) and a connection to *ReWire*.

The *Cinejack* configuration used to control *Orientation* is detailed overleaf (see figure 55) with the mappings detailed in figure 56. During the performance, Harriet's piano would form the main controller. A single *MIDIListener* object would extract pitch and velocity from each note played. A *Tempo* module was connected to *Cut/fade* modules to allow the speed of playing to affect the cutting speed, meaning that quick, arpeggiated passages in the score would lead to more frequent edits. *Leitmotif* modules were used to trigger cuts to a number of recurring subjects identified in the video notation scheme. At various points, different phrases referred to the main character, a second mysterious figure that appeared periodically, a gasmask and Rachel's security pass. A *Content* module was used to update this information alongside the video tracks. *Keycheck*, *Discord* and *Tilt* modules were used in combination to create Dutch tilts in several nightmarish sequences in response to discordant sequences of notes. An *Intensity* module connected to a *Zoom* module was used to force slow tightening of the frame according to crescendos. Finally, a *Soundtrack* module was used to control the film's audio track.

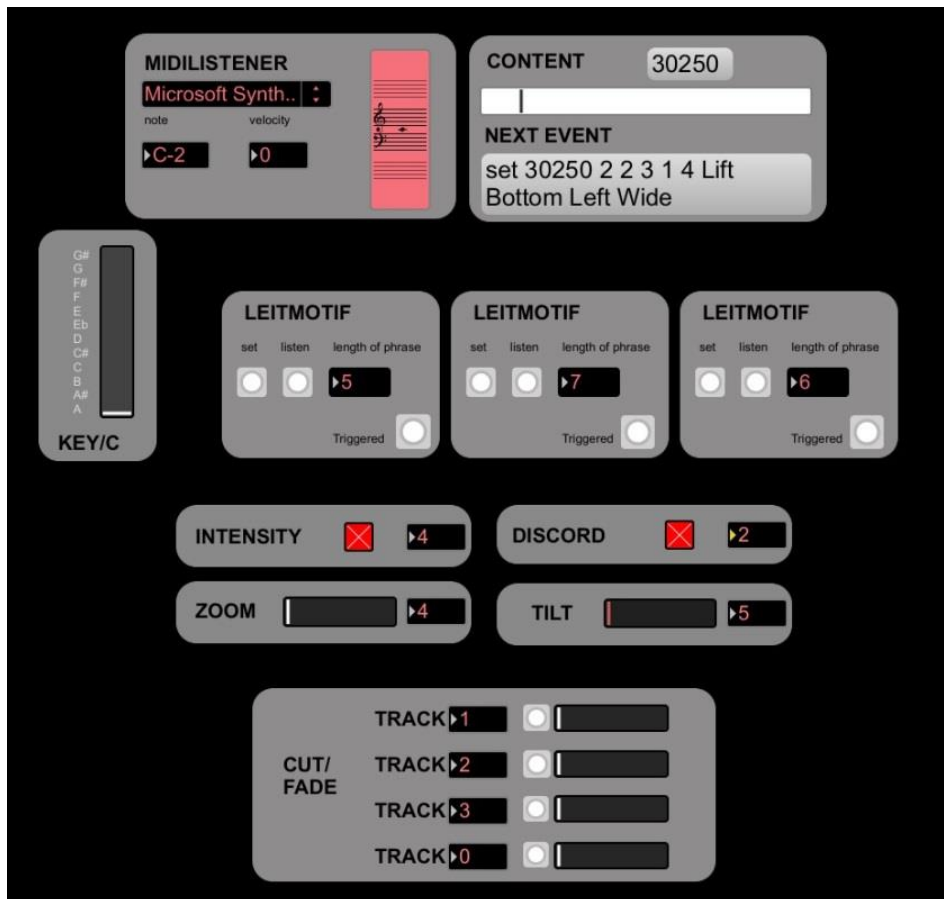
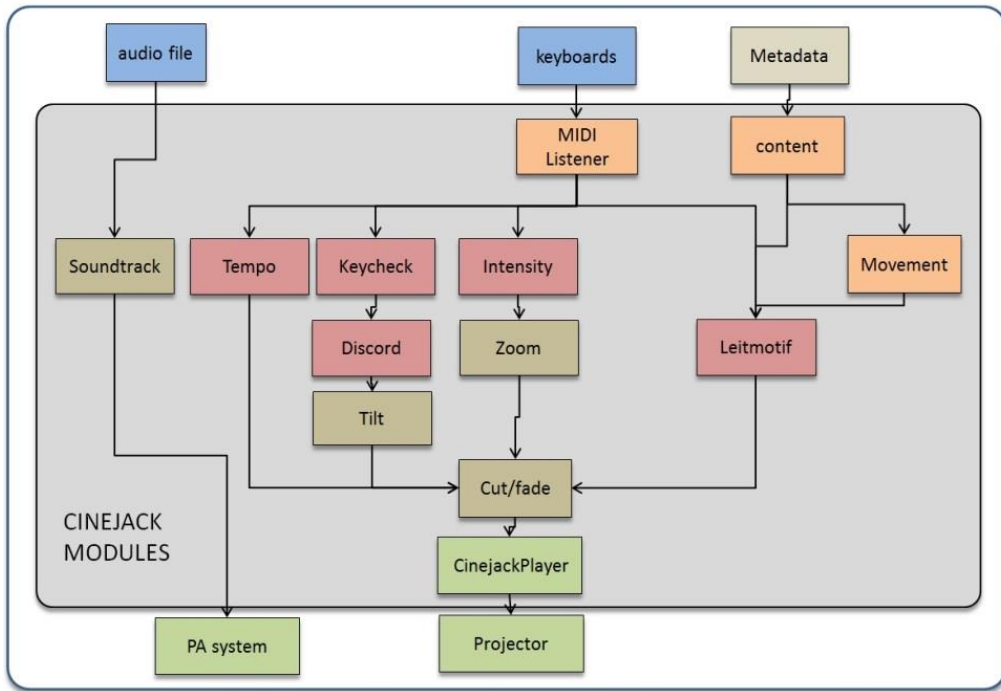


Figure 55: The configuration of modules for Orientation in diagrammatic form (above) and as presented in Cinejack's Max-based UI (below)

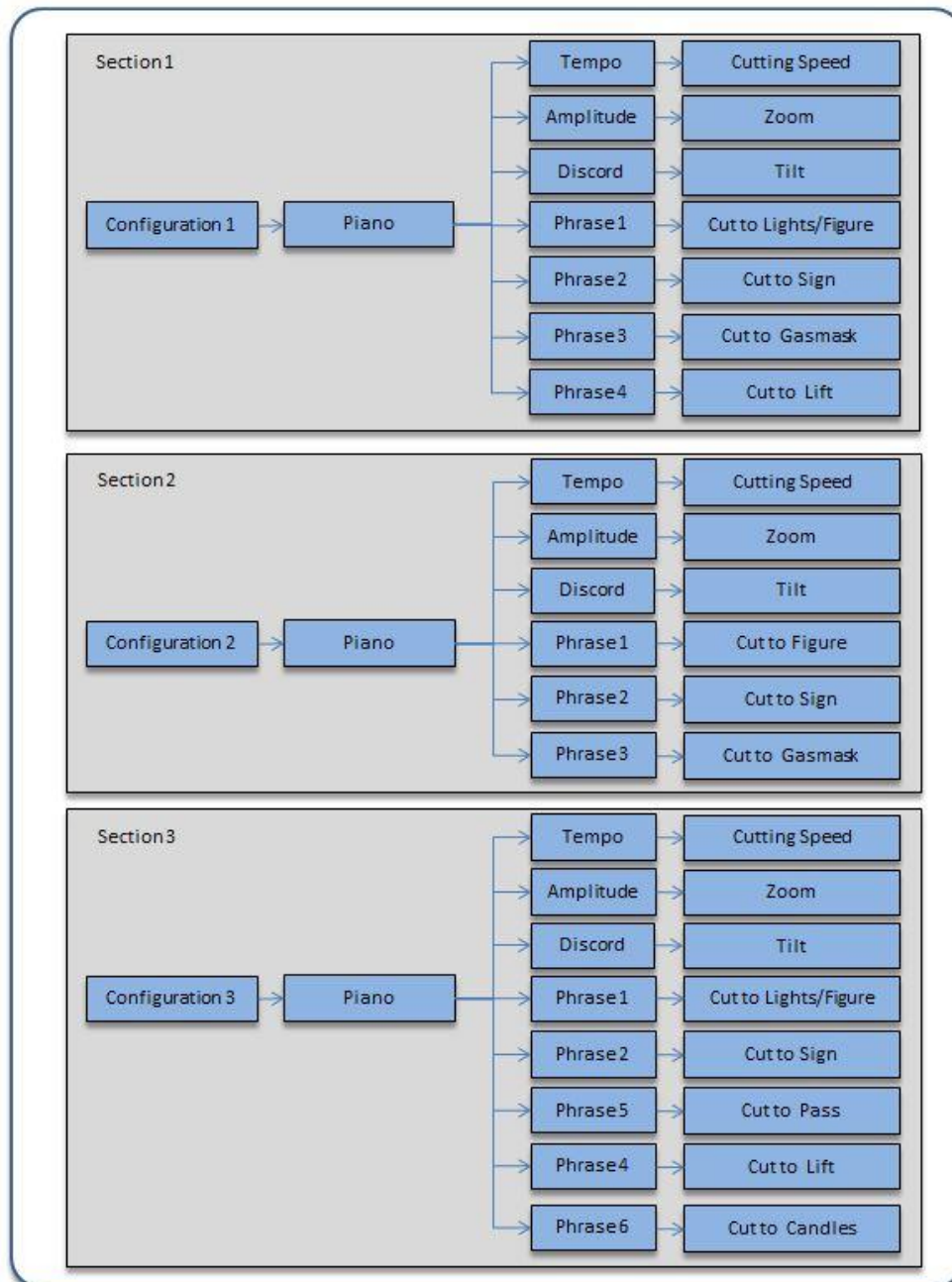


Figure 56: Breakdown of mappings in Orientation

7.6.1 The piece

The plot of the film was as follows: The opening titles are followed by Rachel descending in a lift, clearly preparing for a job interview as a recorded message lists a number of warnings about the level she was about to visit. She steps out of the lift and is surprised to find herself in the darkness of the tunnel with only a sign indicating the way to her *Orientation*. As she stands uncertain, the lift door closes and she realises there is no way of calling the lift back. She attempts to call for help but there is no phone signal. As she moves around the space, a ragged and dishevelled figure lurches towards her in a blinding

light and terrifying blast of sound. Panicking she runs into the dark and becomes lost, finding more signs towards *Orientation*. Each of these seems to be older than the last and the tunnel is increasingly dirty and disused (see figure 57).

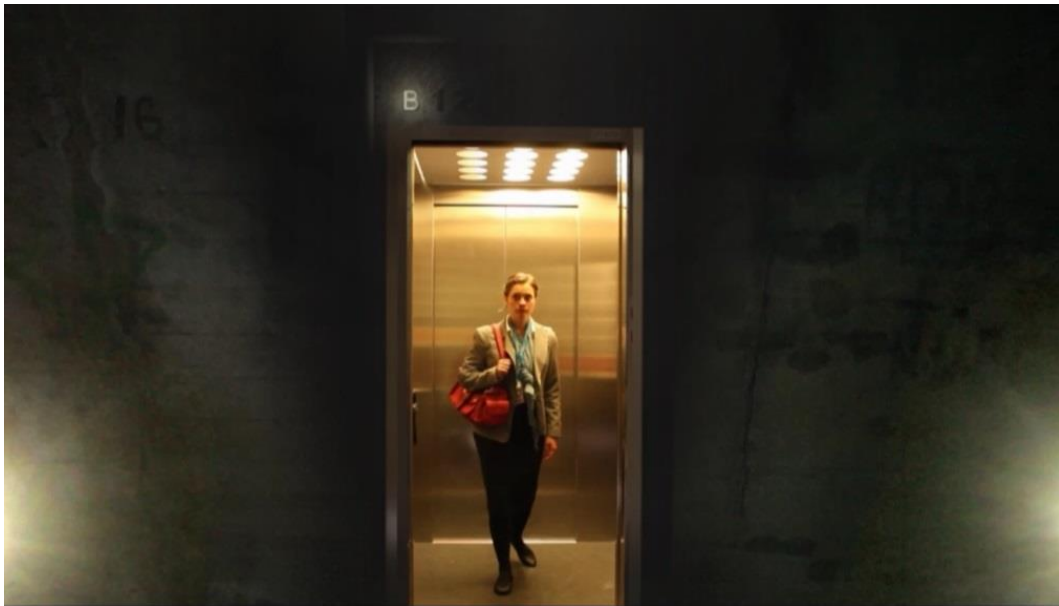


Figure 57: A Still from Orientation

She arrives at an equipment store in which hangs a gas-mask and checklists for safety equipment last signed in the 1970s. She touches the mask leaving fingerprints in the dust and as she does so, glimpses a figure in the distance and runs after it calling for help. Soon she loses sight of the apparition and comes to a seemingly identical equipment store. To her horror, she recognises her own fingerprint on the gasmask hanging there: despite moving straight along the tunnel, she seems to have passed this way before. Soon she finds maps and diagrams in her own handwriting and finally her own security pass, mouldy and damp as if it has been in the tunnel for many years. The film ends with a final twist: the heroine returning to the beginning of the plot and discovering that the figure behind the bright light is her and that she is running from herself.

The stage setup referenced Silent Cinema with the piano, computer and audio equipment placed stage left, below and to the right of the projection screen (see figures 58 and 59). On Harriet's request, I took a minor part in the performance, providing an underlying drone track using a bass guitar and VST effects to complement her score, following her directions. This instrument was connected directly to the Public Address system and did not provide input to *Cinejack*.

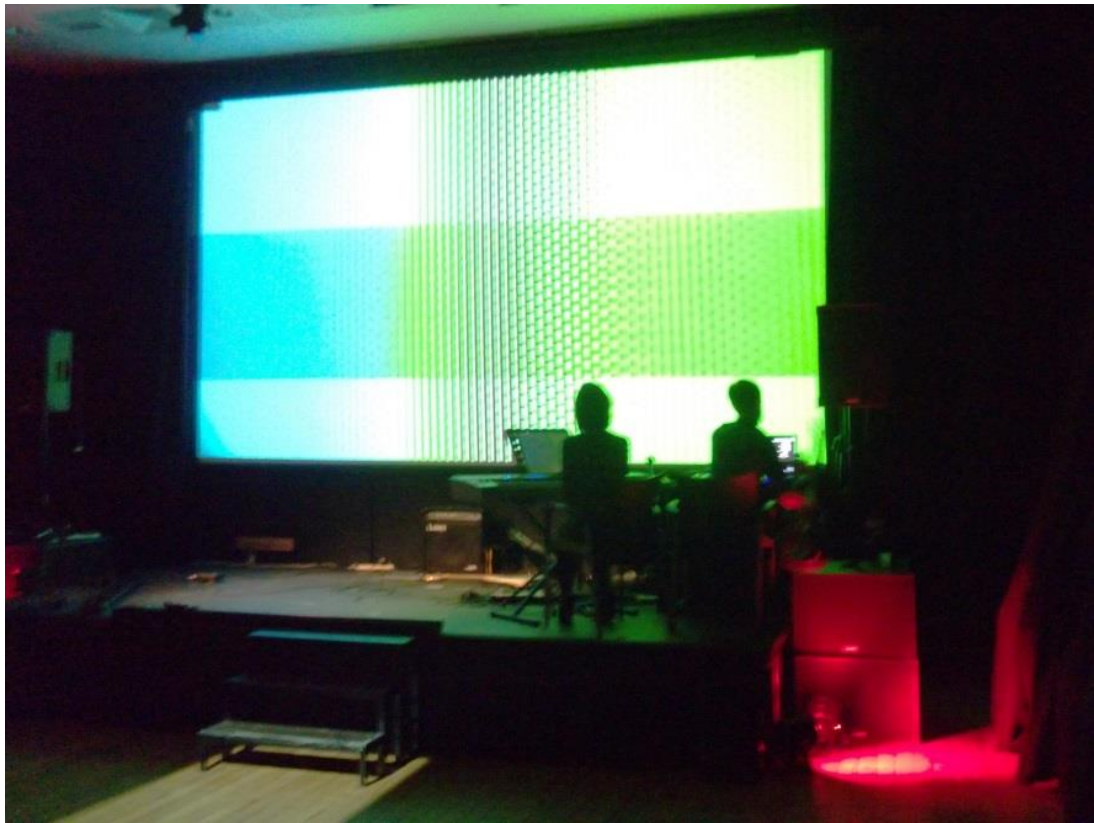


Figure 58: Performing Orientation

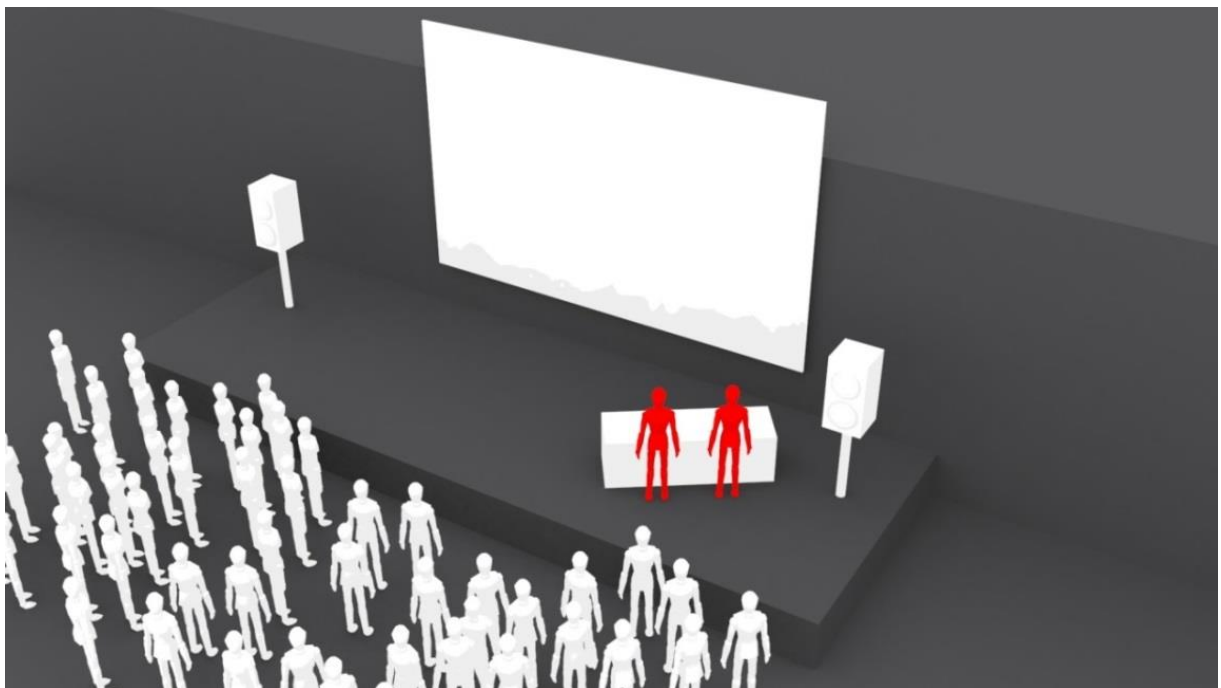


Figure 59: Stage layout of Orientation with musicians in red

7.7 Evaluation and Reflection

Orientation provided a wealth of information in the form of notes, audio recordings and videos. From these a number of themes surfaced, relating not only to the work itself but to the research methods deployed.

7.7.1 Rehearsal

Once again, the strategy of using live rehearsal/composition/development sessions was fruitful in refining *Cinejack* and exploring new connections between music and the film. Compared to working with Rose, there were few problems with monitoring musical content, as Harriet had elected to use a digital piano as her main instrument. She had chosen this for its appropriateness to the silent cinema format, however, an advantage was that her playing could be monitored via a MIDI interface without needing complex audio analysis.

As in *OverWatch*, an interesting interplay developed between Harriet's playing and the system. Unlike Rose, Harriet watched the visuals constantly as she played, constantly adjusting her playing according to her position in the film. At the beginning of the rehearsal process, Harriet had relied extensively on notes to prompt her as to where the different movements would occur. As rehearsals progressed however, she began to rely increasingly on cues from the film, which would prompt her to begin particular sequences: which in turn would alter the film. This feedback loop was something that she came to rely on extensively, leading to an increasing blurring between cause and response in both Harriet and *Cinejack*'s actions.

It was also found however that in developing the score and software, musical and cinematic devices affected some sequences far more than others. The periods of slow exploration in the film where Rachel wanders through the tunnels, seemed to be easy to alter in terms of atmosphere and pace by simple editing effects. The effects of the system on factors such as pace however were less apparent when the same changes were applied to other scenes. When scoring the first scene where Rachel first finds herself in the tunnel, Harriet felt that changes in editing speed barely affected her reading of the scene. Even significant changes in framing and editing made little difference to the overall effect.

7.7.2 Performance

When the time came to perform, we did so without introduction or announcements of any kind, once again wishing to avoid colouring the audience's view of the performance. Upon

finishing the performance, we left the stage, again without explanation or announcement. A colleague then approached several members of the audience and interviewed them privately about their experience. After the performance, Harriet was also interviewed both about the performance and her role in the project in general.

7.7.2.1 Controlling Visuals with Music

For all the audience members interviewed, the music and film had formed a coherent and engaging narrative which they had enjoyed. The horror genre, combined with the way in which spatial description and gradual exposition through objects and landmarks had been used to structure the narrative was commented upon as particularly successful in this context. One audience member - a film director himself - commented:

'It felt like how a narrative film probably should commence, by taking a character and placing them in some sort of unusual situation and asking, creating, some kind of question that the audience need answered. I.E, why is this person being taken to this underground lair for her Orientation? So I was initially very engaged by that.' –Audience Member

The decision regarding the length of the performance however was less successful, with several audience members commenting that the film felt overly long, with not enough narrative content to justify the length. This suggests that in this context, the music would need support from a more complex narrative or at least greater variety in the visual content.

As discussed, a conscious decision had been made to not make clear the connection between the music and film. The interface had been conceived as mysterious: a device used to elicit curiosity in the audience. Audience members interviewed about the work were asked directly about this connection and interestingly, only 2/4 realised that the music was directly controlling the film. When asked to speculate on whether knowing more about the technical connection between music and visuals would have enhanced the experience, the answer was a unanimous yes. This confirmed that a state of engagement which involved both an appreciation of craft skill and a level of immersion in the work (see Chapter 3), could be achieved in soundtrack-controlled cinema works. Harriet agreed, identifying this as something that she as an audience member would have found compelling.

'I don't think the skill of what's involved with your computer programming would be appreciated unless there was a bit more information'. – Harriet

This was not only interesting in terms of it how it related to the legibility of the format and of our specific mappings but that it did not seem to affect the audience's engagement at all. This tension between mystery and legibility (or in Reeves et al's terms the magical and expressive)(2005), suggests that a better way to advertise some of the technical skill behind the work might be to include at least some clearly legible connections between music and visuals.

Especially effective in terms of devices were connections between the tempo of the music and the pace of the film. In the final performance setup, cutting speed was controlled by the tempo of Harriet's playing, which, for her, was both legible and aesthetically satisfying. In rehearsal she stated,

'You can feel the frantic-ness and the chaotic-ness in the film.' - Harriet

The cueing and content system was also particularly successful when linked to *Leitmotif* objects. This connection enabled the system to cut to particular subjects when certain phrases were played, allowing the music to introduce characters and themes. Harriet commented that this was so intuitive that she could effectively forget about it during the performance.

Less effective were the subtle tilts and slow tightening of the frame that had been linked to discord and gradual increases in amplitude, through the *tilt* and *zoom* modules. Although both these features had seemed to work in rehearsal, in performance, these seemed no more expressive of tension than the score played against unaffected footage. The tilt module was slightly more effective on wide shots, however little of the *Orientation* footage contained strong horizontal or vertical lines, so on close shots, its effect was almost undetectable.

Besides *Cinejack* itself, the configuration of the venue had been intended to direct attention towards the stage and to create a particular atmosphere which would support engagement with the work. The stage area was lit with coloured lights, but these were lower than the lighting usually deployed for a live music show. Harriet speculated that the setup and lighting may have contributed to a greater sense of enjoyment and engagement with the piece. Audience members interviewed about the piece also commented that this had caused them to read the work primarily as a film.

'Well to me it kind of just felt like a film. Harriet and Guy were not lit, so there was no attention drawn to what they were doing. Quite often if you see VJ performances there's a

guy with a laptop sort of thing, but there's no show made of that: you're supposed to be watching the projection and it felt like that.' – Audience Member

The configuration of the stage, in which we played facing away from the audience also contributed to the sense of flow we achieved in the playing of the piece. Having finished *Orientation*, I was surprised to notice that many of the audience were quietly sitting down: I realized that I had not registered their presence at all during the performance. Harriet also commented on this configuration:

'It made me a lot more confident, it made me a lot less nervous. I felt that the project went better live because I wasn't thinking so much about my nerves'. - Harriet

7.7.2.2 Instruments as controllers

During the performance, the software and hardware components of the system worked flawlessly from setup to takedown. The *Movement* module, triggered automatically in this case by the video arriving at certain scenes meant that the only manual operation required was starting and stopping the performance. This allowed performance of the piece without disruption and for both of us, the experience of performing *Orientation* was highly enjoyable, given the anxiety we felt in preparation. The system's final setup and controls were intuitive enough that Harriet could for the most part forget about the technological elements and focus on performing. The cueing-through-editing function implemented in the *Content* module enabled Harriet to play without notes and without having even to glance at the UI, instead, she was able to immerse herself completely in the film and the performance.

Harriet found that she was able to improvise far more than we ever had in rehearsal, diverging from the rehearsed passages she had prepared on a number of occasions. She also found that she was playing far more: fleshing out formerly sparse or silent sequences. She felt this to be both a side effect of the normal exuberance felt during performance and also a heightened awareness of the detail of the film due to the sense of immersion already discussed. Harriet confirmed this saying the enveloping environment of the performance had allowed her to be '*a lot braver with the improvisation*', something that she had enjoyed. Certainly from my own point of view it was also due to the excitement caused by performing in front of a large audience.

In terms of the success of mappings between individual cinematic and musical devices, the modular design of *Cinejack* allowed experimentation with various combinations in putting

together *Orientation*. This allowed a far greater range of combinations and subtle mappings to be assembled. Most of the mappings implemented for *Orientation* were higher-level controls; this meant that the sensation of intentionally ‘playing’ the system was very different: as discussed, Harriet felt the mood and pace of the piece affected by her playing, rather than a direct visceral link between musical gesture and cinematic response.

7.7.3 Configuration of the Research

The decision to use a structured collaboration as a tool in this phase of the project was once again effective in generating insights, allowing the most rapid period of development in the entire project. Negotiating the terms of a participant's input without leading their decisions was a particular challenge here, however, allowing them to use the research as a safe environment which they could use to explore their own goals with reduced risk to their practice, allowed for a highly productive period of work. A particular risk of this approach was obviously the handing over of control of specifics of the research to another party; this was mitigated here both by carefully establishing a set of shared goals and working hard at developing a strong rapport with the participant. Another significant risk of this configuration was damage to our collaborators practice in the event that the project was not a success. For this reason, for Harriet, the experience of preparing to perform *Orientation* was coloured by unprecedented stage fright and nervousness. Harriet commented that initially the performance had been,

‘...the most terrifying performance I’ve ever been involved in.’ - Harriet

She attributed this to both anxiety at working within a new format and fear of technical failure. The positioning of the project as research had however helped allay these fears, providing a space where failure could be acceptable and part of a natural process. Harriet commented that this had mitigated some of her fears as the performance progressed.

‘I did feel able to relax and think, well, if things don't go quite as we thought, well that is the whole point of the project and so long as there's no sort of major glaring gaps and sort of discordant notes which I knew there wouldn't be I thought it could only add to it, to the research’. - Harriet

She also stated that participating in the project had allowed her to overcome a number of personal anxieties around free improvisation and working with technology; a process she had found extremely stimulating and beneficial to her practice. This suggests that

configuring collaborations around projects with clear boundaries is possibly a less risky and more productive strategy than full immersion in a collaborator's practice.

7.8 Conclusion

The structure of this phase of the research around a performance enabled exploration of several new cinematic and musical devices. *Cinejack's* modular setup allowed different mappings of these devices to be explored during rehearsal and a configuration designed which suited both the score and *Orientation's* footage. Of these, a number were found to be particularly successful, especially temporal effects such as linking the pace of the cutting scheme to tempo. Others were less successful, subtle reframing effects in particular were found to be largely redundant as the music was capable of achieving the same results alone. A more intelligent use of content was explored in the form of a notation system for use in conjunction with *Cinejack's* video player. This was not only found to be intuitive and robust but, combined with a function which introduced new subjects appearing on the video track, was used as a cueing device by Harriet.

The implementation of the *Movement* module allowed *Cinejack* to control the entire structure of performances, through automatic or responsive reconfiguration while playing. Combined with devices to monitor performance-wide changes in the audio environment, this meant that the system could be run completely hands-off, controlled entirely by musical instruments. The high level controls implemented in *Orientation's* interaction scheme were perceived as feeling different to the lower-level responses implemented in the earlier projects. Individual visceral responses noted in *OverWatch* and *Golden Shroud* were not felt here, however Harriet noted the effect her playing was having on the atmosphere and pace of the piece.

The importance of content in the deployment of the system became increasingly apparent throughout the composition process of *Orientation*. It became apparent that certain sequences resisted modification, retaining their original sense of pace, atmosphere, psychological and narrative effect. This suggests that in generating meaning and affect in soundtrack-controlled cinema, content is still the primary structuring element, with music and cinematography only able alter the meaning of footage which permits multiple readings.

In terms of technical development, *Orientation* generated more features for *Cinejack* and eliminated more technical problems than any other phase of the research, suggesting that

this form of collaborative work was a particularly effective tool for development. The results of the work could now be finalised and released for use by other musicians. The next chapter comprises a final summary of and reflection on the research questions.

8 Conclusions

8.1 Introduction

The research described here was intended to generate insights for researchers and practitioners working in multimedia performance and to develop generalizable approaches for use in interaction design. Discussed here are the specific contributions of the research in terms of approaches and insights, and the overall success of the project against its original goals. Further work which has begun to emerge from the project is also discussed.

The research was carried out through the development of 3 performance artworks, *OverWatch*, *Golden Shroud* and *Orientation*, each of which approached the research questions in different ways. *OverWatch* was intended as a scoping exercise, exploring in practical terms, what might be achieved in soundtrack-controlled cinema. As a performance, measured against the goals of the creative practice it attempted to serve, it was only partially successful, however it was effective in framing subsequent research by suggesting avenues to explore and identifying risks of the approaches being applied. *OverWatch* proved that using existing creative practice for research is not without risk but that applying workflows from performance to developing technology can not only be productive but can generate insights which might otherwise pass by.

In the making of *Golden Shroud* some of these approaches were followed up, refined and applied to a different use case: creating concert visuals for another musician's performance practice. This phase of the research was structured around a collaboration in order to allow the surfacing of design insights from outside the project which could be compared and contrasted with elements of our own practice. The design approach used was an idiographic one (Hook et al, 2013), where the research was placed at the disposal of another musician, in a project which was structured around the requirements of her practice.

The chief drawback of this methodology was the necessity of limiting the scope of the research to another musician's goals. The focus during *Golden Shroud* was necessarily on developing aspects of the research that were of interest to our musician: mainly the overall effect of the visuals as a device for supporting engagement with live performance. The rewards however were numerous, chief among them being a more objective framing of the research questions, supported by testing and evaluation opportunities. The opportunity to observe and film the resulting performance in front of live audiences and use this material as a focus for more discussion and development was particularly useful. A tangible

outcome of *Golden Shroud* was the development of *Cinejack*: a set of configurable modules for controlling narrative visuals through music.

Orientation, the final part of the research, was also by far the most elaborate. Not only did it involve the continuation of the research with musicians and the development and refinement of *Cinejack*, it also led to the production of a full-scale film project, involving an interesting exploration of approaches for preparing content for hybrid performance artforms of this type. Insights from this part of the project have already led to a further project 'cinehack' which is discussed further later in this chapter.

8.2 Connecting devices from cinema and music in live performance.

During the research, a range of use-cases was explored: from *Golden Shroud*, where visuals were used to support a musicians' existing stage performances, to *OverWatch* and *Orientation* where a new form of hybrid performance was created: a form of live narrative cinema drawing upon the languages of film and music. In order to assemble a range of possible controls for narrative visuals, devices from Hollywood cinema were explored (see figure 60). These devices related to framing, composition, camera movement and editing and were derived from standard cinematography texts. Each was chosen for either being particularly useful for spatial or temporal description of action or for achieving specific psychological effects. Devices from film soundtrack were also examined on similar terms.

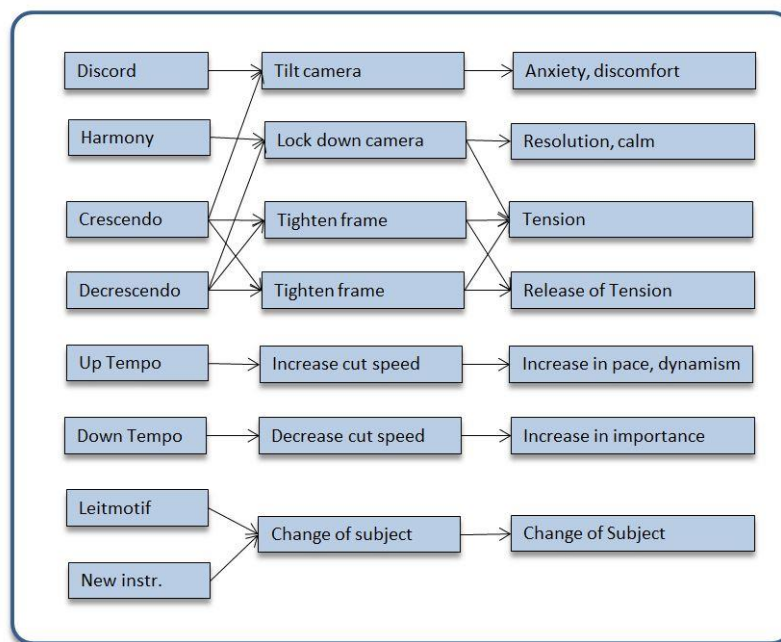


Figure 60: Connections between musical and cinematic devices, as described in Chapter 4.

Over the 3 projects, a number of these devices were deployed in the making of soundtrack-controlled cinema pieces (see figure 61) and were evaluated in context, with regard to how they assisted in developing coherent and engaging audio/visual experiences. Temporal devices including editing were particularly successful. Linked to the tempo of musical scores in both *OverWatch* and *Orientation*, it was felt by the musicians involved that they were able to reinforce and emphasise the pace of the music. Less successful were more subtle psychological effects such as Dutch tilts and slow zooms used respectively to establish instability or tension. Linked to discord or crescendos in the score, the effect of these cinematic devices was found to be negligible compared to the capacity of the music itself for conveying the same effect.

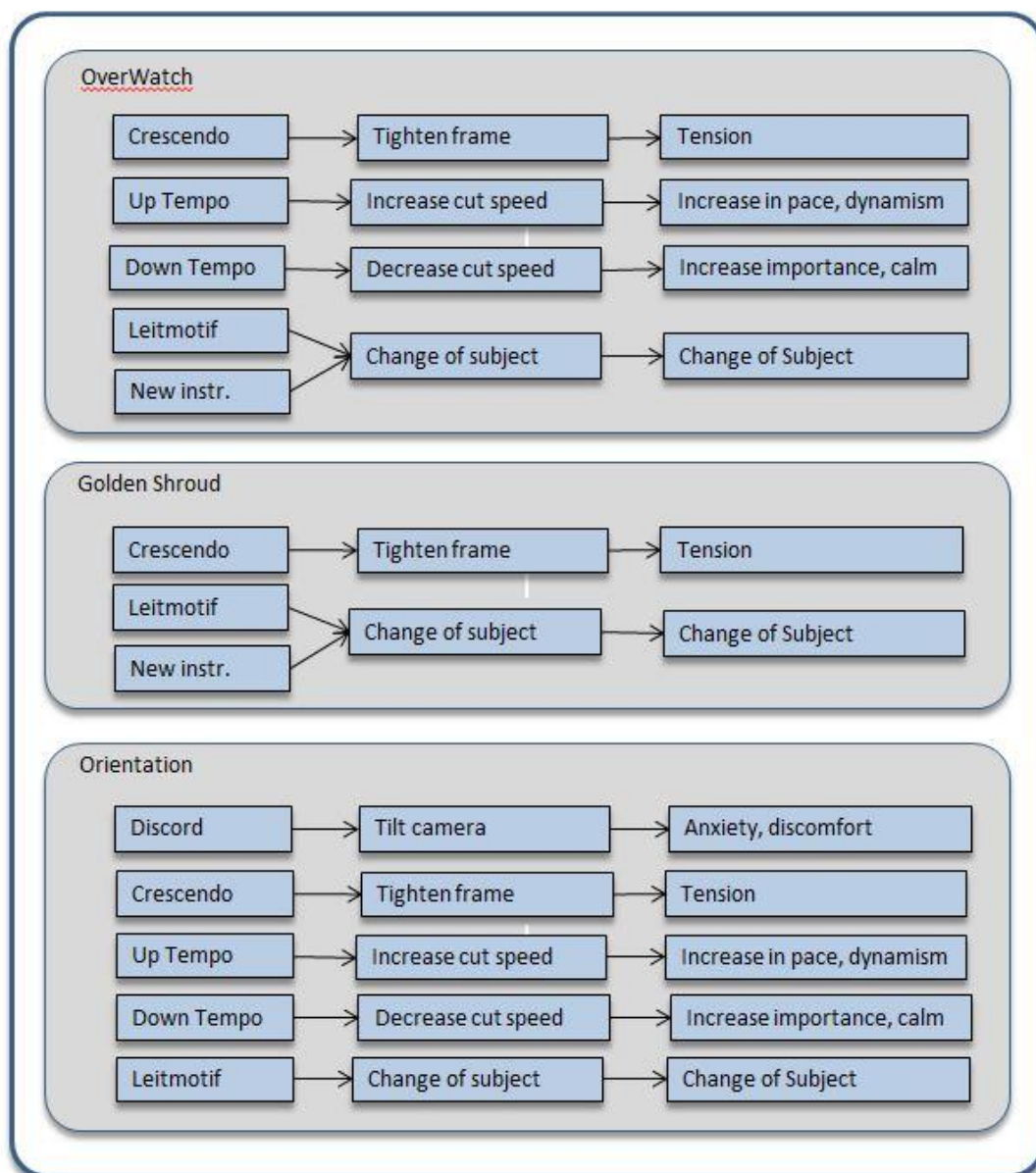


Figure 61: Mappings used in all 3 pieces

Changes of subject controlled by musical phrases were also used in both *OverWatch* and *Orientation*. In *Orientation*, these were deployed extensively and intuitively by the musician composing the score, to reference particular characters and events. This led to an interplay between musician and visuals system that was not only satisfying for the musician but was felt to contribute to a sense of coherency in the performance.

The importance of legibility: how well the audience could read the causal connection between music and visuals was a recurring question throughout the 3 pieces. In each case, it was clear that the audience had little understanding of the details of the interaction scheme, however after the performance of *Orientation*, both audience members and musician felt that understanding that the music was controlling the film might have further scaffolded engagement with the audience. This confirmed an early hypothesis: that audiences might engage with soundtrack-controlled cinema pieces along the lines of spectacular cinema, oscillating between immersion in the story and appreciation of the skill of the performer, film-maker or designer. To ensure this engagement, it was suggested that in future performances, passages might be included which clearly demonstrated this connection.

8.3 Exploring Controlling live visuals with musical instruments

8.3.1 Controlling narrative visuals with music

In Chapter 3 the construction and linking of multiple spaces: the notional space of the film and the physical space of the theatre via the screen was discussed at length. In the performances of *Golden Shroud* and *Orientation*, this issue had been raised by both musicians. Rose Kemp had been delighted at the projections overlapping the band in *Golden Shroud*. Harriet Cole had stated that the lighting and configuration of the venue had helped her immerse herself in the performance. These occurrences suggested that carefully considering the intersection of these spaces could add to the coherency and impact of a performance.

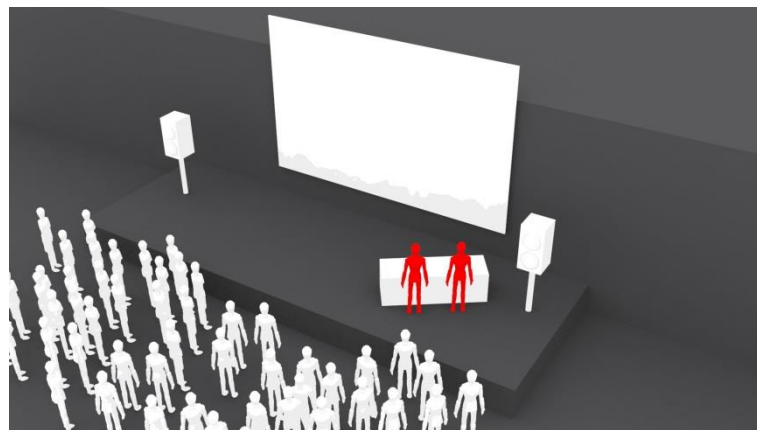
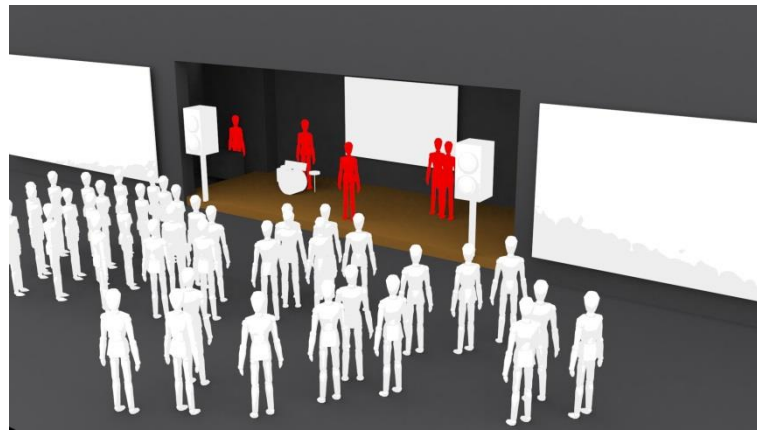
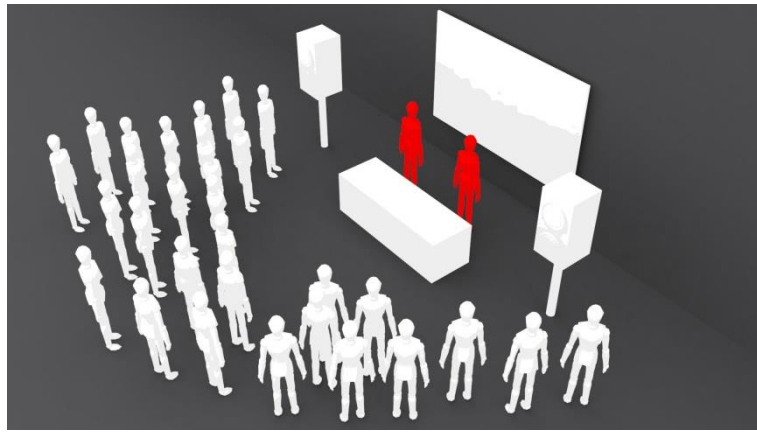


Figure 62: Configuration of spaces in OverWatch (top), Golden Shroud (middle) and Orientation (bottom). Musicians are shown in red.

A challenge in using music to control visuals was the intrinsic power of the visual content. Although *Orientation* had been designed for a soundtrack-controlled performance, some scenes resisted the different readings imposed on them by the score and the cinematography. The pace and atmosphere of the exploration sequences in *Orientation* could be altered significantly by changes in the pace of the score, the editing and the framing; however other sequences seemed largely unaffected in either narrative or psychological terms. In soundtrack-controlled cinema then, content is the key factor, with cinematography able to adjust but not completely restate the narrative content of a scene. The content of the screen, not the actions of the musician have the greatest effect on the overall effect of the presentation. The atmosphere, pace and narrative structure even of a piece designed specifically for flexibility, was determined primarily by visual content, with music playing a secondary role and cinematography only able to affect the result in a limited way. In preparing future soundtrack-controlled cinema pieces then, enough latitude must be planned into visuals to allow music and visuals systems to affect their reading.

8.3.2 Using musical instruments as controllers.

The second aspect of interaction explored in this thesis was how musical instruments could be used as controllers. The motivation behind this part of the research was a lack of available tools that could be used by musicians while playing. The goal was to enable musicians to extend their capabilities without compromising their performance by dividing their attention between playing and controlling. Throughout the research, the practical consequences of this approach were explored with regard to how a system which used musical instruments as its interface could be integrated into musicians' working practices.

An important consideration in the development of the systems described here was that they should be applicable to real-world creative practices. Structuring the research around the production and performance of live shows allowed testing of each system in real venues, largely using musicians' own equipment. This approach provided a variety of venues and performance rigs with which to experiment. It also ensured that the resulting software would be sufficiently robust to be used by other musicians and that useful control systems could be assembled without requiring expensive or specialist hardware.

Through our own work and through working with other musicians across the 3 performance projects, it was determined that a completely hands-off approach, which required no graphical user interface or extra controls was preferable. Both musicians felt that the system should be able to support direct control through musical structures but

should also be able to extract sufficient controls from the music that the musician could focus entirely on playing.

By using pre-determined devices and mappings, it was found that this was achievable, even in the case of elaborate narrative performances. An important factor in this control system was ease of configuration: by designing a modular scheme of simple devices, a range of controls could be quickly and easily set up that were appropriate to the piece being performed. The particular devices deployed had been originally envisaged as exclusively high-level controls, the assumption being that low-level 1-1 mappings would require a distracting level of direct operation. During the development of *Golden Shroud* however, it was found that certain low-level mappings could provide more visceral, equally satisfying responses. Simple measures, such as mapping fade controls and small camera movements to the amplitude of instruments in *Golden Shroud* allowed the system to directly respond to elements of the music without needing intentional control on the part of the musicians.

Throughout this thesis, goals and motivations behind creative practice and music making were discussed at length. The most important of these, aesthetic satisfaction, flow and groove were considered throughout as important criteria for the success of each performance piece. This consideration extended to the specifics of musical instruments in the context of musicians' lives. If a key motivating factor in playing an instrument was pleasure, then it was important that a control system did not detract from this. In practice, these opposite was found to be true. All the musicians involved in the project enjoyed the sensation of using their instruments to control visuals. This visceral sense of 'playing' the visuals using an expressive interface was particularly successful in *Golden Shroud* where Rose Kemp talked about feeling the connection between her voice and the visuals during one of the few occasions she glanced at the projection.

8.4 Exploring new ways of using creative practice in research

In developing tools for creative practitioners, a number of approaches were drawn from the domain in which they were situated. The most striking of these was the application of approaches from collaborative music composition to software development. Much of *Cinejack's* design was carried out in the rehearsal rooms of the musicians involved in the project. This 'jamming' approach to development, where modules were sketched out and refined while the musicians rehearsed and composed was particularly fruitful in terms of providing not only a very rapid iterative cycle of development, but highlighting technical

problems the moment they arose.

The application of multiple perspectives and use-cases to the same research question builds upon previous work undertaken by Hook et al. (2011) in attempting to account for individual voices in the design process. Besides acknowledging the personal motivations of the designer in the process, this project also offers a methodology for placing these perspectives in dialog during the design process. In the making of *Orientation* and particularly in working with Rose Kemp on the *Golden Shroud* project, the designer's own parallel practice formed an important focus for discussion and planning.

At the beginning of this thesis, a number of goals from a creative practice were identified against which the research could begin to be evaluated. In order to justify the diversion of resources from practice to research, the outcome had to not only generate new knowledge but had also to be of value to our practice. The results of this are a conditional success. My own practice has benefitted in terms of improving our performances, adding impact to our shows and providing us with a new set of tools which allows us to focus more fully on making music while developing new visual content.

The chief drawback of using my own practice in the research was an undeniable diversion of resources away from the main work of *The Turing Test*. Rachel remarked that this had been detrimental to the collaboration (see Chapter 2), and had meant a definite reduction in the number of concerts we had played.

'some of the negative aspects which I think have crept into some of the work is that probably when we've wanted to write more new things or just to jam or to do something really basic and really simple, it's been difficult because of time...and circumstances as well.' -Rachel

A less measurable but equally important aspect was the drain of creative energy from the project. Rachel remarked that during busy periods of the research, our creative output purely in terms of the number of songs we were developing had declined. This was particularly acute during the busiest periods around the making of *Golden Shroud* and *Orientation*.

The issues raised here are of importance to researchers attempting to leverage creative practice for research. Although specific and relating to a single practice, it seems reasonable to suggest that some - if not all - of these issues could apply to other research projects within this domain. The fragility and vulnerability of creative practice, both in limitations to the time and resources that the practitioner can apply to it and in the social

and structural makeup of collaborations, should be an important factor in considering how it should be used ethically in research projects.

8.5 Developing a novel form of digital live art

The development of soundtrack-controlled cinema as a new art form: a hybrid discipline greater than the sum of its parts, is also offered as a contribution. Drawing upon the same historical antecedents as VJ practice, audio/visual performance, modern cinema and live musical performance, it offers a different recombination of the constituent elements of these art forms.

As discussed in Chapter 1, the music industry currently faces significant challenges as digital online and download formats supplant physical media. The business model, prevalent throughout the final decades of the 20th Century, in which live shows were used to promote studio recordings, is now almost reversed, with many artists relying on live performances as their main source of income (PRS, 2011). The availability and relative cheapness of recording technology means that with little training, musicians can now produce and distribute professional-quality recordings for a modest financial outlay. This phenomenon is seen by many as overwhelmingly positive (PRS, 2011); democratizing music production and destroying the monopoly of the major record labels. It has also however undoubtedly led to a huge increase in competition for emerging musicians and has made it increasingly difficult for musicians to attract enough attention to sustain a career. In the face of this substantial challenge, many musicians are turning to unusual forms of performance, attempting to distinguish themselves from their peers through artistic experimentation and innovation.

An example of this is Laura Marling's recent collaboration with Secret Cinema (see chapter 3), in which the launch of an album was presented through one of their trademark immersive environments. In this production, Marling and Secret Cinema overcame the homogenising effect of ordinary music venues, by presenting the show in an elaborate visual context, a unique space, created specifically to support the work. It is envisaged that soundtrack-controlled cinema, as a novel form of performance using resources which many musicians have already at their disposal, could be used to the same ends: to provide a detailed and immersive supporting context for their music, making live shows more memorable, more engaging and consequently, more attractive to audiences.

As *The Turing Test*, we continue to use and develop *Cinejack* for our own shows and are currently planning a new production along similar lines to *Orientation*: a soundtrack-

controlled cinema piece presented in a ‘silent cinema’ format. A number of local musicians have also expressed an interest in the *Cinejack* software and have begun to experiment with live music-controlled visuals. We look forward to seeing the results of these experiments in the near future.

8.6 Further work

A concrete outcome of the research described in this thesis was the development of the *Cinejack* software. This software will shortly be made available at guyschofield.wordpress.com. More innovations and additions to the main body of the system are already underway including the addition of new devices and refinement of existing modules. This section details 2 projects which have emerged from the research.

8.6.1 *CinejackLive*

CinejackLive is a version of *Cinejack* which allows the user to incorporate live action elements in soundtrack-cinema performances using live camera feeds from any digital video camera and a simple 2 axis motorised camera mount. To run the system, *Cinejack* is set up as per usuals, with the substitution of one or more camera modules in place of the *Cinejackplayer* module. Basic face tracking, using Pelletier’s *jit.cv* library for Max (Pelletier, 2013) is applied to the camera feed and the framings used in *Cinejack’s Frame* module are used to compose the shots.



Figure 63: miniature motorized camera mount to enable live cameras to be used in Cinejack

Instead of cropping the video, these are manifested as physical adjustments to the camera's rotation on the x and y axes. This allows the motorized camera to identify characters and place them in the frame according to standard film convention. The prototype camera system consists of a rapid-prototyped camera head built in ABS (acrylo-butadeine styrene) (see figure 63). An arduino microcontroller is used to control 2 servos of an easily available standard type. Changes in servo position are sent from Max as MIDI control changes.

8.6.2 Cinehack (with David Green)

A further offshoot of the research is the *Cinehack* project, led by myself and David Green. This research project emerged from the production of *Orientation* during which a number of low-budget alternatives to mainstream film production techniques were employed as a matter of necessity. Many of these were found to be extremely effective and it was noted that, while many film-makers, especially emerging practitioners, are forced to find ingenious solutions to camera support, lighting and special effects problems, there are few dedicated repositories for film production 'hacks' of this sort. The production model used in the making of *Orientation* – using DSLR cameras, a small crew and low-cost supports – is growing in popularity.



Figure 64: Cinehack website

Cinehack currently exists as a website (see figure 64) upon which are documented a number of solutions to common technical film problems. These include using inexpensive industrial lighting to replace dedicated film lights, designs for low-cost camera supports and approaches for planning micro-budget film production. *Cinehack* has been demonstrated at a number of festivals and events and more live events are planned in order to attract discussion and interest around the site. The site is soon to be extended with new material and input from other film-makers. *Cinehack* can be accessed at <http://cinehack.com>

8.7 Concluding Remarks

The research described in this thesis explored controlling narrative visuals through live music and using musical instruments as controllers. These questions were explored through a practice-led series of performance projects which attempted to take into account the motivations, goals and contexts of practitioners involved.

The research has resulted in a body of knowledge which is intended to be of use to musicians, film makers or VJs experimenting with audio/visual media. Specific insights were surfaced on the effectiveness of cinematic devices in the context of live performance, factors involved in staging coherent live shows with projected visuals and how narrative structures and spaces from different media can be connected in multimedia performance. The research also explored qualities, properties and approaches for using musical instruments as controllers for software systems. It is suggested that the outcomes of this research might not only be useful to creative practitioners but may also assist designers working with other groups of expert users, in considering how best to exploit the affordances of familiar tools and interfaces as controllers.

Throughout the research, dialog, collaboration and practical experimentation formed the main tools of inquiry and authenticity of context was a key structuring element of the research. Workflows and approaches were drawn from the domain under investigation and applied in new ways to developing tools for that domain. It is suggested that this approach - of using insiders' knowledge of the domain to not only gain knowledge but to structure processes within the research - might also be of use to other researchers working with creative practice.

9 References

- 2K Games (2007) Bioshock.com [online] Available at <http://www.2kgames.com/bioshock/> [accessed 21/09/2013]
- Abdullah, R., Christie, M., Schofield, G., Lino, C., & Olivier, P. (2011) Advanced composition in virtual camera control. In *Smart Graphics*. Springer, pp.13-24.
- Adorno, T. & Eisler, H. (1947) *Composing for the Films*, New York: Oxford University Press.
- Altman, R. (1984) A Semantic/Syntactic Approach to Film Genre, *Cinema Journal*, Vol. 23, No. 3, Austin: University of Texas Press, pp. 6-18.
- Altman, R. (1999) *Film/genre. Vol. 84*, British Film Institute.
- Arijon, D. (1976) *Grammar of the Film Language*. Hastings House.
- Aronofsky, D. (Director)(2001) *Requiem for a Dream* (motion picture)
- Auslander, P. (2008) *Liveness: Performance in a mediatized culture*, Oxford: Routledge.
- Autodesk (2013) Autodesk.com [online] Available at <http://autodesk.com> [accessed 01/09/2013].
- Barry, M. (2010) *London calling: a countercultural history of London since 1945*, Atlantic Books.
- Bateson, G. (1955) A Theory of Play and Fantasy, *Psychiatric Research Reports*, 2(39) pp. 39-51.
- Benford, S., Fraser, M., Reynard, G., Koleva, B., & Drozd, A. (2002) Staging and evaluating public performances as an approach to CVE research. In *Proceedings of the 4th international conference on Collaborative virtual environments* ACM Press, pp. 80-87.
- Benford, S., Giannachi, G., Koleva, B., & Rodden, T. (2009) From interaction to trajectories: designing coherent journeys through user experiences. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM Press, pp.709-718.
- Bennett, A. (2001) *Cultures of Popular Music (Issues in Cultural and Media Studies)*, London: Open University Press.

- Bevilacqua, F., Rasamimanana, N., Flety, E., Lemouton, S., and Baschet, F. (2006). The augmented violin project: research, composition and performance report. In *Proceedings of New Interfaces for Musical Expression*, IRCAM – Centre Pompidou, pp. 402 -406.
- Blender (2013) Blender.org, [online], available at <http://blender.org> [accessed 03/09/2013].
- Blomkamp, N. (Director) (2006). District 9 [Motion Picture].
- Bødker, S. (2006) When Second Wave HCI meets Third Wave Challenges. In *Proceedings of NordiCHI 2006*, ACM Press, pp. 1-8.
- Boehner, K., Sengers, P., & Warner, S. (2008) Interfaces with the ineffable: Meeting aesthetic experience on its own terms. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 15(3), 12
- Bolter, D., Gromala, D. (2005) *Windows and Mirrors: Interaction Design, Digital Art and The Myth of Transparency*, MIT Press, Cambridge pp.83
- Bongers, B. and Harris, Y. (2002) A Structured Instrument Design Approach: The Video-Organ, In *Proc. New Interfaces for Musical Expression (NIME)*, pp. 18–23,
- Bordwell, D., Thompson, K., and Ashton, J. (1997) *Film art: an introduction. Vol. 7*. McGraw-Hill.
- Bowers, J. (2002). *Improvising machines: Ethnographically informed design for improvised electro-acoustic music*. ARiADATexts (4)
- Brew, K. (2006) Through the Looking Glass. *Women, Art, and Technology*.
- Brown, R. (1994) *Overtones and Undertones, Reading Film Music*. University of California Press, Berkeley.
- Bruce, G. (1985) *Bernard Herrmann: Film music and narrative*. Ann Arbor, Mich: UMI Research Press
- Burns, Edward M. (1999) Intervals, Scales, and Tuning, *The Psychology of Music second edition*, Deutsch, D., ed. Academic Press.
- Buxton, B. (1997) Artists and the art of the luthier. *ACM SIGGRAPH Computer Graphics 31.1*, pp.10-11.
- Campbell, J. (2008) *The hero with a thousand faces. Vol. 17*, New World Library.

Castle, T. (1988) *Phantasmagoria: Spectral Technology and the Metaphorics of Modern Reverie* *Critical Inquiry*, Vol. 15, No. 1 (Autumn, 1988), University of Chicago Press, pp. 26-61.

Castle, W. (Director) (1959) *House on Haunted Hill* [motion picture].

Cavazza, M, Donikian, S., Christie, M., Spierling, U., Szilas, N., Vorderer, P., Hartmann, T., Klimmt, C., Andre, E., Champagnat, R., Petta, P. and Olivier, P. (2008) *The IRIS network of excellence: Integrating research in interactive storytelling. In Interactive storytelling*, Springer, pp. 14-19.

CFC (2011) *cfccreates.com* [online] Available at http://www.cfccreates.com/what_we_do/cfc_media_lab/interactive_narrative_feature_program/index.php [accessed 24/10/2011]

Chion, M. (1994) *Audio-Vision: Sound on Screen*, Columbia University Press.

Coleridge, S., T. (1817) *Biographia Literaria*

Coppola, F.F. (Director) (1992) *Bram Stoker's Dracula* [motion picture].

Csikszentmihalyi, M. (2002) *Flow*. Random House.

Dekker, A. (2003) *Synaesthetic Performance in the Club Scene. Cosign 2003 Computational Semiotics*. University of Teesside, Middlesbrough.

Dix, A., J., Sheridan, J., G., Reeves, S., Benford, S., O'Malley, C. (2005) *Formalising performative interaction. In, DSV-IS, volume 3941 of Lecture Notes in Computer Science*, Springer, pp. 15–25.

Dixon, S. (2007) *Digital performance*. MIT Press

Donnarumma, M, A. C. E. Sound Design, House, A., and Nicolson Square. (2011) "Xth Sense: researching muscle sounds for an experimental paradigm of musical performance." *Proceedings of the Linux Audio Conference*.

Eisenstein, S., Gerould, D. (1974) "Montage of Attractions: For" *Enough Stupidity in Every Wiseman*". *The Drama Review: TDR 18.1* pp.77-85.

Eskandar, X. (2006) *Lights:: video: VJ*. h4SF.

Faulkner, M., ed. (2006) *VJ: Audio-Visual Art and VJ Culture*. Laurence King Publishing.

Fox, G. (2013). <http://www.theguardian.com/music/2013/may/12/the-knife->

roundhouse-london-review [accessed 26/09/2013]

Franco, E., Griffith, N. and Fernström, M. (2004) Issues for Designing a flexible expressive audiovisual system for real-time performance & composition. *Proceedings of the 2004 conference on New Interfaces for Musical Expression*. ACM Press, pp. 165-168

Frith, S. (1996) Music and identity. *Questions of cultural identity 1996*, pp.108-27.

Future Cinema (2013) futurecinema.co.uk [online]. Available at <http://www.futurecinema.co.uk/> [accessed 09/01/2013]

Gombrich, E. (1995) *The Story of Art*, Phaidon Press: London

Graham, B., Herrmann, B. (1985) *Film music and narrative*. UMI Research Press.

Grant, B. (2007) *Film genre: from iconography to ideology. Vol. 33*. Wallflower Press.

Gunning, T., (1990) The Cinema of Attractions, Early Film, Its Spectator and the Avant-garde in Early Cinema: in *Space, Frame, Narrative*. Ed. Thomas Elsaesser. British Film Institute, London, p.58

Haffner, N. (2008) *Yours* [artwork]

Hanke, R. (1999) John Woo's Cinema of Hyperkinetic Violence: From A Better Tomorrow to Face/Off. *Film Criticism 24.1* pp.39-59.

Herrmann, B. (1960) *Psycho Theme* [music]

Hitchcock, A.(Director) (1960) *Psycho* [Motion Picture].

Hogwood, C. (2005) *Handel: water music and music for the royal fireworks*. Cambridge University Press.

Hook, J., Green, D., McCarthy, J., Taylor, S., Wright, P., & Olivier, P. (2011) A VJ centered exploration of expressive interaction. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM Press, pp.1265-1274

Hook, J., McCarthy, J., Wright, P., & Olivier, P. (2013) Waves: exploring idiographic design for live performance. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM Press, pp. 2969-2978

Hook, J., Schofield, G., Taylor, R., Bartindale, T., McCarthy, J. and Wright, P. (2012) Exploring HCI's Relationship with Liveness. In *Extended Abstracts of CHI 2012*. ACM Press, pp. 2771-2774.

- Hughes, J. (Director) (1987) *Ferris Bueller's Day Off*. [Motion Picture].
- IMDB (2013) Internet Movie Database [online]. Available at <http://imdb.com> [accessed 06/03/2013]
- Jazzmutant (2013) Jazzmutant.com[online] Available at <http://www.jazzmutant.com/> [accessed 21/09/2013]
- Jenkins, H. (2007) Narrative spaces. *Space Time Play*, pp.56-60.
- Jordà, S., Geiger, G., Alonso, M., and Kaltenbrunner, M. (2007) The reacTable: Exploring the synergy between live music performance and tabletop tangible interfaces. In *Proceedings of 1st international Conference on Tangible and Embedded interaction TEI 2007*. ACM Press, pp. 139-146
- Kalinak, K. (1992) *Settling the Score, music and the classical Hollywood film*. University of Wisconsin Press
- Katz, S. (1991) *Film Directing: Shot by Shot*. Michael Wiese Productions.
- Kawanishi, T. (2013) Richard Wagner's Parsifal at Bayreuth and 21st Century in the World: From the Viewpoint "Mitleid (Compassion)" using Interdisciplinary Studies." *Academic Journal of Interdisciplinary Studies* 2.9 p.361.
- King, Norman. (1984) The sound of silents. *Screen* 25.3 (1984): pp2-15.
- Kirk, T. (2010) [Telephone Interview 21/04/2010]
- Korg(2013) Korg.com[online] Available at <http://www.korg.com/> [Accessed 01/04/2013]
- Kulezic-Wilson, D. (2008) A Musical Approach to Filmmaking: Hip-hop and Techno Composing Techniques and Models of Structuring in Darren Aronofsky's π . *Music and The Moving Image 1*. Pp 19-34.
- Lauzirika, C. (Director) (2007) *Dangerous Days, the making of Blade Runner* [motion picture]
- Lino, C., Christie, M., Lamarche, F., Schofield, G., & Olivier, P. (2010) A real-time cinematography system for interactive 3D environments. In *Proceedings of the 2010 ACM SIGGRAPH/Eurographics Symposium on Computer Animation*. Eurographics Association, pp. 139-148.
- Lisberger, S. (Director) (1982) *Tron* [Motion Picture]

- Lucas, G. (Director)(1977) *Star Wars* [Motion Picture]
- Lynton, N., Chester, W. (1980) *The story of modern art*, Phaidon, London.
- Maclean, D. (1992) *The Gael* [music]
- Magnusson, T., and Mendieta, E. (2007) The acoustic, the digital and the body: A survey on musical instruments. *Proceedings of the 7th international conference on New interfaces for musical expression*. ACM Press, pp. 94-99
- Mann, M. (1992)(Director) *The last of the Mohicans* [Motion Picture].
- Manovich, L., Kratky, A. (2005) *Soft cinema: navigating the database*. MIT Press.
- Mascelli, J. (1965) *The Five C's of Cinematography: Motion Picture Filming Techniques*. Beverley Hills: Silman James Press.
- Max/MSP/Jitter (2013) Cycling74.com[online]. Available at <http://www.cycling74.com> [Accessed 02/12/2012]
- McCarthy, J. and Wright, P. (2004) *Technology as Experience*. MIT Press.
- Miller, G. Director(1979) *Mad Max* [Motion Picture]
- Moore, A. (1993) *Rock, the primary text*. Open University Press.
- Motion Dive. (2013) Digitalstage.net[online] Available at <http://www.digitalstage.net/en/>[accessed 21/09/2013]
- Murch, W., and Coppola, F., F. (1995) *In the blink of an eye: A perspective on film editing*. Silman-James Press.
- Neustaedter, C., and Sengers, P. (2012) Autobiographical design in HCI research: designing and learning through use-it-yourself. In *Proceedings of the Designing Interactive Systems Conference*. ACM. pp. 514-523
- Newton, D. and Marshall, M. (2011) Examining How Musicians Create Augmented Musical Instruments. In *Proceedings of New Interfaces for Musical Expression NIME*, pp. 155-160
- Nichols, A. and Maner, K. (2008) The Good-Subject Effect: Investigating Participant Demand Characteristics, in *Journal of General Psychology, Volume 135, Issue 2*, pp. 151-166.
- Nyman, M. (2010) [Telephone Interview 04/05/2010]
- O'Brien, W. (Director)(1933) *King Kong*[motion picture].

- Overholt, D. (2011) The Overtone Fiddle: An Actuated Acoustic Instrument. In *Proceedings of New Interfaces for Musical Expression, NIME*, pp.4-7.
- Peacock, K. (1988) Instruments to perform color-music: Two centuries of technological experimentation. *Leonardo* 21.4 , pp. 397-406.
- Pelletier, J., M. (2009) jmpelletier.com[online] <http://jmpelletier.com/cvjit/> [Accessed 21/03/12]
- Penfold, R. (1998) *Practical MIDI handbook*. PC publishing.
- Phelan, P. (2004) *Unmarked: The politics of performance*. Routledge.
- Polanyi, M. (1966) *The Tacit Dimension*. Doubleday & Company.
- PRS (2010) 'Live Music Continues to Outperform Recorded' in *Performing Rights Society Press Release* [online] Available at <http://www.prsformusic.com/aboutus/press/latestpressreleases/Pages/Livemusiccontinuestooutperform.aspx>. [Accessed 10/12/2013]
- Puckette, Miller S., Apel, T. (1998) *Real-time audio analysis tools for Pd and MSP*.
- Punchdrunk Theatre Company (2013) Punchdrunk.com[online] <http://punchdrunk.com/> [accessed 21/09/2013]
- Radford, M.(Director) (1984) 1984 [Motion Picture]
- Reeves, M. (Director)(2008). Cloverfield [Motion Picture].
- Reeves, S., Benford, S., O'Malley, C., & Fraser, M. (2005) Designing the spectator experience. In *Proceedings of the SIGCHI conference on Human factors in computing systems*, ACM Press. pp. 741-750
- Resolume (2013). Available at <http://resolume.com/>[accessed 21/09/2013]
- Ruoff, J. ed. (2012) *Coming soon to a festival near you: programming film festivals*. St Andrews film studies
- Sanchez, E. (Director) (1999) *The Blair Witch Project* [Motion Picture].
- Schechner, R. (1988) *Performance Theory*, Routledge, New York
- Schneemann, C. (1998).Caroleeschneeman.com[online] Available at <http://www.caroleeschneemann.com/performancechron.html> [accessed 21/09/2013]
- Schofield, G., Casey, R., & Olivier, P. (2010) OverWatch: real-time narrative visuals from live performance. In *Smart Graphics*. Springer, pp. 261-264.

- Secret Cinema (2013) Secretcinema.org [online] Available at <http://www.secretcinema.org> [accessed 05/01/2013]
- Smirke, R. (2013) billboard.com [online] Available at <http://www.billboard.com/biz/articles/news/digital-and-mobile/1556590/ifpi-2013-recording-industry-in-numbers-global-revenue> [Accessed 01/09/2013]
- Spielberg, S. (Director) (1977) *Star Wars* [Motion Picture].
- Spielberg, S. (Director)(1975) *Jaws* [Motion Picture].
- Spielberg, S. (Director)(1982) *E.T. the Extra Terrestrial* [motion picture].
- Spielberg, S. (Director)(1984) *Indiana Jones and the Temple of Doom* [motion picture].
- Spinrad, P. (2005) *The VJ book*. Feral House, Los Angeles
- Steinberg (1996)soundonsound.com[online]
http://www.soundonsound.com/sos/1996_articles/jul96/steinbergcubase3.html
[accessed 21/09/2013]
- Stuart, C. (2003) The object of performance: Aural performativity in contemporary laptop music. *Contemporary Music Review* 22.4, pp.59-65.
- Suchman, L. (1987) *Plans and Situated Actions: The Problem of Human-Machine Communication (Learning in Doing: Social, Cognitive and Computational Perspectives)*. 2nd ed. Cambridge University Press.
- Tanaka, A. (2000) Musical performance practice on sensor-based instruments. In *Trends in Gestural Control of Music* 13 pp. 389-405.
- Tanaka, A. (2010) Mapping out instruments, affordances, and mobiles." In *Proceedings of New Interfaces for Musical Expression NIME*.
- Tanaka, A., (2000) Musical Performance Practice on Sensor-based Instruments. In: M. Wanderley and M. Battier, eds. *Trends in Gestural Control of Music*. IRCAM - Centre Pompidou, pp. 389-405.
- Tarkovsky, A. (Director)(1979) *Stalker*. [Motion Picture]
- Taylor, R., Schofield, G., Hook, J., Ladha, K., Bowers, J., & Wright, P. (2013) Crafting interactive systems: learning from digital art practice. In CHI'13 Extended Abstracts on Human Factors in Computing Systems. ACM Press. pp 3223-3226
- Taylor, R., Schofield, G., Shearer, J., Wallace, J., Wright, P., Boulanger, P., & Olivier, P.

- (2011). Designing from within: humanaquarium. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM Press, pp. 1855-1864
- Thompson, W, F., Graham, P. and Russo, F. (2005) Seeing Music Performance: Visual Influences on Perception and Experience. *Semiotica*, p.156
- Tierney, S. (2006) Themes of whiteness in bulletproof monk, kill bill, and the last samurai. *Journal of Communication* 56.3 pp. 607-624.
- Wagner, R. (1975) *Die Kunst und die Revolution*, in Schroeter, J. *The Politics of Intermediality*, Film and Media Studies 2, Acta Universitatis Sapientiae , Munich: Rogner & Bernhard, pp.107-124.
- Wagner, R.(1895) *The art-work of the future, and other works*. U of Nebraska Press.
- Waksman, S. (1995) *Instruments of desire: The electric guitar and the shaping of musical experience*. Harvard University Press.
- White, G. (2012) On Immersive Theatre. *Theatre Research International*, 37, pp 221-235
- Williams, J. (1975) *Jaws, theme* [Music]
- Woods, P, A.(1998) *King pulp: the wild world of Quentin Tarantino*. London: Plexus.
- Wright, M. (1997) Open Sound Control-A New Protocol for Communication with Sound Synthesizers. *Proceedings of the 1997 International Computer Music Conference*.
- Yamaha.(2013) Yamaha.com[online] Available at <http://europe.yamaha.com/en/products/musical-instruments/entertainment/tenori-on> [accessed 21/09/2013]

10 Appendix A: DVD Contents

The contents of the accompanying DVD are as follows.

Footage from the performance of *OverWatch* at Intersections exhibition, Banff Centre, Banff, as part of The International Symposium on Smart Graphics, June, 2010 (Video by Ryan Taylor).

Footage from the performance of *Golden Shroud* at Equinox Paradox Festival, Fellfoot Woods, Cumbria, UK, September, 2011.(Video by John Shearer and Ko-Le Chen).

Footage from the performance of *Orientation* at Culture Lab, Newcastle, UK November 2012. (Video by David Green).

Linear Edit of *Orientation* (without music). Directed by Guy Schofield and David Green.