Iterative Aesthetics:
Computer-Mediated Interactive Artmaking

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Abstract

This dissertation poses and seeks to answer the following question: what are the research processes used by computer technologists to examine the nature of human computer interaction; which processes are used by artists in the creation and experience of interactive artworks; and above all, how might these two research communities most fruitfully engage in interdisciplinary collaboration in order to learn from each other and to generate better outcomes?

These questions are examined, first, through a review of the literatures relevant to each of these fields. Examining this literature as it has evolved enables us to see the outlines of the history of each field, as they are both very recent phenomena. Second, detailed studies of two large-scale computer-mediated interactive artworks and one small-scale installation are undertaken. The review investigates the "conflicted convergence" (Sengers and Csikszentmihályi, 2003) between the study of Human-Computer Interaction and the practice of creating interactive art. The three case studies — of *Conversations* 2004, *Biloela Girls* 2005 and *Day of the Figurines* 2006 — enable reflection upon the developmental processes more widely used in contemporary computer-driven new media art.

The conclusion drawn is that the most effective developmental methodologies, measured by the degree to which they generate the most interesting HCI experimental outcomes, and by the extent to which they vividly realise the artist's experiential intent, are those that incorporate feedback — gathered from real-world user testing and evaluation — into an iterative development process.

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Chapter 1: Introduction

Humans are leading an increasingly technology-mediated existence, from the proliferation of mobile phones in the developing world to the introduction of ubiquitous computing in the developed. As computer technology continues to embed itself in all elements of our lives, its various interfaces proliferate. This aspect of contemporary culture provides a strong lure for artists, thinkers and technologists. One outcome of artist's engagement with this aspect of contemporary culture is the evolution of computer-mediated interactive art.

During the last half century, and especially over the last fifteen years, an increasing amount of new media or digital art has appeared that incorporates innovative software systems. These software systems are becoming increasingly usable, powerful and available. Committed as they are to experimentation and innovation, modernist artists are naturally inclined towards to new and easily accessible techniques. To the traditional gatekeepers of the art world, however, this interest remains marginal. Nevertheless, there is a large community of practitioners, theorists, networks, publications, festivals, conferences and research centres devoted in part, or in some cases exclusively, to it. Further, this community is growing rapidly.

While most contemporary interactive art utilises off-the-shelf software, in many cases software is written specifically for a particular work. Predominately, this software is produced by software engineering professionals — often labelled programmers or technologists — although occasionally it is produced by the artists themselves. It is this specific case, where artists and technologists customise existing software systems or develop new ones, in order to provide an aesthetic, interactive experience for an audience, that I will explore in this thesis.

The study of how humans interact with computers has a short history as an academic field. It is less than fifty years old. During this brief period a lot has been learnt, not just about how humans use interactive computer systems, but also how to most effectively create such systems. These are rapidly changing times for

software engineers of all stripes. The strict, sequential development methods favoured during the embryonic days of computer technology are slowly being superseded by new, agile methodologies that incorporate the eventual user of the interface into its development processes. I will argue that the most effective of these new methodologies, in terms of realising the author's experiential intent, are those that incorporate feedback — gathered from real-world user testing and evaluation — into an iterative development process.

The study of Human-Computer Interaction (HCI) offers interactive art a wealth of practical knowledge. HCI researchers are already cultivating interactive art as a fertile field for their own research and in recent times a growing number of artists have begun to successfully incorporate HCI techniques into their own practice. It is my hope that what is currently described as a "conflicted convergence" may in the future become less confrontational and more cooperative (Sengers and Csikszentmihályi, 2003).

This thesis, with its accompanying appendices and supporting video materials, represents the written component of my combined written/studio PhD submission. The studio element is represented by the design and development of specific technical elements of the works *Day of the Figurines* and *Conversations*, my integral role in the collaborative design and development of *Day of the Figurines* and *Conversations*, and the conception, development and installation of *Biloela Girls*. A brief account of these contributions, including the role each contribution played within the work as a whole, appears later in the introduction. A thorough technical documentation of the work undertaken appears in the appendices.

This dissertation will explore the recent history of both HCI and new media art, highlighting the relatively rare interplay between them. It will test the hypothesis that the most effective method for artists to ensure their interactive artwork reaches its experiential intent is through iterative human-centered design, driven by the study of "viusers" in real-world (or art-world) interaction with it (see below). This idea is investigated and challenged through an extensive review of the literature and three case studies. The review, which is split into three parts, reports on the overlapping areas of interest and expertise between computer-mediated interactive art and iterative human-centered design, prefaced by a brief history of each field in isolation.

I have adopted a narrative style that I believe best conveys the series of events as they unfolded, as I worked on the projects presented here and, in parallel, explored

the world of writing and ideas that guide and define interactive artmaking and HCI. The written elements of my submission were produced by, and conceived from, a rather unique standpoint, where I acted as an artist, a technological collaborator and a researcher/observer on each of the art works documented here. My intention is that the writing be both accessible and relevant to people with an awareness of art theory and interactive art practice, to those with technological expertise, to the teams or individuals involved in collaborative partnerships, and to those simply with an academic interest in the topics covered in the thesis, without excluding anyone by the use of obfuscating terminologies or specialist discourse.

1.1 Chapter outline

Chapter 2 charts the history of interactive art. The chapter begins by acknowledging new media art's predecessors and early influences — in order to place computational interactive art into a wider art historical context — before reflecting on the long and rich artistic tradition of collaborating with the technologists of the day. The infrastructure, institutions and networks that support new media in general, and software-driven interactive art in particular, are discussed. The current condition of computer-mediated interactive art is outlined.

The complimentary roles, in contemporary software engineering, of Human-Computer Interaction (HCI) study and iterative design methodologies are discussed in Chapter 3. The origins of computer interface design are set out, followed by detailed histories of two particular elements of Computer Science, Iterative and Incremental Design and human-centered design. The chapter concludes by outlining where these fields overlap and how they are being used together productively today.

Chapter 4, the last part of the review of these trends to date, describes the meeting of computer-mediated interactive art and iterative human-centered design. It traces the influence of interactive art, and artists, in computer science — exemplified by an increasing number of appearances in conferences, trade shows and publications. Chapter 4 includes work by, and the reflections of, artists who use audience evaluation techniques from HCI as part of their creative process. It presents a number of projects that are both creative art pieces and research studies into developing interfaces for particular interactive experiences. Further, resources that support this intersection of ideas — including specialist conferences which engage specifically with many of the themes presented in this thesis — are described. This chapter concludes with a discussion of the benefits of, and problems with, some of

the more influential theories and trends in practice documented in the literature review, as well as some reflections upon the theorists and artist/researchers who promote them.

The main body of this thesis consists of case studies of three digital artworks. Chapter 5 examines *Biloela Girls*, a solo project I created and exhibited. *Biloela Girls* is included to provide a small-scale example of how the application of iterative human-centered design principles is possible, and can be beneficial, for digital artworks that are motivated by "viuser" experience. In this study, these principles are utilised by a non-interactive, site-specific, one-off work.

There are two main studies, both of which chronicle the collaborative design and development, as well as the display and reception, of a computer-mediated interactive artwork. *Conversations*, developed under the artistic direction of Jeffrey Shaw, Ross Gibson, Ian Howard and Dennis Del Favero, is examined in Chapter 6, and *Day of the Figurines*, a collaboration between Blast Theory, the Mixed Reality Laboratory and members of IPerG[1], in Chapter 7. These two works share many facets, but were developed according to very different methodologies. I was involved in the development of both works.

It will become evident from these studies that computer-mediated interactive art and the scientific study of human-computer interaction share extensive, and fertile, common ground. This thesis identifies iterative human-centered design, driven by experiential feedback, as a key element of HCI research, and proposes that it can be rewardingly adopted in the design and development of computer-mediated interactive artworks.

1.2 Studio Component

My technical, aesthetic and conceptual contributions to *Biloela Girls*, *Conversations* and *Day of the Figurines* constitute the studio component of my PhD submission. I will briefly outline my role within each work below. The importance of my contribution to the evolution of each work will become clearer once the reader has completed the case study chapters that describe the works in detail and assess their relative success and, in some cases, shortcomings. Technical accounts of the software I

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[1]The Integrated Project on Pervasive Gaming (IPerG) is a European Union funded research organisation that explores pervasive gaming. http://www.pervasive-gaming.org/.

developed for these works appear in appendices A, B and C – they too are important elements of the studio component of the dissertation.

In the case of *Biloela Girls*, a non-interactive, site-specific, one-off artwork, I conceived, created and installed the work. I researched the history and geography of the site of the installation in order to create a work that would respond in a responsible yet critical way to the site and its previous inhabitants. I filmed and edited the video elements of the work, and I positioned it on the site where it could be experienced and studied. It was conceived from the beginning as a work that could be used to test the core argument of this dissertation. I monitored its operation, and solicited responses from a number of those who experienced it.

Conversations is a large-scale interactive and immersive artwork experienced through a head mounted display, high-fidelity headphones and a microphone. I was part of the team of technologists under the leadership of Matt McGinity who built the work's core technical components, and collaborated with other groups and individuals to realise the elements that required expertise that we did not posses. As a member of this team I was involved in many aspects of *Conversations* design and development, including the virtual reality engine, the aesthetic of the ghost characters, the speech patterns of the ghosts, the multiuser functionality and feel and the overall virtual environment. In particular I was responsible for the bringing the three dimensional (3D) audio elements into *Conversations*. This entailed working with a number of collaborative partners to create a score for an immersive 360-degree movie, design and develop spatial scoring software to position elements of the score into a 3D space, position in 3D pre-recorded sounds and real time viuser conversations and to connect the audio and visual elements of the immersive experience.

I joined the team at the University of Nottingham's Mixed Reality Laboratory after the first iteration of *Day of the Figurines*, an episodic interactive experience for mobile phones, in which viusers use text messages to interactive with the work. The first iteration focused on game play and text content, and was not automated. I was fully involved in all subsequent iterations, as one of the main developers, as well as an active member of the team that defined the user experience and game play elements of the work. I worked on many elements of the *Day of the Figurines* game play software during the lead-up to its exhibition in Barcelona (Sonar Festival, June 2006). For the final version of the *Day of the Figurines* I focused primarily on the

generation, aggregation and the pacing of the delivery of the messages that the viusers received.

My contribution towards the completed and exhibited work differs greatly across the three case studies presented in this thesis. *Bileola Girls* was entirely my work, in all its aspects. In the other two cases, the works would have been demonstrably different without my involvement. The audio elements, so central to successful viuser immersion in *Conversations*, would have had a different character. Many central elements of *Day of the Figurines*, in particular the manner of which the viuser interacts with the computer-driven narrative engine that facilitates their experience, would not have been the same. These contributions are specified in the chapters devoted to each of these works, and the technical components set out in the appendixes.

1.3 Viuser

A note on my use of the term "viuser", which I use through this text. By this I mean a "visual information user" (Smith, 2003). I have coined this term to draw attention to the changing nature of spectatorship in contemporary human-computer interaction, both in the arts and in the wider community.

The words "viewer", commonly used in the visual arts, and "audience", prevalent in the performing arts, do not adequately describe the viuser's experience of interactive artworks. The notion of the viewer being in active engagement with the work, does not extend to being active in the configuration of the work. This is the realm of the artist and curator only. Further, the viewer is necessarily singular, whereas a multiplicity, or at least the potential of a multiplicity, is required by many interactive works. The audience, in a theatre, is typically a passive collection of observers of a single performance, again incommensurate with the experience of interactive art.

This passivity is being challenged in the home, online, on-the-street and, most pertinently, in galleries, museums and wherever art is exhibited. User-centred interactivity and user-generated content are central to the contemporary internet experience. Even television — arguably the most passive of all mediums — is becoming interactive. Many of the works presented in this thesis exemplify and extend this trend; such works are experienced in a manifestly different way from the

traditional craft-based creative arts. My use of the term "viuser" is an attempt to reflect and celebrate this.

Ever since interactive art works have been created and exhibited, artists and scholars alike have struggled for an appropriate nomenclature. Dewey provided "perceiver and appreciator" in a time before computer mediation played a role in interactivity (Dewey, 1934). In 1973, Cornock and Edmonds introduced "participant" because they believed "that it is a function of [interactive art] to stimulate a high degree of…involvement. Therefore, it is necessary to introduce at this point the term 'participant' to replace the terms 'viewer' and 'audience'" (Cornock and Edmonds, 1973). Although the term "participant" has been taken up by many (such as Kac, 1996; Flintham et al., 2003; Sheridan et al., 2004; Gemeinboeck, 2005), it does not fully embody the experience of the majority of interactive art works. It implies a person's full and acknowledged participation and a clear demarcation of the terms of interaction — akin to an audience member, lured onto the stage by a magician to be sawn in half — whereas many interactive works subtly draw from aspects of people's current or previous presence to generate their aesthetic displays.

Since the 1970s the namespace has become seriously cluttered with the addition of "immersant" (Davies and Harrison, 1996), "interactor" (Rokeby, 1996), "participant-observer" (Milgram and Kishino, 1994), "vuser" (Seaman, 2000), "beholder-manipulator" (Bourriaud, 2002), "user" (Courchesne, 2002), "explorer" (Rogers and Muller, 2003), "audience-participant" (Turner et al., 2005) and, one of my personal favorites, "spect-actors" (Boal, 1979). For the reasons stated above, and because each of these words has its own specific set of associations, I have preferred "viuser" — visual information user.

The intended usage of "viuser" is sympathetic in some ways with Bill Seaman's "vuser", which he defines in the following passage:

> Meaning, within this kind of computer environment, is produced through the experience of a series of media-proximities and media-processes accessed through physical and intellectual interaction with this techno-poetic mechanism over time. These media-proximities and -processes are not fixed but arise and function through this dynamic process of interaction with the participant. I have coined the term vuser conjoining the words viewer and user to articulate the participant's relation to the environment.
>
> (Seaman, 2000)

It is clear from this passage that Seaman has in mind the mode of interaction afforded by works such as his *The Exquisite Mechanism of Shivers*, where interaction is restricted to inputting selections of word/image sequences at predefined moments. "Vuser" describes this kind of limited interaction succinctly, yet does not encompass the incredibly wide range of interactive possibilities present in contemporary interactive arts practice. It is these possibilities that will be the focus of this text.

Chapter 2: Computer-mediated interactive artmaking

2.1 The pre-history

During the latter part of the last century digital art, under various names, grew enormously in complexity, influence and acceptance. The focus of this thesis is on computer-mediated interactive art. Nevertheless, a discussion of this specific area of art practice requires acknowledgment of its relationship to the wider field of digital or new media art, in order to contextualise its development.

Paul's *Digital Art* and Rush's *New Media in Art*, both from the Thames & Hudson *World of Art* series, offer complementary readings of the historical passage of digital / new media art. Both cite the temporal nature of installations, performances and Fluxus happenings during the 1960s, born out of the seminal work of Duchamp and Cage, as influential in the medium's early development. Contemporaneous improvements in image-based technologies, such as photography and video, and their increased availability, also played an important role. Rush, in preference to the strictly chronological, uses a thematic approach for new media in art, dividing it into 'Media and Performance', 'Video Art', 'Video Installation Art' and 'The Digital in Art' (Rush, 2005). In *Digital Art*, Paul focuses her attention on this last theme, connecting the tale of digital art to the contemporary development of computer science and technology, which has exploded since the early 1990s, as much to as art historical precedents and the influence of other modes of contemporary art.

Paul makes a useful distinction between work created using digital means, where digital technology is used as a tool for the creation of traditional art objects, and works that require digital technology in order to be presented; "art that employs technology as its very medium, being produced, stored, and presented exclusively in the digital format and making use of its interactive or participatory features" (Paul, 2003). I will concentrate on the latter.

2.2 Collaborations in art and science (and technology)

Before computer-mediated interactive art appeared — in fact, before personal computers were readily available — artists began to explore the new technology of the electronic age in collaboration with scientists and engineers. Collaborations between artists and the technologists of the day are not new, nor specific to the field of digital art. History provides many precedents, such as Egyptian engineers working on a sphinx, the development of oil paints during the 16th century or, more recently, artists working with electronic, mechanical, fabric, biological or chemical specialists. Artists have always reflected upon the technology as well as the broader society and culture of the day. The current age, since the so-called "digital revolution", is no exception. As this electronic age emerged from its industrial predecessor, artists became increasingly interested in the intersection between arts and new technology. It is no coincidence that this occurred during a period of greatly improved access to the said technologies.

An early, and prominent, example was the creation of Experiments in Art and Technology (E.A.T.) in 1966, by Billy Klüver and Robert Rauschenberg. E.A.T. sought to connect artists and engineers, to facilitate the creation of technology based art works, or, as John Cage put it, "[E.A.T. is] not about artists and engineers talking; it's about hands on, working together" (Obrist, 1998). E.A.T.'s greatest tangible success came via *9 Evenings* in New York in 1966, where 10 artists and 30 engineers and scientists worked together to create foundational performances incorporating the latest technology. Klüver, however, had another goal in mind; "Bob Rauschenberg and I always said that if E.A.T. was successful it would automatically disappear, because once everybody understands the idea of artists and engineers working together there is no reason for E.A.T. to exist" (Obrist, 1998).

While the art works made during this period were predominately electronic or mechanical, performance based and non-interactive, some artists and theorists, encouraged by the rapid development of the computer and the appearance of the first truly graphical computer interfaces, were excited by other possibilities these new technologies offered.

2.3 The potential of interactivity in the arts

Since the 1960s Roy Ascott has been a practitioner and advocate of interactive art. A decade before the invention of the personal computer, and two decades before

his influential work *La Plissure du Texte* was created for the Electra exhibition in Paris, Ascott was already promoting the potential of computer-mediated interactivity in art. In *Behaviourist Art and the Cybernetic Vision* he drafted, in 1966, a theoretical framework for interactive artworks, a cybernetic vision, where the computer is...

> the supreme tool that technology has produced. Used in conjunction with synthetic materials it can be expected to open up paths of radical change in art. For it is not simply a physical tool in the sense that an aluminum casting plant or CO_2 welding gear are tools — that is, extensions of physical power. It is a tool for the mind, an instrument for the magnification of thought.
>
> <div align="right">(Ascott, 1966)</div>

In 1973, Cornock and Edmonds proceeded, with a respectful nod to Ascott, to actively consider the implications of the introduction of computer technology to arts practice, with an emphasis on the addition of interactive technologies and their effect on creativity. They said that the computer could be used as a tool to mimic certain aspects of what could be described as the "traditional art situation: the artist, the art work, and the viewer, where the artist is an individual who makes all of the decisions regarding the development of an art work, where the viewer is expected to be 'cultured', e.g. familiar with a set of rules and conventions" (Cornock and Edmonds, 1973). They went on to suggest three possible situations; *the static system*, where the work is unchanging, *the dynamic-passive system*, where the work changes over time but the "participant" has no control, and *the dynamic-interactive system*, which "enlarges the dynamic-passive system to include an output from the participant to an art work. We thus have a feedback loop" (Cornock and Edmonds, 1973). It is precisely this feedback loop that is most interesting, exciting and relevant to this thesis' investigation of how interactive artworks that incorporate viusers' actions are experienced and created, and acknowledges that such works are quintessentially different from those that simply use computer technology in their creation or display.

2.4 Supporting interactive art (and artists)

> I'm an interactive artist; I construct experiences. Since the early 1980's I've been exhibiting my installations in galleries, trade shows, science museums, and public and private spaces. These exhibitions serve as a public research laboratory where my ideas about interaction and experience are tested, affirmed or shot down.
>
> <div align="right">(Rokeby, 1998)</div>

While digital art in general, and interactive art in particular, has only recently been accepted by some art world gatekeepers, since the early 1980s interactive artists have been creating and presenting work outside this market, primarily in research & development labs, universities, media centres and computer trade shows and conferences. Although to some extent present since the birth of the personal computer in the late 1970s, computational interactive artists only appeared in force in the early 1990s: since then their numbers have swelled considerably[1].

Early influential works include David Rokeby's *Very Nervous System* in 1986[2], Jeffrey Shaw's *Legible City* in 1989, Gary Hill's *Tall Ships* and Christa Sommerer & Laurent Mignonneau's *Interactive Plant Growing* in 1992, Luc Courchesne's *Landscape One* and *Portrait One* in 1993, Toshio Iwai *Piano - As Image Media* in 1995 and Char Davies' *Osmose* in 1995[3].

Some artists who are interested in making computer-mediated interactive art acquire the necessary skills to develop their work unassisted (Rokeby or Iwai for example), others take the more common path of technologist collaboration (Shaw, Davies, Hill, Courchesne and Sommmerer & Mignonneau, as a few examples). The role of technologists — programmers, hardware specialists, mechanics etc — in the collaborative development of interactive art has been highlighted and investigated in a number of studies, the most compelling of which are discussed in section 4.5.

Although technologists are infrequently mentioned — and rarely given equal billing — in what Brad Miller calls "art in the age of collaboration" (Miller, 1997), they are manifestly instrumental in the creative process (Turner, 2006). There is obviously no blueprint for creating seminal interactive art, nevertheless it is most likely when brilliant technologists collaborate with brilliant artists. Two pioneering technologists from computer-mediated interactive art's formative period in the 1980s and 1990s are Gideon May and Bernd Lintermann. May collaborated on a number of projects with renowned artists such as Jeffrey Shaw, Bill Seaman and Peter Weibel. Lintermann worked with, amongst others, Bill Viola, Agnes Hegedüs and Jeffrey

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[1] The history of the personal computer is discussed in section 3.1.

[2] Rokeby and this work are discussed in section 4.1.

[3] Although these works only represent a small fraction of the works produced during this period, a detailed treatment is not possible here.

Shaw and is now Director of the Institute for Visual Media, at the Zentrum für Kunst und Medientechnologie (Center for Art and Media) in Karlsruhe, Germany[4].

Many of the works listed above, and others like them, would not have been made without the existence of and support from the digital art shows in which they were presented and, especially, what Brouwer, Mulder, Nigten, and Martz call "special art labs". In the introduction to a compelling collection of studies of technological research and development in art practice, Brouwer et al. note the difficulty a work of this kind can have fitting within existing art institutions, because…

> the artistic experiences it generates are difficult to place within existing aesthetic categories, which mainly concern art made with stable media, such as painting and sculpture… Electronic art's lack of a language and place of its own within the traditional artistic sphere has prompted the establishment of new institutes for electronic art and the development of a new body of theory. New methods of financing relatively expensive electronic media projects also had to be found… [As such] special art labs have arisen around the world, where electronic and digital art is made and studied using financial assistance from governments, arts funds, companies, scientific programs and the like.
>
> (Brouwer et al., 2005)

2.4.1 Special art labs

Foremost among these institutions are the Center for Art and Media (ZKM) in Karlsruhe, Ars Electronica in Linz, Austria, NTT's Intercommunication Centre in Tokyo and the Banff New Media Institute in Banff, Canada. Equally important are the festivals that offered interactive artists a rare opportunity to present their work, such as the Inter-Society for Electronic Arts' festivals (ISEA), Berlin's Transmediale, the Dutch Electronic Arts Festival (DEAF) and the computer graphics conference SIGGRAPH[5]. Surveys of the influence of, and output from, these institutions and events appear in a number of publications. Notable among these are ZKM's *Artintact* series (ZKM, 2002), Timothy Druckrey's Ars Electronica survey (Druckrey, 1999) and Sarah Cook's writings on the Banff Institute (Cook, 2005).

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[4]Details of their technological collaborations and artistic practices can be found at http://www.particles.de/paradocs/bio/gideon.html and http://www.bernd-lintermann.de/ respectively.

[5]SIGGRAPH's influence on interactive art is explored later in this chapter.

These institutions have been pivotal in supporting, promoting and presenting the many varieties of digital art in recent decades. In 1997, after more than a decade of planning, lobbying and, crucially, functioning as a research institute for artists, the ZKM opened its doors to the public as a media museum. Other institutions soon followed. Prior to this period most artists and collectives interested in creating such works were forced to operate alone, at a time when computer technology was often prohibitively expensive. For example, the price of the Silicon Graphics Personal IRIS 4D/20 computer used in *Legible City* (1989) was measured in the tens of thousands of dollars, in order to do a computational task that can now be undertaken by a commercially available laptop. Jeffrey Shaw acquired a personal grant from the Dutch Arts Council to purchase the computer and to hire Gideon May to write the software for *Legible City*.

The institutions cited here are all well known; other institutions that match Brouwer et al.'s description are scattered all over the globe, with more opening each year.

2.4.2 An expanded toolset: graphical programming environments

During the 1990s, as the personal computer grew in power and availability, as did creative software products. Software quickly appeared that was seen to be tailor-made for the needs of interactive artists. At the same time that currently familiar multimedia products like MacroMedia's *Flash* and *Director* appeared, so too did graphical programming environments, that is, specialist software environments which allow users without programming skills to create audio and visual displays.

The most famous of these, now in common use among artists and musicians world wide, is *Max/MSP*[6]. *Max/MSP*, and its freeware cousins *jMax* and *pure-data*, appeared during the early 1990s and were drawn from work by Miller Puckette at IRCAM (Institut de Recherche et Coordination Acoustique/Musique) in Paris. Initially this software allowed people, including non-programmers, to construct software applications that could generate procedural or interactive music performances. *Max/MSP* was later expanded to include all manner of multimedia input and output. Each of these graphical programming environments work on an object/patch metaphor, where users create their own, potentially interactive, software using a

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[6]More on Max/MSP, including software demos at:
http://www.cycling74.com/products/maxmsp.

"visual toolkit of objects, and connect them together with patch cords" (Cycling 74, online).

These patching environments were later join by other products, including powerful and complex development environments such as *Virtools*, a commercial virtual reality graphical programming environment, with a plug-in development metaphor where users can create their own programmatic objects and link them with those provided natively in the software[7]. A more recent, and increasingly popular, addition is *Processing*. *Processing* is free, simple, powerful and can run on everything from a web browser to a java enabled mobile phone. Although it is not a graphical programming environment, it is very simple and ideally suited to creating the visual applications favoured by many of today's interactive artists[8].

2.4.3 Online support network: mailing lists, blogs, journals and software

The world wide web, already of central importance to commerce, governance and education, has also become a venue for displaying interactive art pieces. Although the generic internet browser offers a limited creative palette for development and display of interactive art — as well as being tethered to the screen and frequently the desk — it does provide easy access to the growing armoury of relevant software and literary resources. The world wide web provides an abundance of globally accessible locations for publishing ideas, displaying all manner of work and for establishing and continuing (albeit often mundane) dialogues. This has been especially pronounced in, and ideally suited to, the work of digital art's practitioners and theorists.

The internet allows geographically disparate parties a chance to converse, collaborate, organise, review, argue, share and offer help, as well as providing a dynamic venue to continue the contemporary new media art discourse. Mailing lists of particular relevance include, but are not limited too, *Rhizome*, *Nettime*,

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[7]Virtools is discussed in the *Conversations* study, in this thesis. Company information at: http://www.virtools.com/.

[8]Information and demos at: http://processing.org/.

Fiberculture, *CRUMB* and *-empyre-*[9], with topics ranging from funding, creating, curating, displaying and preserving new media works, to active discussions of particular works, artists, shows and festivals. Since the turn of the century there has been an increasing emphasis on blogs and online journals, so much so that Ned Rossiter was prompted to ask, on the once lively *Fiberculture* list, if new media, in Australia at least, had "moved over to blogsville" (Rossiter, online). Useful examples from the shifting sands of internet publishing, at the time of writing, are blogs *we-make-money-not-art*, *networked_performance*, *grand text auto* and *Cross-Media Entertainment*[10] and the journals *Leonardo On-Line: Art, Science and Technology*, the *Fiberculture Journal*, *Convergence* and Experimenta's journal *MESH*[11].

The web now facilitates a lively dialogue, in mailing lists, blogs and online journals, that mirrors, in many ways, the conversations being held on stage and in the cafes at new media conferences, just as it reflects, and reacts to, the ideas being published by new media theorists and artists alike, in cloth-bound tomes.

2.4.4 Cloth-bound tomes

> Although it is relatively easy to specify different interactive structures used in new media objects, it is much more difficult to deal theoretically with users' experiences of these structures. This aspect of interactivity remains one of the most difficult theoretical questions raised by new media.
>
> (Manovich, 2001, page 56)

A growing body of theory partly leads, and is partly led by, digital art's increasing creative output, institutional support and opportunities for exhibition. Some of the earliest and most rewarding writings in this area were by the artists themselves. These texts explored the artists' own practice, often reflecting on the technology, techniques and experiences of working with interactive technology and collaborative

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[9]For more information on each please see, in order: http://rhizome.org/text/, http://www.nettime.org/, http://fibreculture.org/, http://www.newmedia.sunderland.ac.uk/crumb/ and http://www.subtle.net/empyre/.

[10]For more information on each please see, in order: http://www.we-make-money-not-art.com/, http://www.turbulence.org/blog/, http://grandtextauto.gatech.edu/ and http://www.cross-mediaentertainment.com/.

[11]For more information on each please see, in order: http://www.leonardo.info/, http://journal.fibreculture.org/, http://con.sagepub.com/ and http://www.experimenta.org/mesh/.

partners, as well as, in some rare cases, offering insights into the reasons behind their adoption of interactive elements in their work.

An interested reader can easily uncover a number of anthologies of this kind of writing, mostly in the form of festival and media show catalogues (*Future Cinema: The Cinematic Imaginary After Film* being the finest example (Shaw and Weibel, 2003)), but also in collections such as *aRt&D: Research and Development in Art* (Brouwer et al., 2005) and *New Screen Media: Cinema/Art/Narrative* (Rieser and Zapp, 2002). These books provide diverse writings, such as Luc Courchesne's piece, *The Construction of Experience: Turning Spectators into Visitors*, in which he discuses his use of HyperCard and the potential of interactivity in art (Courchesne, 2002), Time's Up's observations of the development, construction and experience of *SPIN* (*Spherical Projection Interface*) (Time's Up, 2005) or Ross Gibson's think piece on "what will count as artistry in the future?", in which Gibson imagines a future where "artists won't be fabricating *objects* so much as *experiences*" (Gibson, 2003, original emphasis). Nevertheless, in the wider new media landscape, as with new media in the wider contemporary art landscape, computer-mediated interactive art plays the role of the ugly duckling.

Since the late 1990s, but primarily since the turn of the century with the publication of Manovich's landmark, although contested, *The Language of New Media*, there has been a plethora of publications marked by a conflicted nomenclature, including "media art", "digital art", "electronic art", "unstable media", "variable media" and, most commonly, "new media". Nowadays new media readers (Grusin and Bolter, 2000, Rieser and Zapp, 2002, Brouwer et al., 2005, Wardrip-Fruin and Montfort, 2003) crowd the shelves in bookshops and art school libraries, along with books on NetArt (Stallabrass, 2003, Greene, 2004, Baumgärtel, 2005), rich catalogues of new media exhibitions (Shaw and Weibel, 2003, Stocker and Schöpf, 2003), texts on particular artists (Shaw et al., 1997, McRobert, 2007) and accessible *Thames & Hudson* publications (Paul, 2003, Rush, 2005).

When establishing new media's heritage, Lev Manovich looked primarily to the cinematic, as well as contemporary computer technologies. He does not, however, believe that interactivity is a fundamental component of new media. Rather he argues that all artefacts are interactive due to the "psychological process of filling-in, hypothesis formation, recall, and identification, which are required for us to comprehend [the work]" (Manovich, 2001). This omission is part of a historical divide between contemporary and computer-mediated art, as exemplified in Nicolas

Bourriaud's highly influential writings, in which he argues that the "main effects of the computer revolution are visible today among artists who do not use computers" (Bourriaud, 2002). Manovich acknowledges this historical division, as one between "Duchamp land" (home of the art world's "galleries, major museums, prestigious art journals") and "Turing land" (the world of computer arts; "as exemplified by ISEA, Ars Electronica, SIGGRAPH art shows") (Manovich, 1996).

Lev Manovich, in *Language of New Media*, and Nicolas Bourriaud, in *Relational Aesthetics*, argue convincingly that a conception of the artist-as-auteur— inspired, but not led, by contemporary technology and technologists¬¬—best describes contemporary new media arts practice. It is my belief that this model, although appropriate for many contemporary new media artists, is deficient when used to understand, engage with and, most importantly, to create computer-mediate interactive art. This deficiency is especially pronounced for works create by a collaborative team whose members' skills, backgrounds and area of contribution differ greatly.

Instead of attempting to provide a one-size-fits all model for the multi-faceted, hyperactive, mutable field of contemporary new media art a more intelligible picture emerges when theorists examine specific elements of the field, such as in Grau's *Virtual Art*, where he provides an enlightening archaeology of immersion and illusion in art practice going back centuries, placing the current technological sleights-of-hand used in interactive and immersive art environments into a coherent art-historical trajectory (Grau, 2003).

2.5 Computer-mediated interactive art and contemporary art

The designation "artist" has acquired new connotations, as we see painters directing films, sculptors crossing over to do architectural work, fashion designers installed in the art museums, Internet artists colonising the galleries… It would seem that all of the media — music, video, performance, publishing, and the internet — are beginning to join hands with architecture, fashion, and the fine arts in a networked system of mutually reinforcing, polymathic collaborations that finds echoes in cities as diverse as Brussels, São Paulo, London, and Sydney… The information revolution, of which the digital image is just a primitive beginning is a feature of our society not only to be used, but to be understood and argued with, as in the best traditions of the avant-garde. Art today and tomorrow has the challenge of the technology to meet.

(Taylor, 2004, page 244)

This is the conclusion to Brandon Taylor's comprehensive survey of contemporary art since 1970. He begins the text by stating that "during the past thirty years or so art objects have come to exist that bear no resemblance to the art of former times", that present "experiences of puzzlement, disorder and in some cases disappointment to the ordinary viewer in search of imaginative stimulation" (Taylor, 2004). In another widely used textbook, David Hopkins' extensive survey of the period from 1945 to 2000, the author discusses work that is "frequently challenging, provocative, and 'difficult'", artworks that do not fit into traditional fine art categories (Hopkins, 2000). Both books note that as modern makes way for contemporary art, so do artists who deal primarily in a single medium make way for artists who follow their ideas across, through and in-between various mediums, as exemplified for both authors in Matthew Barney's work. Both authors conclude their books by citing Barney as the quintessential contemporary artist.

I will argue, throughout this thesis, that interactive art, although largely absent from the above surveys, succinctly embodies this fundamental shift, as its artists, usually in collaboration with other specialists and technologists, combine whatever available mediums they can successfully manipulate. This collaborative exchange, key to new media specifically, but also prevalent in the wider contemporary art landscape, helps drive contemporary art practice away from the traditional artist-as-genius model as seen in craft-based fine arts such as painting and sculpture, through the idea of the artist-as-auteur (based on the filmic model favoured by theorists such as Manovich), towards a contemporary model of artist(s) as collaborators, inspired by feedback and exchange. Throughout this review of the literature and the collection of compelling real-world case studies, I will demonstrate that computer-mediated interactive art is most successful when the last model is in operation.

Despite its importance, computer-mediated interactive art is inadequately acknowledged, both in the new media scene and in contemporary art in general. Nevertheless, artists are producing and presenting work all over the world in festivals, galleries, museums, online, on the street and everywhere in between. The new media conversation is presented in print and online, as well as at a multitude of conferences, where *Ars Electronica*, *ISEA*, *Sónar* and *Transmediale* have been

joined by new recruits such as *NODE.I*, *Enter* and *Refresh!,* the self-appointed first international conference on the histories of media art, science and technology[12].

Computational interactive art, like many other fields, benefits greatly from a heavy internet presence. The world wide web acts as a testing ground, a place for conversation and review, for support and dissemination. However the most important factor for facilitating this kind of work is the continuing reduction in costs of its essential materials: computers, sensors, cameras, displays and software have become cheaper, better and easier to use (and abuse). Although the availability of cheaper materials does not, in itself, lead to the production of better or more successful artworks, it does enable experimentation by those outside the support structures of universities and media centers, including, hopefully, a new generation of artistic innovators[13].

Some of the foundational art histories of new media mentioned above are now being set as course readers for tertiary new- and digital-media courses. This is, in part, a response to a newly won legitimacy and, in part, due to demand from students like myself. Some forward thinking institutions are now offering interdisciplinary courses that traverse science and the arts, and building centres that include researchers from art schools and (usually computer) science faculties. There are a number of examples interdisciplinary courses being offered in Australia, Europe and North America, such as Carnegie Mellon University's Studio for Creative Inquiry[14], Berlin's University of the Arts' Digital Media courses[15] and the University of New South Wales' Computer Science/Digital Media course, which is co-hosted by the Computer

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[12]For information on these conferences please see, in order: http://www.aec.at/, http://www.isea-web.org/eng/sympos.html, http://www.sonar.es/, http://www.transmediale.de/, http://nodel.org/, http://www.enternet.org.uk/ and http://www.mediaarthistory.org/.

[13]It is important to note two points here. First, that non-programming artists who require complicated customisation of existing software, or the creation of new software, will generally require extensive funding. Many artists, especially those not supported by established institutions, will find this prohibitively expensive. Second, when attempting to acquire sufficient funds through governmental arts funding, artists must negotiate bodies that are, primarily, conservative and risk-adverse. These two factors, when combined, stifle the sort of radical arts practice that could, potentially, extend the field. The two main cases studies presented in this thesis are exemplary of the expense and institutional support needed to create technically sophisticated experiences.

[14] See: http://www.cmu.edu/studio/overview/index.html

[15] See: http://www.digital.udk-berlin.de/en/

Science and Engineering faculty and the College of Fine Arts, as is this research thesis[16]. Research institutions are becoming more common, in Sydney alone there are two; the iCinema Centre for Interactive Cinema Research and the Creative and Cognition Studios. Without an institutional appreciation of the potential of this kind of research, this thesis itself would not have been possible.

Collaborations between artists and technologists, so central to the development of interactive art — where it is very unusual for a single artist to do everything on a project — are becoming increasingly prevalent in the new media landscape. Interactive artists can be found collaborating with clothing makers, biochemists, neuroscientists, Human-Computer Interaction specialists, ethnographers, engineers and artificial intelligence researchers, amongst other professions[17]. This fact is beginning, slowly, to be reflected in governmental arts funding[18].

The rate at which new interactive artworks are being created seems to be increasing exponentially, perhaps as a social corollary to Moore's Law, which has predicted the increasing speed of the very computers that are used to deliver these artworks to their audiences[19]. This quantitative progress should not be mistaken for qualitative progress; manifestly remarkable interactive art is currently the occasional remit of brilliant technologists teamed with gifted artists. This thesis aims to provide both artists and technologists with processes, techniques and examples that will enable

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[16] See: http://www.handbook.unsw.edu.au/undergraduate/programs/2007/3982.html

[17] There are many examples for each of these kinds of collaborations; I will briefly point to where an interested reader may find them. For a catalogue of clothing in contemporary art see *we-make-money-not-art's* "wearable" category (http://www.we-make-money-not-art.com/archives/cat_wearable.php). *SymbioticA* is an example of collaborative research in biochemistry and art (http://www.symbiotica.uwa.edu.au/). Artist Tina Gonsalves and affective neuroscientist Dr. Hugo Critchley provide another example of interactive artists eclectic choices for collaborative partners (http://www.tinagonsalves.com/feelinside.html). Examples of interactive artists collaborating with Human-Computer Interaction specialists, ethnographers and engineers are presented in the forthcoming chapters. The role of artificial intelligence (AI) research in art making was deftly explored by Stephen Wilson during a period of great interest in AI (Wilson, 1995).

[18] An Australian example of a recently established art/science collaborative funding opportunity is SYNAPSE (http://www.synapse.net.au/) funded by the Australian Research Council Linkage Grant Industry Partnerships (http://www.ozco.gov.au/).

[19] Gordon Moore, who co-founded the massive processor manufacturer *Intel*, is credited with the assertion that, in essence, base-line computer processors would double in speed every 18 months.

them to produce qualitative improvements in the viuser experience of their interactive works.

Despite the opportunities afforded interactive artists, and the explosion of interest in their work — starting in the 1990s and continuing to the present — the majority of new media or digital art works currently shown are screen based, and non-interactive. The reasons for this are multifarious and continuing, but they are not stifling. This thesis will demonstrate the undeniable momentum building in computational interactive arts; I will also argue for the benefits of incorporating iterative human-centered design practices into the creation of such works. As Blast Theory's Matt Adams says: "Technology is changing the way in which people access culture and relate to it. The explosion of digital culture in the last decade will continue to resonate long into this century"[20].

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[20]Taken from an interview with Annet Dekker (Dekker, 2002). Work by the arts group Blast Theory appears in the forthcoming chapters.

Chapter 3: Iterative human-centered design and development

To properly understand how contemporary computer software is created and why computer interfaces, be they on your mobile phone or on your fridge, are the way they are, an appreciation of their respective evolutions is valuable. In this chapter I will follow the two intertwined stories of Iterative and Incremental Design and the study of Human-Computer Interaction. I will briefly cover the key moments in their histories, their promoters and doubters and their more recent collaboration as well as their combined influence on how I develop software and on my creative art practice.

3.1 The evolution of Human-Computer Interaction

3.1.1 Prologue: the Sketchpad, the *Dynabook* and the PC

> Some mass items, such as cars and television sets, attempt to anticipate and provide for a variety of applications in a fairly inflexible way; those who wish to do something different will have to put in considerable effort. Other items, such as paper and clay, offer many dimensions of possibility and high resolution; these can be used in an unanticipated way by many, though tools need to be made or obtained to stir some of the medium's possibilities while constraining others. We would like the *Dynabook* to have the flexibility and generality of this second kind of item, combined with tools which have the power of the first kind.
>
> (Kay and Goldberg, 1977)

The modern graphical user interface (GUI), which introduced direct graphical manipulation, can be traced back to Ivan Sutherland's *Sketchpad* application which enabled, thanks to a light pen, the movement and manipulation of onscreen objects (Sutherland, 1963). *Sketchpad* marked the beginning of pronounced change in how computer technology was viewed inside the research community and industry, but it was not until Alan Kay joined Xerox PARC that the move from the super computers of the post-war era to what Kay described as a "personal dynamic medium" began (Kay and Goldberg, 1977). Before joining Xerox PARC and founding the Learning

Research Group, Kay studied in Utah with Dale Evans who made every student read Ivan Sutherland's Sketchpad thesis. It is difficult to overestimate the importance of the work Kay and his fellow researchers did through the 1970s at Xerox PARC. As well as generating a powerful array of technological breakthroughs, a more profound shift in the emphasis of computing occurred there.

The Learning Research Group's research efforts and projections of the future were summarised in Alan Kay and Adele Goldberg's prophetic, groundbreaking 1977 paper, *Personal Dynamic Media*. The ideas manifested in their design for a "personal dynamic medium the size of a notebook", which they called the *Dynabook*, heralded a shift in the computer paradigm from textual and mathematical, office-bound systems towards a personal multimedia communication device that "could be owned by everyone and could have the power to handle virtually all of its owner's information-related needs" (Kay and Goldberg, 1977). Kay felt that computers were not simply for business people, engineers or researchers like himself, he felt that they should be, and soon would be, for everyone, particularly for children, and that they would be used for everything, especially creative endeavours. To better understand how the system should be built, and how it could be used, Kay studied users, primarily children, experimenting with various prototype and precursor systems[1]. Kay did not feel he was proposing a technology that would "cure society's ills", rather he saw — through his studies of user experience — that the *Dynabook*, and its contemporaries, could have a profound, positive effect on how people live and work, and how children learn (Kay, 1972).

Dynabook, and its larger desktop test counterpart *Alto*, were precursors to Xerox's *Star* computer. The *Star* heralded the age of desktop computers with a graphical user interface, with overlapping windows, a mouse and WSIWYG (What You See Is What You Get) printing; later made popular by the Apple Macintosh and then the Microsoft Windows operating systems. Interfaces with which all computer users are now familiar.

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[1]A prototype is a working model of an intended final product, often built with a subset of the planned functionality. Prototyping, common in many disciplines, is used in software engineering to give developers a chance to test the system, preferably with end users, before the design and functionality are finalised. This testing regime is used to inform the design of further prototypes and, subsequently, the final system. A detailed analysis of prototyping, and a persuasive argument for its use in almost all software production, appears in the respected software project management book *The Mythical Man-Month* (Brooks, 1995).

Kay saw the *Dynabook* as a "programming and problem solving tool; as an interactive memory for the storage and manipulation of data; as a text editor; and as a medium for expression through drawing, painting, animating pictures, and composing and generating music" (Kay and Goldberg, 1977). At its heart a creative device, or rather a device to enable creativity — a lump of clay to be moulded by skilled artisans and inquisitive children alike.

3.1.2 The early history of Human-Computer Interaction research

Human-Computer Interaction (HCI) research is the multidisciplinary study of how people design, develop and use computer systems. It also looks at the effect that this interaction has on individuals, institutions and the wider society. The field was initially knows as Computer-Human Interaction: the first major conference was CHI 1982. By 1994 industry consensus had, in an oft used phase "put the human first", as evidenced by the title of the first HCI textbook Preece, Rogers, Sharp, Benyon, Holland and Carey's *Human-Computer Interaction: Concepts And Design* (Preece et al., 1994).

Throughout HCI's history, the scope of computer interfaces has continued to grow, from initially appearing as specialised tools for the military, business and research, to the present day, where various computer interfaces appear in almost all aspects of first world lives. During this time HCI incorporated other disciplines in order to manage its increasing ubiquity. The first was psychology, which helped provide HCI with specific, scientific methods of evaluation. The second key discipline, sociology, in particular ethnography, proved very useful in understanding the collaborative and social aspects of interface use. Rather than the manufactured reality of psychological experimentation, ethnography focused on studying how people interact in their natural environment. The inclusion of sociology in the HCI armoury has heavily influenced this still developing field.

Research into Human-Computer Interaction (HCI) is one of the most visibly successful elements of computer science. The mouse, windowing and direct object manipulation, as mentioned above, are all products of foundational explorations of how humans can and could interact with computers. Early HCI research focused on the spatial and the technical, such as Card et al.'s HCI application of Fitts' law, which is a mathematical model for human movement that predicts the time required to swiftly move from a stationary position to a target point, i.e. when using a mouse (Card et al., 1978).

Many outside HCI might regard this as no more than Computer Scientists deciding on the best screen colours, optimal placement of onscreen menus or studying users' mouse speed. But HCI has a very wide remit that includes the study of new techniques to support technologies old and new; all forms of computer input and output including sensing technologies; the ergonomics of computer use; how computers are monitored and manipulated; the various ways users are offered help by the system; searching; communication and, importantly, the processes that developers use when creating new interfaces (Myers et al., 1996).

3.1.3 Human-centered design

The field of HCI changed dramatically in the late 1980s and early 1990s, in response to, amongst other authors, Lucy Suchman's 1987 compelling and influential call to arms *Plans and Situated Actions* (Suchman, 1987). In this book she argued that, traditionally, systems designers relied on computational models of development, as opposed to situated interaction methodologies. This reliance on computational methods has, as I have previously argued (Smith and Hagen, 2004), contributed to the tendency for design practice to lack scope beyond the immediate, the aesthetic and the technical. Suchman was right to advocate the use ethnography to ground theories of action and interaction in empirical evidence. The evidence gathered through studies of situated experience helped HCI researchers promote the user to the centre of the design process, an important step in HCI's evolution. Ethnography, in particular the "quick and dirty" observational kind, is particularly suitable for prototyping activity as it enables examination of transient or evolving situations to be observed (Crabtree et al., 2002b). This is especially relevant to the study of artistic interfaces, as it supports the study of interactive systems in a real world environment such as an art gallery or museum.

The elevation of the user to centre stage is clearly evident in the 1990 book *The Art of Human-Computer Interface Design* which features contributions from wide-ranging group of experts (Laurel, 1990). HCI, already born, was now defined and celebrated by those who saw not only the benefit, but the necessity, of human-centered, user-tested interface design, to make the "transaction with the computer as transparent as possible" (Laurel, 1990, page 248). *The Art of Human-Computer Interface Design* is the first in a series of titles that effectively surveyed the HCI research of the time, and offered it up in a digestible format for inclusion in tertiary syllabi, as well as supplying practical solutions for use by computer professionals. Later, widely used titles include the excellent and practical *Human-Computer*

Interaction: Concepts And Design (Preece et al., 1994), which is enriched by interviews with researchers such as Donald Norman, and the follow-up *Interaction Design: Beyond Human-Computer Interaction* (Preece et al., 2002), which lacks the functional focus and wide applicability of the original.

HCI's rise in popularity throughout the 1990s, contrasted against the plethora of increasing complicated computer interfaces, led authors such as Jef Raskin, Donald Norman and Ben Shneiderman to produce non-technical, polemic texts in support of human-centered design (otherwise called user-centered design or UCD). As use of the computer interface spread rapidly throughout the workplace, the home and everywhere in-between, UCD's advocates began to ask why so many interfaces, computer based and otherwise, are so confusing and obfuscated, why do many features go under-utilised and why are "manuals or special instructions [needed] to use the typical business telephone?" (Norman, 2002). This frustration, born out of a belief that objects and systems could be designed to be usable and useful, but frequently were neither, induced the cognitive scientist Donald Norman to write the early UCD bible *The Design of Everyday Things* (Norman, 2002) and Jef Raskin, co-originator of the Macintosh at Apple Computers, to write readable, if disjointed, polemic *The Humane Interface: New Directions for Designing Interactive Systems* (Raskin, 2000). Although *The Humane Interface* lacks the intellectual rigour of Norman's excellent *The Design of Everyday Things*, it is one of a number of books that were written for non-research and non-professional audiences.

Human-centered and user-centered design are, in essence, the same thing. "User-centered" is the most commonly employed terminology, however I prefer "human-centered" as it expressly acknowledges the real person who must attempt to use the designed object, system or interface. Here I defer to Robertson et al.'s concise summation of human-centered design as a "commitment to technology design research, methods and approaches that prioritise the agency and quality of experience of those who use the technology. Human-centered approaches are motivated by a commitment to the usability and usefulness of technology on the one hand and user-participation in technology design and implementation on the other". They also note, pertinently for this research, that this design perspective is contrary to the "more dominant technology-driven or management-driven perspectives" (Robertson et al., 2004).

It is commonly stated that usefulness and usability are the twin goals of HCI research and development (in Crabtree et al., 2002a; Robertson et al., 2004, for

example). Human-centered design, however, seeks to expand on these laudable intentions. Recent trends in HCI research indicate a change of emphasis from the technical to the experiential, as exemplified by the inclusion of "Interaction Design" in the title of the common university HCI course textbook *Interaction Design: Beyond Human-Computer Interaction* (Preece et al., 2002). Or by Brenda Laurel's compelling, introspective writing in *Computers as Theatre*, in which she explores the parallels between human-computer interaction and the emotional engagement of the theatrical performance. Laurel, perhaps unconsciously, invokes Kay and Goldman when she suggests that we "think of the computer not as a tool, but as a medium". Following this idea, Laurel, justifiably, appeals to designers of all types to "focus on designing the action. The design of objects, environments, and characters is all subsidiary to this central goal" (Laurel, 1993).

The emphasis in HCI has shifted in recent years from interaction to experience. Influential texts are appearing that incorporate new elements, such an understanding of our emotional reactions to design (Norman, 2005), and focus explicitly on understanding the "user experience" (Kuniavsky, 2003). This shift is exemplified by the compelling non-technical arguments presented in Ben Shneiderman's Leonardo's laptop. Shneiderman argues that people "are not satisfied with current technologies that make them feel incompetent or unsuccessful." And rightly contends that HCI should be focused on "raising user satisfaction, broadening participation and supporting meaningful accomplishment." Further, that those who design and build interactive systems should focus on helping make more people more creative more of the time (Shneiderman, 2002).

3.1.4 Towards the end of "rather complicated" interfaces

HCI has moved far beyond measurable increases in productivity, task completion or averting disastrous misuse, such as when the Aegis tracking system's "rather complicated" user interface was judged a contributing factor in an Iranian passenger plane being shot down (Neumann, 1991). HCI techniques have been successfully applied in all manner of educational, commercial and industrial software developments (Myers, 1998). Public beta testing is now common[2], bad interface

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[2]Beta testing is where a software manufacturer, commonly in the gaming industry, provides advanced, unfinished versions of their product for the public to play, use, break and provide feedback on. This is used to get extensive feedback, from the real end users, on bugs, style

design is being named and shamed[3] and readable usability books are appearing for programmers of every conceivable skill level, including amateur web designers[4]. Further, as Bellotti, Rodden, Ishii and Mariette show, HCI studies and human-centered design principles are being successfully applied to new interface technologies as they appear, be they sensing systems (Bellotti and Rodden, 2000, Bellotti et al., 2002), tangible interfaces (Ishii and Ullmer, 1997) or audio interfaces (Mariette, 2006).

HCI research now incorporates any knowledge base that can be brought to bear on the design, development, understanding and evaluation of interactive computer technologies. The British HCI group, for example, includes people from "computer science; human factors; software engineering; ethnography; technical writing; cognitive psychology; sociology; organizational development; systems analysis; graphic design; programming; anthropology; industrial design; process re-engineering; IT management; and many other disciplines" (BCS-HCI, online).

3.2 The evolution of Iterative and Incremental Design

Computer technology, in its various forms, had been around for thirty years before Ivan Sutherland developed the *Sketchpad*. However the technology required for the development of the personal computer, namely the microprocessor, has a shorter history, only coming to prominence in the 1970s. It is from this era to the present that I will trace, briefly, the evolution in the terminology and use of the software development process often called Iterative and Incremental Design.

3.2.1 The early history of Iterative and Incremental Design

During the early days of computer development the majority of software was written by large teams, for large projects. In 1970 Winston Royce wrote *Managing the*

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and usability. Beta testers usually apply for the opportunity, either through a company's website or via registry portals like Beta Watcher (http://www.betawatcher.com/).

[3]By websites like Suck Busters (http://www.suckbusters.com/) and books like David Platt's *Why Software Sucks...and What You Can Do About It* (Platt, 2004).

[4]There are many books that service the needs of programmers in this regard (such as Niederst, 1998, Sun Microsystems Inc., 2001, Tidwell, 2005). Other books, such as *Designing Web Usability: The Practice of Simplicity* by outspoken usability proponent Jacob Nielsen, prioritise web usability, for professionals and amateurs alike (Nielsen, 1999, Johnson, 2003, Nielsen, 2006).

Development of Large Software Systems: Concepts and Techniques which set out his view of current software system development, through the constraining lens of U.S government contracting (Royce, 1970). His influential views were seen as a promotion of what became known as the "waterfall model", namely strict sequential production, in accordance with an overall software plan, for large and complex projects. At this time, others were promoting an alternative, which emphasised incremental development, with functional complexity added at each step once the previous stage had been verified. They would later be called Iterative and Incremental Design (IID) or "agile software development" (Larman and Basili, 2003).

By the mid 1970s large scale projects that explicitly used iterative, or incremental, development started to appear at NASA and IBM, and a few theorists came out in support of IID. Writers such as Tom Gilb and Harlan Mills promoted IID (or "evolutionary project management" as Gilb then futuristically called it) in articles and books, with Gilb adding evolutionary to the software development lexicon and Mills boldly stating in 1976 that; "software development should be done incrementally, in stages with continuous user participation and replanning" (Mills, 1976). By the end of the 1990s the U.S. Department of Defense, one of the biggest software contractors in the world, began to use, in a small number of projects, something akin to modern IID, i.e. feedback-driven refinement with customer involvement and clearly delineated iterations (Larman and Basili, 2003). Despite growing interest, IID was still considered by many to be inferior to the waterfall model, for example, when William Cotterman wrote "The fundamental idea was to build in small increments, with feedback cycles involving the customer for each" in a book chapter entitled *A Minority Dissenting Position* (Cotterman, 1981). Cotterman, as with most IID proponents, understandably, although mistakenly, preferences the customer over the user when incorporating feedback into the development process.

3.2.2 A minority dissenting position?

Throughout the 1980s and 1990s software development gurus began urging programmers and managers to "grow, [not] build, software" (Brooks, 1987). At the close of this period, Agile Software Development (ASD) and eXtreme Programming (XP) were born and suddenly came into vogue. According to the Agile Alliance, ASD requires an emphasis on close collaboration between the programmer team and business experts, face-to-face communication (over written documentation), frequent delivery of new deployable versions of the software (or prototypes), and small and self-organised teams. It also includes ways to craft the software code, and

the development team, so that the inevitable changes in requirements do not result in a crisis (Agile Alliance, online). Despite its seemingly exciting name, XP is a self-described "deliberate and disciplined" approach to software development that prioritises short cycles, continuous testing, teamwork and regular interaction with the customer (Wells, online). Neither ASD nor XP make explicit a need for user feedback in their cycles or iterations.

These methodologies in themselves were somewhat popular, gaining some high profile devotees and appearing in tertiary software engineering syllabi, but more importantly they heralded a community wide shift in software engineering processes that coincided with the rise of object oriented programming. This thesis is not an appropriate venue to present the details of this story, however it is important to note the general trend towards iterative, customer- and user-feedback driven software development as exemplified by a multitude of supporting publications (such as Boehm, 1981; Gilb, 1988; Booch, 1995; Van Cauwenberghe, 2002; Larman and Basili, 2003; Beck and Andres, 2004). So prevalent are these ideas, that they have begun to produce their own spin offs, such as Pliant Software Development[5] or Lean Software Development (Poppendieck and Poppendieck, 2003) and even their own manifesto[6].

3.2.3 Inviting trouble

The software engineering industry has a chequered history of effectively delivering software that meets the needs of its clients, be they, schools, businesses or the Department of Defense (Larman and Basili, 2003). Agile software development best practice is to iteratively develop the technology from a small subset of the functionality up to the full system, and to include feedback from, and interaction with, the people who are buying it, as well as the people who will use it, at every step. The goal is that the software itself will evolve to meet the demands of the two, in order to avoid what Brooks calls a "common fallacy". "Much of present-day software acquisition procedure rests upon the assumption that one can specify a satisfactory system in advance, get bids for its construction, have it built, and install it" (Brooks, 1987). Brooks asserts that "this assumption is fundamentally wrong". All of my

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[5]See the Pliant Alliance for details and a blog, http://pliantalliance.org/.

[6]The Agile Manifesto, and a chance to be a signatory, can be found at http://www.agilemanifesto.org/.

practical experience, both in the arts and commercial industry, would lead me to agree.

By the turn of the century these evolutionary ideas with their myriad of monikers were no longer a minority dissenting position. Again we follow Larman and Basili's lead as they uncover documents from 1999, produced by the usually conservative U.S. Department of Defense, that state: "In the decade since the waterfall model was developed, our discipline has come to recognize that [development] requires iteration between the designers and users". Further, that "evolutionary development is best technically, and it saves time and money" (Larman and Basili, 2003). This unexpected recommendation could lead us to look again at Royce's influential article, closer scrutiny of which it has been noted, could be taken to encourage although perhaps not endorse, agile methodologies.

> For some reason what a software design is going to do is subject to wide interpretation even after previous agreement. It is important to involve the customer so that he has committed himself at earlier points before final delivery. To give the contractor free reign between requirement definition and operation is inviting trouble.
>
> (Royce, 1970)

3.3 Iterative human-centered design: an easy match

Iterative and Incremental Design and Human-centered design are an easy match, with significant overlapping interests. The main element of difference between the two approaches is the consistent and counter-productive emphasis on the customer over the user — from Royce in 1970 through to Well's recent definition of eXtreme Programming. The customer is not, however, the sole focus in UCD, nor in my own practice. Although it is very important to understand the needs and expectations of the customer when building software systems, it is of paramount importance to understand how the end user will actually use the system. In cases where the customer and the end user are not the same person, methodologies that incorporate end user feedback into their iterative development are, I believe, essential. Usefully these two ideas or movements have gained considerable traction. And when harnessed together they not only complement, but push each other further.

Human-computer interaction study, along with the various human-centered design approaches, offers a comprehensive toolset that an iterative software development process can utilise to inform the creation of each new version of a system, including the first. By choosing the most relevant tools and techniques for each project,

developers, in collaboration with customers, users and colleagues, are in the best position to incorporate the inevitable changes required, even when developer and the customer are the same person. This is especially true when attempting to create something entirely novel, such as an interactive artwork.

These two developmental methodologies, when employed together, are central to my creative art practice and greatly influence how I build and deploy software products in all contexts. I bring an iterative human-centered design approach to the projects I am involved in, including, with various degrees of success, the three case studies presented in this thesis.

This takes us to the heart of iterative human-centered design, taking the best from the world of software development and melding it with all that computer science has learnt about human-computer interaction, to provide a way of creating interactive computer-mediated systems. Practical examples abound – such as marrying prototyping and ethnography (Crabtree, 2003) – a selection of which is presented in section 4.7. Such systems, objects and interfaces will, it is hoped, produce the interactive experience their authors set out to provide, no matter what the experience may be, or the context in which it is lived.

3.3.1 Epilogue: the first metamedium

> The protean nature of the computer is such that it can act like a machine or like a language to be shaped and exploited. It is a medium that can dynamically simulate the details of any other medium, including media that cannot exist physically. It is not a tool, although it can act like many tools. It is the first metamedium, and as such it has degrees of freedom for representation and expression never before encountered and as yet barely investigated.

> (Kay, 1984)

Although iterative, feedback-driven, human-centered design has gained a seat at the table of an encouraging proportion of new software developments, preference is still commonly given to the designer/programmer or customer, over the user. We must hope that the measurable successes of these new approaches will transfer into broad adoption by anyone designing and developing software that people, in any context, will interact with. Alan Kay wrote the above thirty years ago and, although the power, the appearance and the very nature of computing has changed considerably in that time, in many ways, like our understanding of the earth's oceans, we have only skimmed the surface.

Chapter 4: Where iterative human-centered design meets computational interactive artmaking

4.1 The Rokeby prototype

> In 1983 I was invited at the last minute to exhibit my interactive sound installation in an exhibition called "Digicon '83" in Vancouver. This was to be my first public show, and I was very excited, but there was a tremendous amount of work to be done. I worked between 18 and 20 hours a day refining an interactive interface from a barely implemented concept to an actual experiential installation. I spent no time with friends and didn't get out at all. I got the piece done and was extremely pleased with the results. After setting up my installation in Vancouver, I was astonished by the fact that it did not seem to respond properly to other people, and sometimes didn't notice people at all. I didn't really understand the problem until I saw videotape of myself moving in the installation. I was moving in a completely unusual and unnatural way, full of jerky tense motions which I found both humorous and distressing. In my isolation, rather than developing an interface that understood movement, I'd evolved with the interface, developing a way of moving that the interface understood as I developed the interface itself.
>
> (Rokeby, 1998, page 3)

This self-reflective anecdote offers a glimpse of one of the originary moments in the meeting of iterative user-centered design and development and computer-mediated interactive art. This work, the *Very Nervous System*, and this story, play an important part in the continuing narrative of the development of interactive art, as well as pointing to the pitfalls of attempting to develop a novel interactive interface without diligently studying and testing people's experience of it.

Rokeby's revelations here were not the result of deliberate, predictive testing of a formulated hypothesis, they were the serendipitous outcome of intense effort applied to an uncharted field. He is an accidental hero. Without an accurate map or memory of the terrain to guide him, Rokeby spent hours before the exhibition refining the interface and, unexpectedly, himself, until he had built what he felt was right. Then

to test his hunches he spent further hours, during and after the show, studying the experience of the system, including his own.

It is little wonder the *Very Nervous System* (VNS) took on his characteristics. The system did not know anyone else. What is more interesting is how Rokeby began to take on movements that were not his own, somehow morphing into an unnaturally jerky creature, like a flesh and blood Tin Man, or a human imagined by a computer system. HCI research tells us that we build mental models of the computer systems we use, was Rokeby's body trying to physically match his mental model of this art-system, a system that he himself had developed?

VNS was exhibited at *Digicon* '83, the first International Conference on the Digital Arts, organised by the Computer Science department of the University of British Columbia and held in Vancouver, Canada. This conference was designed to draw people who would normally attend the technically oriented conferences for new music, film and television products or those devoted to new developments in computer graphics, but in this case they only invited "artists and musicians, serious ones who are using the latest in computer technology to extend 'the edge of the art'" (Lehrman, 1984). As I will show later in this section, computer science conferences, with their newly established streams and off-shoot publications, offer excellent opportunities for bringing together artists and technologists to share experiences and methods. As has been previously noted, art/science collaborations are not new, but collaborations between computer scientists applying, where appropriate, the principles of interactive human-centered design and artists whose practice is that of computer-mediated interactivity, are very much so.

David Rokeby is a respected, still-practising, interactive artist whose works have shown in "galleries, trade shows, science museums, and public and private spaces" (Rokeby, 1998), whose writings and reflections have appeared in arts and computer science publications alike[1] and whose software developments are now widely used and available to others seeking to make interactive systems[2]. Sometimes Rokeby is a software developer and sometimes he is an interactive artist, but he is always

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[1] For example he wrote a chapter of the book *Critical Issues in Interactive Media* (Rokeby, 1996) and an article for *Digital Illusion: Entertaining the Future with High Technology* published by Associated for Computer Machinery Press (Rokeby, 1998).

[2] By creating and distributing products such as the video processing software softVNS http://homepage.mac.com/davidrokeby/softVNS.html.

watching, learning and testing how people interact with his works, in this case by close observation of viusers' interaction with his work, both live and on video. Crucially, Rokeby incorporates this knowledge, this feedback, into each iteration of his works and into each new work, as it initially develops. He remarks that these exhibitions "serve as a public research laboratory where my ideas about interaction and experience and resting, [are] affirmed or show down" (Rokeby, 1998).

The *Very Nervous System* is an interactive sound installation in which a computer system, via a video camera, monitors a physically small space. It uses a viuser's bodily movements in this space to create "sound and/or music" (Rokeby, 2000). In 1991 VNS won the Prix Ars Electronica Award of Distinction for Interactive Art. The video processing software created for VNS, softVNS is now a part of the greater Max/MSP family, available to anyone with a credit card[3]. In the years since its debut Rokeby refined VNS over a number of iterations, exhibiting it all over the world.

The context, the practitioner and the work in this story are all very important keys to the emergence of what is a still-developing field. In this part I will explore the history of the connections and collaboration between computational interactive art and iterative human-centered development methods, through a survey of the literature. To my knowledge, this particular story is about to be told for the first time.

4.2 Computer Science conferences welcome the interactive arts

The conference, more than the journal or book, is the effective high watermark for publication of breaking computer science research, due to the rapid nature of innovation in the field. Without doubt the established peer-reviewed annual computer science conferences attract the top theorists, researchers and practitioners. Of these conferences, those under the patronage of the world's oldest and largest computer society, the Association for Computer Machinery (ACM), are commonly held in the highest regard.

The three oldest and most influential annual conferences with a specific relevance to this study are ACM Special Interest Group on Graphics (SIGGRAPH), ACM Multimedia (ACM MM) and ACM Special Interest Group on Computer-Human Interaction (SIGCHI). Each of these three conferences have, in varying degrees in

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[3]Max/MSP is a popular commercial graphical programming environment from Cycling '74.

their recent histories, begun to actively explore the arts, and in particular interactive computer-mediated art, as a novel and rewarding way to further their own research agendas. It is the meeting of these fields, and the work of the practitioners within them, that I will explore further, but first a few words about the conferences themselves.

4.2.1 ACM SIGGRAPH

SIGGRAPH has been the benchmark for computer graphics development since its inception in 1974, but recently it has elected to widen its scope to include "interactive techniques". Since the mid 1970s SIGGRAPH has "grown from a handful of computer graphics enthusiasts to a diverse group of researchers, artists, developers, filmmakers, scientists, and other professionals who share an interest in computer graphics and interactive techniques" and is attended by tens of thousands of computer professionals, researchers, filmmakers, animators and artists each year (SIGGRAPH, a, online).

Over the last ten years SIGGRAPH has begun actively encouraging practising artists who use computer technology to present reflections on their work and show screen-based works in the film program. Further, SIGGRAPH hosts an art show that coincides with the conference; they are highly aware that "an essential part of our community has been those artists and researchers who use the computer as a part of the creative process" (SIGGRAPH, b, online). David Rokeby presented *Very Nervous System* at the 1988 SIGGRAPH art show and Jeffrey Shaw's *Legible City* appeared in the 1989 show. In 1991, Loren and Rachel Carpenter presented a prototype interactive cinema system to a large audience at SIGGRAPH, before developing it further and taking it to ISEA three years later (Maynes-Aminzade et al., 2002). In 1993 Simon Penny chaired and curated an exhibition called Machine Culture - The Virtual Frontier for the art show, a self-described survey of interactive art. SIGGRAPH has also launched a dedicated arts portal to "promote a dialogue between visual artists and the larger SIGGRAPH community" (SIGGRAPH, c, online). In 2006 and 2007, SIGGRAPH continues its interest in interactive art with opportunities for interactive art makers to exhibit their work in the Art Gallery, show works in progress and present theoretical or practical papers. SIGGRAPH also

encourages submissions from areas that overlap with computer graphics, such as human-computer interaction[4].

4.2.2 ACM MM

ACM's Multimedia conferences have been held each year since 1993, promoting research into all elements of computing that go beyond the traditional text-dominated documents to include continuous media. Although ACM MM initially focused primarily on technical research and development, in 2003 it broadened its scope to include presentations by interactive artists and a year later included a dedicated interactive arts program. The 2004 Interactive Art Program sought "to bring together the arts and multimedia communities to create the stage to explore, discuss, and push the limits for the advancement of both multimedia technology through the arts, and the arts through multimedia technology" (ACM Multimedia 2004, online).

4.2.3 ACM SIGCHI

The Special Interest Group on Computer-Human Interaction (SIGCHI) conferences have been running, in their current form, since 1982. These conferences offer a snapshot of the current thinking in all forms of Human-Computer Interaction research, bringing together "people working on the design, evaluation, implementation, and study of interactive computing systems for human use" (SIGCHI, online).

Since 2001 this conference has sought out artists to present the results of their experiments with novel interactive experiences, to the extent that it began advertising its call for papers on new media orientated mail lists such as Rhizome's TextBase[5]. The number of artists, technologist collaborators and people studying artistic practice presenting at CHI has increased each year, while in 2003, Sengers and Csikszentmihályi spoke of SIGCHI's goal to "develop a conversation on the potential role of the arts in the HCI community" in response to convergence they

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[4]More on SIGGRAPH submission options, such the *Fusion Works* show in 2006 for works that "combine innovative technology and creative art expression", can be found at http://www.siggraph.org/s2006/ and http://www.siggraph.org/s2007/.

[5]Rhizome's TextBase contains a selection of the conversations, commentary and listings that have appeared in its mailing lists since 1997. It can be accessed, and searched, at: http://rhizome.org/text/.

saw arising between HCI and interactive arts, in their panel *HCI and the Arts: A Conflicted Convergence* (Sengers and Csikszentmihályi, 2003).

In 2005 this convergence took centre stage when the call for papers, posters and workshops for the 'Interactivity' stream of the conference, requested submissions of "compelling user interface technology, metaphors, and applications" in three categories. Those were "Scientific Innovation", "Product, Service, and Industrial Innovation" and "Creative and Artistic Innovation". The last was described as "Compelling new approaches to human-computer interaction from the creative arts. Submissions will be judged on the novelty of the idea, aesthetic and artistic value, applicability to CHI, how interactive they are, and how far they challenge or expand existing notions of human-computer interaction" (CHI 2005, online). Also in that year a fascinating, investigative paper that used, amongst other evidence, a study of interactive art to illuminate the question "how should a spectator experience a user's interaction with a computer?" won best paper in the conference (Reeves et al., 2005). The insights presented in Reeves et al.'s paper are pertinent to, and outcomes applicable by, both new media artists and HCI researchers. This interest continues to the present day, with CHI 2007 hosting a workshop entitled *HCI and New Media: Methodology and Evaluation*[6].

As well as the benchmark CHI conferences, SIGCHI also supports smaller and less frequent niche events such as DIS (Symposium on Designing Interactive Systems) and DUX (Designing For User Experiences) conferences. Over the last five years a number of papers and presentations have appeared in various SIGCHI conferences that directly engage HCI's application to interactive art. The most pertinent of these are discussed in the next two sections.

These conferences are not the only examples of computer science researchers taking advantage of the possibilities offered by the study of interactive art. Interactive arts appear in conferences devoted to virtual and augmented reality systems[7], those that deal with ubiquitous and pervasive computing[8], others for

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[6]CHI 2007 runs from April 28th to May 3rd in San Jose, USA, information at: http://www.chi2007.org/. More information on the workshop at: http://orchid.cs.uiuc.edu/HCIandNewMedia/.

[7]Examples include Virtual Systems and Multimedia (VSMM) and IEEE's Virtual Reality conferences.

gaming and entertainment[9] and still others related to audio systems[10]. The Creativity & Cognition biannual conferences series, that has been running since 1993, is an excellent source of related research, with an emphasis on software tools for creative practice and understanding, and better facilitating artist and technologist collaborations (CC2007, online).

Over the last decade, and particularly since the turn of the century, there has been a surge of interest in applying appropriately selected elements of iterative user-driven design practices in interactive art making, both for the art works themselves and for the wider study of how humans interact with computer systems. Nevertheless, despite this interest, it is by no means the most common approach in interactive arts practice. In many ways the Mixed Reality Laboratory (MRL) at the University of Nottingham, and in particular their collaboration with the interactive performance art group Blast Theory, epitomises this rise. In the following section I will profile the evolution of MRL's research work as it relates to this connection, before providing a survey of other significant research into the convergence of human-computer interaction and interactive art.

4.3 The Mixed Reality Laboratory

Situated in England's East Midlands, the University of Nottingham's Mixed Reality Laboratory is a "dedicated studio facility where computer scientists, psychologists, sociologists, engineers, architects and artists collaborate to explore the potential of ubiquitous, mobile and mixed reality technologies to shape everyday life". The MRL's research is "grounded in a user-centred approach" employing many different techniques from "ethnographic studies to simulator experiments" to explore how new interactive technologies are experienced in the real world (Mixed Reality Laboratory, online). Since its inception in 1999, the MRL has grown into a large research organisation which attracts collaborators from all over the world, myself included. One of the most successful of these relationships is the MRL's ongoing collaboration with Blast Theory.

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[8]Such as UbiComp for ubiquitous computing and the Pervasive conferences series for pervasive computing.

[9]Such as Advanced Computer Entertainment (ACE), the International Workshop on Entertainment and Computational Semiotics for Games and New Media (COSIGN).

Based in Brighton, England, Blast Theory are an internationally renowned artist group engaged with interactive media. Their work "explores interactivity and the relationship between real and virtual space with a particular focus on the social and political aspects of technology" (Blast Theory, c, online). Since 1991 Blast Theory have exhibited their work worldwide, although primarily in Europe and Australia. In 2003 they won the Golden Nica for Interactive Art at Prix Ars Electronica for *Can You See Me Now?,* a collaboration with the MRL[11].

The MRL's early research sought to illuminate various aspects of mixed reality through the application of HCI, with a focus of facilitating interaction in collaborative virtual environments (Koleva et al., 2000, Benford et al., 2000). The researchers at the MRL consistently apply iterative design methodologies, informed by rigorous studies of use and experience, to the projects they develop. One such project is the *Augurscope*, an interactive outdoor mixed reality interface for virtually navigating the, now absent, Nottingham Castle, on the site it once stood. The *Augurscope* has seen a number of iterations, each improved through the study of its predecessors with the goal that it "should be open and inviting to the public. It should be immediately usable by non-expert first-time users with only minimal training" (Schnädelbach et al., 2002).

Leading up to 2000, Blast Theory began collaborating with the Mixed Reality Lab, a relationship which quickly bore fruit in the form of *Desert Rain*. The relationship has subsequently generated a number of internal research initiatives and successful touring art pieces, including *Day of the Figurines*, a study of which appears in this thesis.

In 2001 researchers from the MRL and members of Blast Theory noted that "the increasing use of computer technology to create engaging public experiences in galleries, museums, exploratoria and theme parks raises new challenges for HCI" (Koleva et al., 2001). This relationship enabled the MRL to bring its knowledge of HCI, ethnography and iterative human-centered development to the field of performative interactive art, and produced research relevant to various elements of the HCI, interaction design and interactive arts communities. The following

[10]The Audio Engineering Society Conventions (AES) and the International Conference on Auditory Display (ICAD) are two examples.

[11]This work is examined in some detail in the next section.

subsections will cover key elements of this research through the crucible of two collaborative art projects, *Desert Rain* and *Can You See Me Now?,* before investigating further.

4.3.1   Reflections after the Desert Rain

The *Desert Rain* installation is part performance and part collaborative computer game, in which six viusers are given a mission to find six human targets in a virtual world of deserts, buildings and underground bunkers. In this world, where "Gulf War images echo Hollywood images, where Norman Schwarzkopf blurs into Arnold Schwarzenegger", they have thirty minutes to find their targets and get to the final room (Blast Theory, a, online). The virtual world is displayed via projection onto a personal rain curtain, through which performers and viusers can pass physically. The viusers can help each other, and can communicate via audio head sets, success is measured by everyone finding their target and getting to the final room[12].

When reflecting on *Desert Rain*, the work's authors note that "computers have traditionally been designed as tools to be applied autonomously by users." Where "help and tutorial facilities provide users with a means to learn how to tackle problems by themselves." They clearly feel that this insufficient for the interactive collaborative experiences they are trying to create. Taking up Brenda Laurel's emphasis on action, and therefore experience, over objects, worlds, environs and interfaces in designing computer systems as expressed in *Computers as Theatre* (Laurel, 1993), they feel that the central issue here is "designing the user's experience so that they become engaged with the content rather than with the technology. 'Behind the scenes' activities are required to successfully engage the user and to orchestrate their experience. These have to be hidden from the user's view, so that their engagement with the content is not disrupted" (Koleva et al., 2001). Through testing and revision they were able to do just that.

Desert Rain is a powerful example of iterative design, of testing, revision and, primarily, of articulating the intended experience the artists wish to elicit and then refining their art system until they get it right. For example, in response to early observations of people experiencing *Desert Rain*, Blast Theory altered the orchestration of particular parts of the performance.

> The players no longer removed their anoraks until after the final motel room. Furthermore, the performers carefully planned the order in which to take the players from their cubicles, so that the players spent the minimum possible time together before moving on up the sandhill, and also so that the performers were best positioned to shepherd them on.
>
> This last observation shows the level of detail that has to be considered when planning and executing a performance. This is a key point. The interactions with the players are meticulously planned and repeatedly rehearsed, including dialogue, inflexions, gestures and speed of movement. Potential problems are identified in advance and responses are rehearsed, with a particular focus on how they can be woven into the experience.

(Koleva et al., 2001)

4.3.2 *Can You See Me Now?*

Can You See Me Now? (CYSMN) is a mobile mixed reality game where online viusers are chased around, and caught in, a virtual version of a city that Blast Theory's runners (performers) physically run through. Down on street level, these runners are equipped with handheld computers showing the positions of up to 20 online viusers. The viusers can message each other, and the runners, and a live audio stream, mixed from all the runner's walkie-talkies, is broadcast over the internet allowing the online viusers to hear the runners verbal communication as well as their aural environment[13]. It was first staged over three days in November/December 2001, in Sheffield, as part of the BBC's Shooting Live Artists (BBC, 2002).

CYSMN is an excellent example of iterative development informed by, in this case, a series of ethnographic studies of viusers' experience of the work. CYSMN has been performed nine times since 2001 around Europe, North America and Japan. An interested reader can track the results of these studies and subsequent changes to the design of the interface, the runners' equipment and the gameplay experience through a series of publications.

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[12]For detailed information on how the work was developed and displayed, and the creator's motivations, see (Blast Theory, a, online and Koleva et al., 2001).

[13]For detailed information on how the work was developed and displayed, and the creator's motivations, (see Blast Theory, d, online and Benford et al., 2005b).

For SIGCHI 2003 Flintham et al. wrote *Where on-line meets on-the-streets* which focused, in relation to CYSMN, on GPS[14] problems and how to deal with and avoid them, game play and reliability, the online interface and the importance of a contextualising audio stream. In 2004 Crabtree et al. wrote *Orchestrating a mixed reality game 'on the ground'* exploring the decentralisation of the orchestration of mixed reality experiences through an ethnographic study of *Can You See Me Now?* (Crabtree et al., 2004). In 2005 Benford et al. published a paper that observed the various successes obtained in the implementing changes, some major some minor, to many facets of the work, that were suggested during the previous studies (Benford et al., 2005b).

Can You See Me Now? has benefited greatly from its continued commission, allowing the creators the opportunity — one that many one-off or site-specific interactive artworks would not receive — to refine and perfect the experience. It also benefited from the testing and iterative development employed before the first curtain opened.

4.3.3 Technology in the wild

> ...our general experience is that games are particularly appropriate applications for researching how people experience emerging technologies because they offer an open and flexible design space where researchers can test a variety of scenarios (both collaborative and competitive) and yet can be relatively easily and safely fielded to the public at events such as new media festivals, bringing end-users into contact with new technologies in a way that might not be so easy in commercially sensitive or safety-critical environments.

> (Benford et al., 2005b)

Researchers at the Mixed Reality Laboratory are in no doubt about the possibilities offered by interactive art as a site for their continuing research. In some cases this results in discursive studies of particular works, including investigations of any generalisable outcomes. An example of this is the study of *Uncle Roy All Around You*, another collaboration with Blast Theory, where the team produced a professional touring work that also "served as a research project, being studied through a combination of ethnography, audience feedback and analysis of system

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[14]CYSMN used global positioning service (GPS) to track its runners; GPS is notoriously troublesome when used in built up areas like cities.

logs in order to provide insights into experience design and technology development" (Benford et al., 2004). In other cases a wider scope is explored, such as design strategies developed in Reeves et al.'s *Designing the Spectator Experience* or a design framework constructed in response to four recent trends in HCI by Benford et al. in *Expected, sensed, and desired: A framework for designing sensing-based interaction*.

In a 2005 summary of the collaboration between the Mixed Reality Laboratory and Blast Theory for the ACM journal *Interactions*, Professor Steven Benford, one of the MRL's directors, wrote:

> The overall goals of this work have been to create professional touring products that demonstrate the potential of emerging technologies to establish new kinds of performance while also enabling researchers to study these technologies "in the wild" in order to identify new challenges for interaction design.
>
> (Benford, 2005)

4.4 A conflicted convergence

In the few years since the turn of the century a number of artists, computer scientists and art/science collaborators have begun to publish the results of their explorations of what Höök, Sengers, and Andersson describe as the "conflicted convergence developing between human-computer interaction and interactive art" (Höök et al., 2003). This research is aided and abetted by a number of institutions, primarily in the tertiary education sector, that actively explore this convergence, such as the Creativity and Cognition Studios in Australia[15], the Interactive Institute in Europe[16] or studio416 in North America[17]. In addition there are numerous institutions, events and individuals interested in the more general intersection of computer science and

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[15]This group focuses understanding and facilitating digital media and arts practice. It is based at the University of Technology, Sydney. See website for details: http://www.creativityandcognition.com/.

[16]II's research combines art, design and technology. It is based in Stockholm, Sweden. See website for details: http://w3.tii.se/en/.

[17]A collaboration between the School of Art and Human Computer Interaction Institute at Carnegie Mellon University, Pittsburgh, USA. See website for details: http://studio416.cfa.cmu.edu/.

the arts, such as the iCinema Centre for Interactive Cinema Research[18], and many more under the enormous umbrella labelled "art & technology".

4.4.1 Sense and sensibility

In her influential research with Kristina Höök and Gerd Andersson, Phoebe Sengers has explored the use of HCI techniques to enhance the usability, and therefore success, of interactive artworks. They define success as improving the effectiveness of communicating the artist's message or creating a more affective interface. In the paper *Sense and Sensibility: Evaluation and Interactive Art* they describe the laboratory testing of an artwork, the *Influencing Machine*, where HCI goals and techniques are adapted in order to inform the design of the interactive work, to achieve a more "successful" artwork.

> It would be ludicrous for us to suggest replacing art criticism with HCI evaluation, and we will not answer the question "is this good art?" But we will show that, suitably adapted, user testing can help fine-tune the interaction design of interactive artwork, helping artists to get their message across. In the process, we also hope to show how the perspective of artists can help HCI evaluation by suggesting some new aspects of the relationships between system builders, users, and evaluators.
>
> (Höök et al., 2003)

While there is ample evidence, both in this thesis and in the wider research community, of the possibilities afforded to Computer Science in general, and HCI in particular, when used with interactive artworks to learn about the nature of interaction, Höök et al. are at pains to provide evidence of the rewards to art makers of applying HCI techniques to art. It is important to note that they maintain the HCI is not a prescriptive handbook for interactive art development, and that they do not "want to force the arts into following HCI principles". Further they acknowledge that this process…

> will not be appropriate for all artworks… Instead, we want to develop an understanding of some of the ways in which HCI and art can productively come together. Here, we are interested in how to adapt usability

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[18]The iCinema Centre, of which I am a member, is a joint venture between the University of New South Wales' Computer Science and Arts schools. See website for details: http://icinema.cofa.unsw.edu.au/.

techniques, goals, and methods in order to be more compatible with the goals of artists.

(Höök et al., 2003)

4.4.2 The Syren's call

Ideally, in a classically 'usable' system, the technology should also provide feedback that the input has been successfully interpreted and some perceivable information about the available options for further action. When the interface with the technology is the room itself, then the options for further action need to be part of the design of the room.

(Robertson et al., 2004)

Robertson, Mansfield and Loke, in *Human-Centred Design Issues for Immersive Media Spaces*, are also in search of ways to use HCI techniques to evaluate interactive art, but they go further to suggest that audience experience evaluation should be a formal part of developing interactive artworks. They place their iterative user-centered development of the interactive multimedia artwork *BYSTANDER* directly in the context of HCI, its techniques, histories and traditions. By doing so they tease out some of the issues that are of central importance to this thesis, namely the how and why of applying HCI and human-centered design principles to the development of interactive art pieces.

Our two core concerns in this project are, firstly, how we as technologists concerned with human-centered design might best assist with the design of immersive, media spaces such as *BYSTANDER* and, secondly, how our design tools and techniques need to be extended to make them useful and usable in these design contexts.

(Robertson et al., 2004)

The benefits of using iterative user-centered design during art development are not limited to the experience of the work, as evidenced by Woo, Mariette, Helyer, and Rizos's reflections in a scientific journal of the Synapse funded[19], augmented audio reality installation *Syren*, which was exhibited at ISEA 2004[20]. Running over three days, *Syren* used a 12-channel speaker array to provide a spatial audio experience that augmented the landscape of the Baltic archipelago as the conference's cruise

[19]Synapse is a Art/Science funding initiative under the auspices of the Australian Research Council Linkage Grant Industry Partnerships. See the Australia Council for the Arts website for further details: http://www.ozco.gov.au/.

[20]The 12th International Symposium on Electronic Art held in August 2004, in the Baltic Sea.

ship navigated through it. During *Syren's* collaborative development, between sound artist Nigel Helyer, user interface design and usability expert Daniel Woo and GPS and spatial information systems specialist Chris Rizos, their emphasis on user-centered design helped focus their "attention to the needs of the audio artist and assisted in the development of reusable tools, rather than a one-off exhibit" (Woo et al., 2004). This is especially important for ongoing projects or investigations, such as this project, where a version of the installation can act a prototype system. *Syren* was constructed with open and configurable elements which allowed tinkering and experimentation during the developmental stages. This construction also enabled live, and sometimes hurried, alteration of the system and underlying audio database, which proved essential when the ship docked in an unexpected area of Stockholm during the show.

> Artist involvement early in the development phase and throughout was a key factor to produce a highly productive editing environment. The approach that artists take when exploring tools can be highly creative and lateral in ways that engineers would not have readily foreseen, hence pushing the boundaries of possibility.
>
> (Woo et al., 2004)

4.4.3 Ubiquitous interaction

> We live between two realms: our physical environment and cyberspace. Despite our dual citizenship, the absence of seamless couplings between these parallel existences leaves a great divide between the worlds of bits and atoms. At the present, we are torn between these parallel but disjoint spaces.
>
> (Ishii and Ullmer, 1997)

Current changes taking place in our perception and use of interactive technologies include a shift from single user to multiple users, from users to viusers, from desktop metaphors to mobile and ubiquitous computing, and from interface to interaction. Interactive environments and systems are fast becoming social communication networks. This emerging area is of great interest to many artists, including Sommerer & Mignonneau, The Millefiore Effect, Blast Theory and Rafael Lozano-Hemmer[21].

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[21]Sommerer & Mignonneau have engaged with the social aspects of interaction in their work for a considerable time, prime examples are *Mobile Feelings I and II* and *NanoScape*. The Millfiore Effect exhibited *FRONT* at ISEA 2004, *FRONT* consists of two lightweight wearable

Ubiquitous computing, where computation is integrated into the environment, encompasses many technologies, ideas and names. For reasons of coherency and readability the term "ubiquitous computing" will be used (where some might write pervasive computing, calm technology or "everyware") and will include wearable, tangible and context-aware computing. Since Mark Weiser first outlined his vision of ubiquitous computing in 1991[22], it has become an increasingly popular area of research and development, in universities and commercial institutions alike. In many cases this research takes HCI and the arts as initial points of reference.

Ishii and Ullmer's influential work on human-computer interaction using tangible interface technology, or "Tangible Bits", examines commercial blue-sky research and artistic tangible interactive interfaces to reveal what they see as three key concepts; interactive surfaces, coupling computation with graspable physical objects and ambient media for background awareness (Ishii and Ullmer, 1997). Other researchers stress the importance of maintaining, adapting and applying the knowledge that has been painstakingly collected by the HCI community when designing new interactive technologies or devices (Bellotti and Rodden, 2000; Norman, 2002; Bellotti et al., 2002, for example). Jennings argues convincingly that this advice is particularly pertinent to interactive art makers in her study of the *Constructed Narratives* project (Jennings, 2005).

Developed in a collaboration between the School of Art and the Human Computer Interaction Institute at the Carnegie Mellon University, Pittsburgh, USA, the goal of the *Constructed Narratives* project was to develop a framework for designing social interfaces, with a focus on "intersubjective" public space. To do so the team created an interactive artwork *Constructed Narratives*, which took the form of a technologically advanced block-based construction game, designed in many ways like a child's construction toy. Jennings notes that many new media art projects have "synergistic if not parallel concerns as human computer interaction research concerned with social networking, social navigation, experience design and design and emotion", but that new media can critique, as well as celebrate, the "great

suits that contain voice activated inflatable air sacs. Blast Theory's work is covered earlier in this chapter. Lozano-Hemmer's usually architectural and sculptural work is supplemented by *Under Scan*, a large-scale interactive public art project (Lozano-Hemmer, 2000).

[22]Mark Weiser twice worked at Xerox Parc, in 1991 he published *The Computer for the 21st Century*, in which he set out a view of computing and HCI where machines fit the human environment, instead of making humans fit theirs.

accomplishments of new technologies and the information age" (Jennings, 2005). This study is useful because it includes reflections on how the design and development team was selected, how design decisions were made, the iterative, evolutionary development process that was used and how the project's stakeholders, with quintessentially different skills and assignments, communicated and collaborated.

Building and studying interactive artworks gives HCI researchers and art practitioners the ability to study novel interactive technology, such as those used in ubiquitous computing, outside the laboratory. For artists, in cases such as Sheridan et al.'s work in "playful arenas" (Sheridan et al., 2004) or Blast Theory's work in the city streets, ubiquitous computing allows them to work outside the gallery or museum. Here we must let Graham reminds us that the experience of interactive art is seldom as individualistic as artists might expect (Graham, 1997).

This "conflicted convergence" is not limited a single viewer standing at a computer on a plinth in a museum, it stretches to all aspects of computational interactive art practice — at a dance club, running through a crowded city centre, in an airport waiting lounge, on a Baltic cruise ship, in a deserted factory, on the ruins of an old castle or in a research laboratory.

4.5 Collaborative creativity

> The current direction in digital art involves a significant increase in the role of interaction and innovative user interface technologies. Most interesting, in many ways, for the interactive systems community is the modes of interaction being employed, such as movement in a space or the making of physical gestures… For today's artist, innovations in such modes of interaction, and in ways of defining and implementing engaging behaviors, is a central concern. Collaboration between artists and technologists offers a very interesting development path for user interfaces.
>
> (Edmonds et al., 2004)

The intersection of computer science's and interactive art's interests is clearly not limited to those that use HCI techniques to influence how their works are designed, developed and finally experienced. Unlike most designers, artists are able to focus on one instance, often in a controlled space. For the same reason many things artists do in their single situated space are not comparable to mass distributed design products or software. Nevertheless, computer scientists have successfully

studied computer-mediated interactive art with specific motivations, such as to influence design (Benford et al., 2003; Rogers and Muller, 2003; Crabtree, 2004b; Smith and Hagen, 2004), to reveal problems with existing technology (Benford et al., 2004; Flintham et al., 2003) or to learn more about the creative process itself.

The creative process in its various forms has been studied for over two thousand years. In the most contemporary sense this continuing and evolving examination is evidenced by the wide-ranging submissions to the Creativity & Cognition conference series. Of particular interest here are those who in their study of new media art practice focus specifically on the collaborative development of computer-mediated interactive art systems. One such group is the Creativity & Cognition Studios (CCS) at the University of Technology, Sydney. CCS is a self-styled "interdisciplinary research organisation comprising artists, technologists, curators, sociologists and everything inbetween", which developed from the CoStART[23] artist-in-residency program at Loughborough University, in the UK (CCS, a, online). Amongst other initiatives CCS runs *Beta_space* at Sydney's Powerhouse Museum, where works, at different stages of development, are displayed and observed so that "engagement with the public can provide critical information for further iterations of the art work or of the research" (CCS, b, online). A clear description of *Beta_space*, placed in the context of an exhibition acting as a living laboratory for creating and curating interactive art, appears in Muller, Edmonds, and Connell (2006a).

The main focus of CCS's research is to understand and improve artist/technologist collaborations and the precise nature of what kind of environments, technological and methodological, best support the development of digital art. An example of this research focus is Weakley, Johnston, Edmonds, and Turner's study of the use of the graphical programming environment *Max/MSP* in, what they call, "close collaborations". As well as providing a boundary object to help communication between collaborators, a *Max/MSP* program can be considered a working sketch that can evolve by way of alterations made by artist and technologist alike (Weakley et al., 2005).

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[23]The CoStART project took place from 1998 to 2003 and consisted of a series of studies of digital art making, in which evaluation of public interaction with the developing works played an important, and rewarding, role (Edmonds et al., 2005).

Greg Turner is his Ph.D. thesis *Supportive Methodology and Technology for Creating Interactive Art* takes this idea further, persuasively arguing that, where appropriate, technologists should go the extra mile and create "toys" that expose all possible parameters of the art system, instead of building an initial version of a system according to their perception of the artist's specifications and then making future alterations as the artist requests changes. This suggested methodology is at the opposite end of the development process spectrum from traditional "waterfall" software design. Further, it allows the artist to "play" with the system (Turner, 2006). These "toys" can act as prototypes, to be tested by the artist according to their own requirements and, importantly, they offer a perfect platform for testing the work with the public, as is the case with *Cardiomorphologies*, a collaboration between George Khut, Greg Turner and Lizzie Muller.

4.5.1 *Cardiomorphologies*

In *Interactive art and embodied enquiry: working with audience experience* Khut presents an exploration of the HCI and design methods espoused by the experience-centered design community[24] from his own perspective as a contemporary arts practitioner, during the development of *Cardiomorphologies* (Khut, 2006). *Cardiomorphologies* is an interactive "biofeedback artwork" that uses non-intrusive sensors to collect breath and heart rate information, which in turn controls a "large video projection consisting of a series of halo-like concentric circles that pulsate and blush in time with their own breathing and heart rate patterns", enabling viusers to "explore aspects of their own psychophysiology" (Khut, online).

To develop *Cardiomorphologies*, Khut set out six clear experiential goals and, in collaboration with curator Lizzie Muller and interaction designer Greg Turner, utilised various tools (such as Video-Cued Recall, Personas & Scenarios and Future Workshop, (as explained in Muller et al., 2006b)) to enable the work to manifest them within the audience. Crucially they saw the "development of *Cardiomorphologies* as a case study of the application of the methods [they had] adopted from HCI as a means of creating interactive art experiences that involve novel and highly specialised forms of audience participation" (Khut and Muller, 2005).

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[24]In this case Khut uses the work of Rosalind Picard (1997), Paul Dourish (2001), Press and Cooper (2003) and Forlizzi and Battarbee (2004) as starting points.

The team's success was achieved through rigorous testing of different versions, and iterations within the versions, of the work. Khut acknowledges, even celebrates, the fact that the experience of an artwork changes when the one is being observed, as is frequently the case in the experience (or "co-experience") of art in a gallery, and that this is further pronounced when the audience was interviewed on camera afterwards. This is not seen as a deficiency, rather he hopes that the frameworks and methods he presents will offer a means for "artists engaged in these kinds of critical and research-focused interactive practices to gain a closer understanding of the experience-centred processes and conditions at the heart of their work" (Khut, 2006).

4.6 Joining the conversation

> It's very important for us not only to show our work at art festivals, museums and galleries but also to try to contribute to the research community, for example in HCI or telecommunications research. Not only in terms of inventing new technologies or interfaces but also through inventing systems that have a slightly critical or unusual angle on technology. Scientists often have fantastic brains but they don't always see the social relevance of what they do, so I think it is very important that artists are there to look at technology from a more social or cultural point of view.
>
> (Sommerer, 2004).

Interest in, and conversation about, the potentials of using HCI techniques in the context of computer-mediated interactive art, as well as precise nature of their implementation, is no longer limited to computer science conferences or particular research groups. Since the turn of the century literary references have increasing appeared in various media including blogs (such as *we make money not art* (Debatty, online) and *pasta and vinegar* (Nova, online)), mailing lists (such as *Rhizome* (Scholz, online) and *CRUMB* (Graham, online)) and online journals (*artificial.dk* (Sørensen, online) and *Leonardo On-Line: Art, Science and Technology* for example). Practical examples emerge in galleries and museums, artists' practice and, very recently, conferences that explicitly engage this thesis' central themes. Although this discussion is not amount to a torrent, it should not be dismissed as a trickle.

4.6.1 Walking the walk

The experience of art is complicated and multifarious, it is subjective and deeply contextual, but is it, without doubt, an act of engagement, of interaction. In traditional art making this interaction is usually psychological, however in computer-mediated interactive art this interaction can be manifestly physical, changing the very art work itself. In this exchange the experience of the work becomes, in effect, the art object. Artists and researchers alike have begun to treat the experience of the interaction with their work as something that can be refined, evolved, tested and, some hope, perfected. To do this they are searching out the techniques, technologies, methodologies and practitioners that are already well-versed in this experiential vocabulary. For some, their artistic process is changing.

Increasing nymbers of artists are showing a willingness to explore the possibilities afforded by applying human-computer interaction techniques and methodologies to their art practice. Some artists discussed in this review have been doing this for a number of years with their works, such as Blast Theory's *Desert Rain*, *Can You See Me Now?* and, more recently, *Day of the Figurines*. Many of the artists whose work is covered in this thesis have benefited from close ties with tertiary education institutions. Yet the agreeable environment of a university research institute is not the only place such artists can be found, they are also in studios, artist residencies and drafty warehouses around the world.

In the very recent past, this flow of interest has extended from HCI's ability to influence the artistic developmental process, to influencing the conceptual motivation of artworks themselves. An example of this is *Icon==Function*, by Josh Nimoy, a new media artist "with an interest in electronic engineering"(Nimoy, online). This work was commissioned by the forward thinking Foundation for Art & Creative Technology (FACT) for their HCI-FUN project, subtitled "Artists on Usability". HCI-FUN included open workshops and an exhibition, at the FACT Centre's galleries and Media Lounge in Liverpool, UK, that ran from 30th March to 27th May 2006. Nimoy and two other artists were "commissioned to propose experiments, based on scientific principles of human-computer interaction that analyse how a variety of different users, from different backgrounds and levels of experience, interact with computers" (FACT, online).

4.6.2 Talking the talk

> The experience of the audience is at the heart of interaction and, in particular, interactive art. Computer-based interactive artworks come into being and exist in their full form when they are used. They cannot be understood only as objects, but must be thought of as time-based experiences, or periods of engagement. There is an increasing interest from practitioners and researchers in the field of interactive art in learning more about audience experience from theoretical, empirical and applied perspectives[25].
>
> (Edmonds and Muller, 2006)

Most of the practical and procedural reflections of artists and researchers that have already appeared in this thesis, and many of those omitted, were not found in traditional computer science conference proceedings or arts publications. Over the last five years a number of smaller events have emerged that operate between these two poles, gatherings that directly address elements of the central focus of this thesis, namely why and how should iterative user-centered design practices be applied to the development of computer-mediated interactive art. I will briefly look at two in particular: *Interaction: Systems, Practice and Theory*, (Sydney, 2004), and *Engage: Interaction, Art and Audience Experience*, (Sydney, 2006).

Interaction

Drawing on "digital art practice, computer game developments, human-computer interaction as well as social and cultural theory", *Interaction: Systems, Practice and Theory* focused on the "emergence of art, communication, information and entertainment systems using interactive environments and media in museum, gallery and other public spaces" (Edmonds and Gibson, 2004). The conference featured keynotes from Sidney Fels[26] and Christa Sommerer[27], both of whom have

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[25] This quotation comes from the "Forward" that opens the proceedings of the 2006 conference *Engage: Interaction, Art and Audience Experience*.

[26]Fels is a digital artist and is the head of the Human Communication Technologies Research Lab at the University of British Columbia, Canada.

[27]Sommerer heads the InterfaceCulture Lab, Institute for Media, University of Art and Design, Linz, Austria, in partnership with Laurent Mignonneau. Together they are world renowned media artists who focus on interactive computational installations.

published widely on technology or science and art[28]. Presentations, as well as demonstrations, covered topics ranging from the use of physics in mixed reality installations (Berry et al., 2004) to experiments in interactive sound synthesis (Martin, 2004), as well as my own research, with Penny Hagen, into how "thick" user-content relationships in art can inform the development of everyday systems (Smith and Hagen, 2004).

Engage

Engage: Interaction, Art and Audience Experience sought to explore, amongst related ideas, the audience experience of interactive art to shed light on experience of interaction in a more general sense. The conference called for papers from four areas; artist led and practice based research, curatorial and museological approaches, art historical and theoretical approaches and, most relevantly here, the intersection of HCI and interactive art. In her summary of the conference's offerings Lizzie Muller notes the special emphasis placed on the reflections of practising artists, such as Davies, Davis, Moss and Gonsalves[29], who describe their various endeavours to induce particular effects or emotions in the experience of their audience (Muller, 2006). Also favoured were researchers and artists who use HCI's "user-centered' tools and techniques as production and evaluation methodologies for interactive artworks, such as Mariette, Paine and the already mentioned Khut[30].

4.7 Don't sweat the technique

The aim of research, according to this approach, is not to produce formal models of knowledge and action, but to explore the relation of knowledge and action to the particular circumstances in which knowing and acting

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28Here I am thinking in particular about the book *Art @ Science*, edited by Sommerer and Mignonneau, and Fels' work on the implications for art and technology from embodiment in interactive art in Fels, 2000, amongst their other related writings.

[29]See *Engage* conference proceedings for; *Frolicking with Phantoms: Illusion in Mixed Reality* by Alex Davies, *Creating a social anxiety interface in the artwork 'In the house of shouters...'* by Anna Davis, *The reflective practitioner: in creation of a presence based experience* by Sarah Moss and *An exploration into deeper engagements of audience and creative process* by Tina Gonsalves.

[30]See *Engage* conference proceedings for; *Perceptual Evaluation of Spatial Audio for "Audio Nomad" Augmented Reality Artworks* by Nick Mariette, *The Thummer Mapping Project - ThuMP* by Garth Paine and *Interactive Art as embodied inquiry: working with audience experience* by George Khut.

> invariably occur. This alternative approach requires... a renewed commitment to grounding theories of action in empirical evidence: that is, to building generalisations inductively from records of particular, naturally occurring activities, and maintaining the theory's accountability to that evidence.

(Suchman, 1987, page 179)

This review of the literature is not, and should not be, a methodological investigation of all possible HCI techniques that have been applied to creation of interactive artworks. Nonetheless it has noted some of the more useful examples of specific artistic implementation. Direct, in-depth investigations of three works, including their developmental processes, appear in the coming chapters.

Plans and Situated Actions, Lucy Suchman's promotion of ethnography in order to ground theories of action and interaction in empirical evidence gathered through studies of situated experience, has echoes in contemporary research. Applying ethnography, one of the "oldest methods in the social research armory", to the study and understanding of interaction with art is becoming increasing popular. Benford et al. use it in their study of the artwork *Can You See Me Now?* as it is a "natural observational method that seeks to provide rich descriptions of human activity and, in a design context, of technology use" (Benford et al., 2005b). Crabtree argues that it is especially useful when studying new technologies *in situ*. He remarks that some technologies that artists want to engage with do not have a body of practice associated with them, a fact that could be the precise thing that initially attracts an artist to such technology. In these cases, experimentation and iteration within the work are paramount to ensure the intended experience of the work (Crabtree, 2004b). Other examples of ethnography, or even "technomethodology" (Crabtree, 2004a), used to illuminate interactive art projects by the Mixed Reality Laboratory team include (Koleva et al., 2001), (Flintham et al., 2003) and (Benford et al., 2004).

A focus on qualitative experience is common in research where the emphasis is on user-centered or experience-centered design or on experiential evaluation. Höök et al. report on, and crucially compare, the experience of different versions of the interactive installation the *Influencing Machine*, as revealed in post-experience interviews (Höök et al., 2003). Forlizzi and Battarbee also stress an experience-focused approach in their popular framework for designing products and systems, where the user's experience of their interaction with the product, as well as those around them, is kept firmly in mind (Forlizzi and Battarbee, 2004). Hansen uses a study of an artwork and a design proposal to argue that understanding the

relationship between viuser and artefact is key to developing interactive artefacts that can provide seductive, fun and interesting experiences (Hansen, 2005). Sykes and Patterson importantly stress the need to acknowledge the user, or in this case the player, in the design of video games, after they found that very few game designers consider the game's intended target audience during the design process, instead creating games for their own amusement (Sykes and Patterson, 2004)[31]. Video game designers are not immune for the common creative affliction of designing interactive systems for one's own enjoyment, based on one's own expectations and experience, with little focus on, or even acknowledgement of, the persons who actually experience the finished work.

The study of novel interaction situations provides fertile ground for those producing frameworks and strategies for other designers (such as, Reeves et al., 2005; Benford et al., 2005f). Delving into the under-explored world of wearable computing in the arts, especially in "playful arenas" like nightclubs, Sheridan et al. have developed a framework for designing public performances. They justifiably use and promote the Performance Trial model, which was developed during their research into human-computer interaction in digital performance, to explore the potential relationships between performers and spectators, through a study of their interactive artwork *Schizophrenic Cyborg* (Sheridan et al., 2004).

Other methods available in human-computer interaction research that have been developed for, or used in, aiding understanding of the experience of interactive artworks include Personas & Scenarios (Kan et al., 2005b), Video-Cued Recall (Costello et al., 2005) and Future Workshop (Muller et al., 2006b). Some of these are utilised in works covered earlier in this part, namely *BYSTANDER* and *Cardiomorphologies*.

When taken together, these initiatives offer a potent arsenal of investigative techniques, but they are most useful when selectively applied during the development process, in concert with the needs and peculiarities of each particular work. What is consistent across all of these methods, apart from their growing

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[31]Sykes and Patterson and other authors promote player-centered design, essentially a brand of UCD tailored for the gaming industry, through publications (eg Jegers and Wiberg, 2006a; Ballagas and Walz, 2007) and workshops, such as the Player-Centered Game Design workshop at the 2004 CHI conference.

acceptance and measured success, is an emphasis on iterative development informed by situated, human-centered, feedback.

4.8 Conclusion

I support Ross Gibson's prediction of a future where "artists won't be fabricating *objects* so much as *experiences*" (Gibson, 2003, original emphasis). Although artists have been creating experiences as well as objects for generations, contemporary computer technology provides particular conditions for such experiences to manifest themselves. I believe that artists who fully engage with the viusers who experience their works, those who acknowledge, study and respond to their audiences, will be the ones who will create works with the most affect.

I find little practical potential in the concept of artist-as-auteur, as proposed by Lev Manovich, or contemporary versions of traditional notions of artist-as-genius exemplified by artists such as Damien Hirst. Much more promising is the idea of artist-as-collaborator. Throughout this review I have highlighted theorists, researchers and practitioners whose actions and words celebrate the viusers' experience as part of the creative, collaborative development process they undertake when making computer-mediated interactive artworks. This is work on which I will build.

These propositions will be tested in the case studies that constitute the main body of this thesis. Each work utilised a different production methodology and provided a distinctly different experience to its viusers. The two major case studies – *Conversations* and *Day of the Figurines* – are, arguably, significant works within the admittedly brief history of interactive new media art. Because they were developed within similar situations, the grounds for comparison between them are clear. Furthermore, no one else was a collaborative partner in both; this has provided me with a unique opportunity for investigation and review.

Chapter 5: Study 1: Biloela Girls

5.1 Introduction

Cockatoo Island has, for me, a familiar face. I grew up in an adjacent suburb; the playground of my primary school looks out over the southern shore of this eighteen hectare island in Sydney Harbour. In 2005 I was invited to produce an installation for the inaugural *Cockatoo Island Festival* (CIF), which was held during the Easter holiday of that year[1]. Because CIF was an all-ages rock festival, in a location with considerable historical significance to the Sydney public, the audience expected by the organisers was quite different to the traditional museum or gallery attendee.

After visiting the island and researching its history, I decided to create something with echoes of its past. Since European settlement in 1788, Cockatoo Island has been mostly used for shipbuilding and repair, but it has also been used, beginning in 1839, as a convict prison, a home for wayward teenage boys, a gaol, as a Customs' quarantine area and as the Biloela Public Industrial School and Reformatory for Girls. It was the last that most interested me.

In an attempt to surprise and intrigue, as well as to promote reflection and conversation on the history of island, I developed an ethereal video work in which a girl from the distant past runs, intermittently, across the inside of a set of windows that face a common lane-way on the island. She runs from dusk to dawn, backwards and forwards, over the same ground.

I include a study of this project in this thesis in order to provide a small-scale example of how the application of iterative human-centered design principles is possible, and can be beneficial, for any digital artwork that is motivated by viuser

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[1]*Cockatoo Island Festival* was presented by MixedIndustry and the Sydney Harbour Trust March 24th to 27th 2005 (http://www.cockatooisland.net/home/).

experience. In the case of *Biloela Girls*, these principles are utilised by a non-interactive, site-specific, one-off artwork.

5.2 History of the site

> As a prison, Cockatoo Island was not a nice place. Prisoners of all kinds were crowded together in inadequate accommodation. The solitary confinement cells were frequently occupied. And one of the cells was so small its occupant could only stand.
>
> (Jeremy, 2005)

By all accounts the island was always a rather inhospitable place. According to Cockatoo Island historian John Jeremy there was no evidence of Aboriginal use of the island prior to its inception as a Colonial gaol in 1839. The first permanent European residents were convicts, who were immediately drafted into building themselves a prison and providing for future life on the island by digging a well and clearing the land. In deplorable conditions they then built the first of the island's various docks and shipyards. The conditions were so poor that, at night, the guards had to be protected in a newly constructed guardhouse, built to keep them safe from convict attack. These conditions prompted official calls for a public enquiry into the way the island was run. Finally, in 1858, a Board of Enquiry was created to examine the management of the Cockatoo Island Penal Establishment. Despite the report's harsh criticism it took more than ten years (1869) before the break-up of the Penal Establishment was approved and the prisoners were relocated to Darlinghurst[2].

After the prisoners were removed from the island it was turned into an industrial school for girls, with a separate reformatory for young female offenders. The island also briefly got a new name, 'Biloela' (the local Aboriginal word for Cockatoo), in an attempt to ameliorate its convict prison past, but the island itself did not receive a make over. A short time later it received a further boost to its population when the sailing ship *Vernon*, purchased by the government for conversion for use as a training ship for wayward and orphaned teenage boys, was moored on the eastern shore. The reformatory and industrial school were separated from the rest of the island by a corrugated iron fence, although, as the conditions once more deteriorated, contact between the imprisoned girls and the wayward boys was inevitable…

> Three girls came down abreast of the ship, in a semi nude state, throwing stones at the windows of the workshops — blaspheming dreadfully and conducting themselves more like fiends than human beings. I was compelled to send our boys onto the lower deck to prevent them viewing such a contaminatory exhibition.
>
> I. V. S. Mein, superintendent of the Vernon school, October 1871[3].

Although it was quickly and clearly apparent that the island was inappropriate for housing already troubled young girls, it was not fully closed for another 20 years. The Reformatory was closed in 1880 and the girls moved to the Shaftesbury Reformatory, South Head, New South Wales. The Industrial School stayed on the island until 1887/8, when it was closed and relocated to an old school site in Parramatta where it stayed, in various guises, until 1975 (NSW Government, online).

After the removal of the twin girls' schools, the island was quickly redrafted as a prison to ease overcrowding at the Darlinghurst Gaol. It remained as such until 1908 when Cockatoo Island's convict days were finally put to rest.

For the majority of the remainder of Cockatoo's active life it was as a dockyard used for shipbuilding, repair and refitting. This is a legacy that has left the island's docks dangerous to human contact. Between 1857 and 1992 more than 12,000 vessels were docked for repair or maintenance and it was, for a short time during the Second World War, the main ship repair base in the South Pacific (Jeremy, 2005).

There is little or no mention of indigenous connection to the island in the official histories. This is despite the establishment of a satellite branch of the Aboriginal Tent Embassy on the island from 20th November 2000 to 12th March 2001 (Connolly, 2000).

In 2001 the Commonwealth Government handed the Sydney Harbour Trust control and management of the island, the largest of eight in Sydney Harbour. The Harbour

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[2]The details presented here we compiled from a series of publications (Parker, 1977; Kerr, 1984; Jeremy, 2005).

[3]This quotation is taken from a letter to the New South Wales Principal Under Secretary. Originally cited in *Cockatoo Island: Sydney's Historic Dockyard* (Jeremy, 2005).

Trust initiated the *Cockatoo Island Festival* after spending millions rehabilitating the island, and has plans to give it a slightly brighter future[4].

5.3 *Biloela Girls*

> As in the convict era, treatment of girls comprised a mixture of sublime indifference to their personal welfare and prurient interest in their sexuality. At the New South Wales Industrial School and Reformatory, at first located in old military barracks at Newcastle, girls rioting there were said to have exposed themselves naked at the windows and from the top of the building. Unlike boys, they were likely to have been removed from the street not for mischief or petty theft but for being in 'moral danger' and once 'fallen', it continued to be assumed, their sexuality was out of control. In 1871, the school was removed to Cockatoo Island, thoughtfully renamed to Biloela to remove any convict memories associated with the site. But here, too, the girls seemed determined to regress towards the convict stereotype, singing 'improper songs', it was alleged, and indulging in 'disgusting sexual practices'. Punishments were extreme. A New South Wales Commission of Public Charities visiting Biloela in 1872 found that rioting inmates had been 'beaten, kicked and dragged by the hair'. Eight girls were found locked in a small room without adequate clothes, bedding and toilet facilities and in absolute darkness. They had been there for days and seemed 'half-crazed'.
>
> <div align="right">(Kociumbas, 1997)</div>

Of the varied histories of Cockatoo Island, the one that stayed with me was that of the troubled teenage girls and their treatment. Not only how they were treated on the island, but how girls and boys through Australia's history had, on occasion, been treated in care and how we, as a society, deal with and remember those who suffered. This path of investigation led, via accounts from the time and even some of the place, to organisations such as the Care Leavers of Australia Network (CLAN). CLAN is a self-funded support network for those who have, in their past, lived in care, in some cases in institutions such as Biloela.

Through petitioning, CLAN and others were largely responsible for the Australian Federal Government's Senate Inquiry into Children in Institutional Care, the report from which was, influentially for this work, entitled *Forgotten Australians*. To remember the "students" from Biloela's Industrial School and Reformatory, the work was named *Biloela Girls*.

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[4]Further details about the Trust and its plans for the island can be found at:

> The Committee considers that there has been wide scale unsafe, improper and unlawful care of children, a failure of duty of care, and serious and repeated breaches of statutory obligations.
>
> The Committee further considers that many comments in recent years by governments, churches and care providers reveal a complete lack of understanding of or acceptance of responsibility for the level of neglect, abuse and assault that occurred in their institutions.
>
> (Commonwealth of Australia, 2004)

A need to regain their past, to have it dealt with and acknowledged, drove some people to demand an enquiry which required, of them, to recall their diverse ordeals. This need also inspired *Biloela Girls*. I wanted to create something that embodied a haunting memory, and in particular one that was trapped in the Biloela girls' time, and on their island.

5.3.1 Experiential aims

The experiential impetus for this work was the desire to lure unwitting passers-by, people who had not specifically set out to have a visual art experience, into a dialogue with the site, with the people around them and, hopefully, with the work and its themes. All of the design and implementation decisions made, both in development and while the work was installed, were informed by this aim.

Biloela Girls is a projected video work, in which a ghostly characterisation of an inmate of the reformatory is stuck in a never-ending loop. Forever running, as if chased, over the same ground. Most of the time the video is empty, black, and each passing of the character is fleeting and ethereal. The video is projected onto a curtain-like screen set inside an unmarked and nondescript window that faces out onto a common thoroughfare. From the outside it looks as if there is a cream and white ghost, in late nineteenth century attire, running scared past the windows, inside the room. The room inside the building is locked and the door covered. The projection began at nightfall and continued to sun-up.

The windows that house the projection are not in the direct line of sight of someone walking down the thin path between the two buildings, as such, most viusers' initial contact with the work is through their peripheral vision. It was hoped that she would appear as a fleeting phantom, and that those that witnessed it would not be sure if it

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http://www.harbourtrust.gov.au/topics/sitescockatoo.html.

had happened or not, or what they had seen. To see the image clearly would require some tenacity and patience. In keeping with the experiential intent of the work, the projection was placed such that only some people who walked past it would see it, in the hope that they would engage with others, perhaps even strangers, to seek out what had initially grabbed their attention.

5.3.2 The installation

During my first official visit to the island I scoured the two dedicated arts spaces for a site that would accommodate the twin goals of inadvertent audience participation and the ability to configure and covertly observe the work while it was running. A room was located in the old Pattern Storage/Joiners Shop, which was being used as a gallery, and which met all the requirements. From the back of the rectangular room it would be possible to project, with the equipment that was already available to me, a video on three by four meter window, which would be covered by a back projection material. A material was chosen that would look like a cheap curtain. The material was hung loosely, but still conveyed the image of the girl to anyone using the lane. The projector was mounted on its flight case and oriented such that its throw covered the whole window, giving it a uniform look from the outside.

The video content was a delivered via a looping Quicktime video file, running on an Apple iBook laptop. The windows were situated part way along a common through-fare between the lower area of the island and the top stages. This position guaranteed a lot of traffic during the feasible projection time, from thirty minutes after sunset (approximately 6:30 pm) until the close of the top section of the island to festival goers (approximately midnight). Directly across the small roadway from the projection was an empty room that facilitated covert observation of the work *in situ*.

5.3.3 Creating the video

In *Biloela Girls* I wanted to capture the girl's fear and energy, to incorporate the way care-leavers talk about being trapped in their past. Further, to remember them and the history of the island.

With technical assistance from Greg Ferris, I filmed a female actor, Alex Hamblin, running through a large dark room. From more than thirty passes, five from left to right and five from right to left were selected that most accurately articulated the feelings we were trying to capture. In some she was head down, some looking over

the shoulder, others were stop and start, but all were furtive, fleeting, hunched and harried.

Figure 5.1 Alex Hamblin as the Biloela girl.

During each pass she was lit by two direct lights, one to the left of the camera's field of view pointing right, and the other oppositely positioned. Alex was then filmed running left to right, and right to left across the camera's field of view (FOV). The actor fully exited the FOV with each pass, allowing for the frequency of her movements to be adjusted to fit the different versions of the work. The lighting set-up meant that Alex's clothes were only ever lit from the back or the front as she ran. This caused a two fold effect, firstly that she always looked like she was running from a light to a light and secondly that the centre of her body would, at times, totally disappear. Alex was dressed in a period costume that matched, as closely as possible, images found in *Australians 1888* (Davison et al., 1987) and textual descriptions in Robert Hughes' *The Fatal Shore* (Hughes, 1987), of poor or incarcerated women of the era.

A time based semi-transparent echo was used to give the character a ghostly look. The ten short passes were used, alternately, to give the impression that the character was imprisoned in the room. There were two different versions of the

video created for the first two days of the festival, a third was planned that would be created during the festival, incorporating what was learned during the first two screenings.

5.4 Using HCI and human-centered design

5.4.1 HCI research methodology

On the first night of the festival, a version of video was employed in which the ghost presented herself infrequently and unsystematically. The apparition reappeared at different intervals, ranging between fifteen seconds and four minutes. The video ran for twenty five minutes.

On the second night, the ghost crossed the windows precisely every fifteen seconds. The video ran for two and a half minutes.

On the third and last night, after two nights of observation and informal interviews, I created a version where the ghost appeared on average every twenty seconds, at different interval times ranging from five to thirty five seconds. The video ran for three minutes. In terms of audience reaction, provision of intended experience and artist satisfaction, this was the most successful night.

I employed two techniques during the *in situ* study of *Biloela Girls*; observation and informal open-ended "post-use" interview. Due to the presentation environment and the intended ambient nature of the work, there were no outward signs that *Biloela Girls* was also acting as a research opportunity. This also meant that was no audio recordings made of the interviews.

Observation
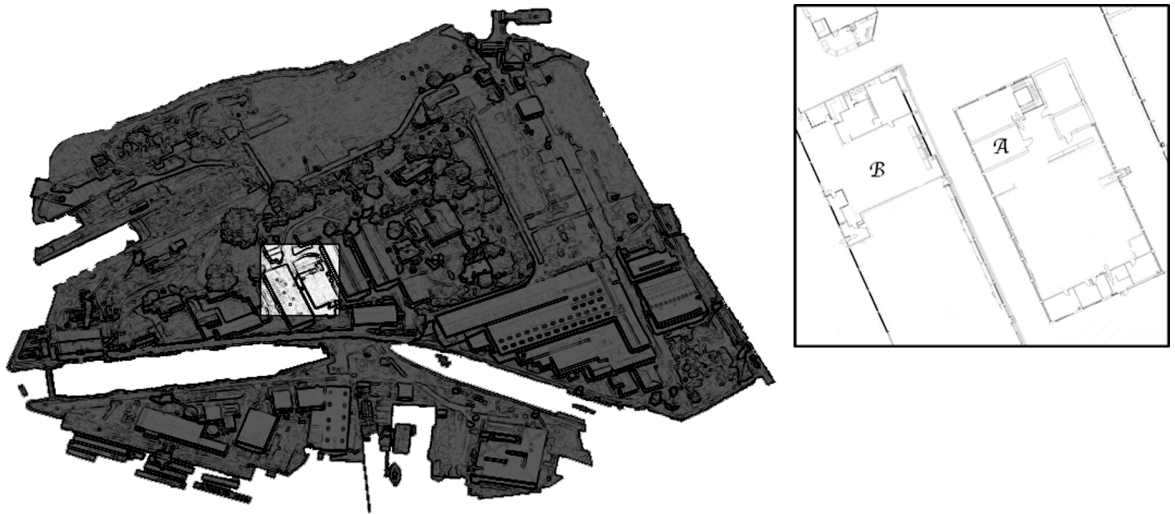
Figure 5.2 Biloela Girls *exhibition on Cockatoo Island. Projection room is labeled "A", observation room "B".*

Some of the observations we made from a room that faced the work, from the opposite side of the lane, as shown in the preceding figure. The building was used as a record and collectables fair during the day, but was empty at night. The room afforded unobstructed view of the lane and anyone viewing the work, but it muffled conversation, especially quiet or reflective conversation from those facing towards the work, and thus directly away from the observation room.

Another, more successful, technique employed was to be physically present in the lane, usually by walking up and down the lane. On some occasions I entered into conversation with the people present. My authorship was not explained, or directed questions asked, these were simply informal discussions with strangers.

Post-use Interview

It must be noted that the post-use interviews were conducted with people with prior knowledge of my authorship of *Biloela Girls*, as such all the interviewees were in some way related to me, be they colleagues, friends or acquaintances.

During each of the six post-use interviews notes where taken, but no voice recordings were made. Direct transcriptions were only made for potentially reproducible quotes, such as those that appear in this document. The interviews all took place within the festival context; on Cockatoo Island, usually in the room where the work was projected from, and occurred during the three days of the festival. The

interviews were conducted as an informal discussion with no set questions, and were often lead by the interviewee's interests in the work and the ideas it engaged[5].

5.4.2 Observations

The interviews and observations of versions one & two of *Biloela Girls* (which appeared on the first and second night of the festival respectively) revealed significant problems, modest successes and clear avenues for revision of the work. For readability, all of the data collected for versions one & two will be presented first. Following this is an analysis of the data, in which three consistent themes emerge, and the plan for improvements to the work. The data collected from, and analysis of, the final iteration of *Biloela Girls* is then incorporated.

Observations of version one, Friday the 25th of March, 2005

Sequence one: Three people, two male and one female, walk past the installation. In the following re-enactment they will be named Frank, Dean and Samantha.

A group of three friends are walking down the lane around 9:30 pm, they are noticeably inebriated. The couple, Frank and Samantha, are both looking to the side at Dean who is talking. As they pass the installation windows, directly behind Dean, the girl's apparition appears and Frank and Samantha stop walking. Annoyed Dean asks what they are doing. Frank replies for both saying, "there was something moving in the room". Samantha decides that they should stay to see if it "does it again", and to see "what it was". Dean is quickly convinced that there is nothing to see, and that they are making fun of him. The ghost takes a, seemingly, considerable time to reappear, during which Dean requests, pleads and then orders the group to continue on their path. By the time the ghost does reappear Dean has given up looking and has begun hitting Frank and Samantha with a giant inflatable hand that he was holding. During which time the ghost re-appears and both Frank and Samantha exclaimed loudly. "There it is, it's a ghost of a woman", "I told you there was something in there", "That was cool" and "I wonder if it's different the next time". Dean, who missed the apparition because he was, good-naturedly, hitting his friends, is now thoroughly convinced that they have made up the event. He proceeds to storm off down the lane, thus forcing his friends to follow.

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[5]Please see Dix, Finlay, Abowd, and Beale's *Human-Computer Interaction: 3rd Edition*, chapter 9, for a precise explanation of this technique.

Sequence two: Two people (one male, one female) are witnessed standing in front of the window, waiting for the ghost to appear. In the following re-enactment they will be named Bonnie and Clyde.

Bonnie leads Clyde up the lane to the window. When they are both in front of the window they wait (the ghost had appeared very recently before they arrived). Bonnie, it appears, has seen the ghost previously and is trying to convince Clyde that it is worth sticking around for. Clyde wants to leave as he "doesn't want to miss the Hilltop Hoods just to stare at a wall". When the ghost does appear, some minutes later, Clyde is unimpressed at how little happened for all waiting he had done. Bonnie is unimpressed with Clyde's attitude, and they both leave soon after the ghost.

Interviews during version one, Friday the 25th of March, 2005

The majority of people interviewed were frustrated by how long they had to wait to see the ghost, especially after their initial exposure. Although one person enjoyed the delay, he found it difficult to keep others waiting as "everyone was drinking and listening to music and stuff and it required them to stay still watching a blank window". One person thought that it was "broken" as nothing happened immediately when they arrived. While another failed to find the work, despite written instructions to its location; he asked why there was no signage on the outside of the building. All of the people interviewed, who saw it, enjoyed the visitation, but two of the five said that was not bright enough and that it was sometimes hard to make out as a woman. There was obvious interest in the themes presented in the work, and an amplified curiosity about the history of the island, during the discussions.

Observations of version two, Saturday the 26th of March, 2005

Sequence three: Midnight, a large group of people (approximately fifteen) are being ushered by security from the top section of the island to the lower section of the island, where the camping is situated.

The group coming down the lane stops where a different group, of three people, is looking at *Biloela Girls*. Security tries to move the enlarged group along but word has spread there is a "ghost in that room" and everyone has stopped. A game begins where the assembled throng wait and cheer each time the ghost appears, it is unclear whether this was an ecstatic art experience or simply a way to agitate the

security guards. The security guards continue to argue with the group, and eventually move everyone along the lane and out of view.

Interviews during version two, Saturday the 26th of March, 2005

Contrary to version one, no one complained that version two forced them to wait to long. Two people, however, expressed disappointment that they felt that they had "worked it out", because the ghost always appeared after the same wait. They both, in various ways, indicated they wanted to be surprised. Interestingly, when asked how long they thought the gap was, they both stated more than twice the actual time. One person enjoyed the metronomic nature of version two, stating that they "enjoyed knowing when it was coming. I was able to focus on the moment it would appear". Interviewees variously described the woman in the window as "beautiful" and "over very fast", while one person asked, "why don't you put your name on the outside, or post information in the festival guide on how to get to it and when it's on?" Again, people's attention was drawn to the history of the island, and in particular of the girls who were incarcerated there.

Reviewing versions one & two

As with any artwork, or any creative human endeavour, different people have different, sometimes contrary, experiences. However, during the evaluation of *Biloela Girls*, three themes emerged that were commented on or observed readily and consistently. These were timing, content and detectability.

Timing: It was made clear that the timing for version one inhibited the intended *Biloela Girls* experience. There was too much visual silence, so much so that some people thought that it was broken, turned off or could not find it. Version two was an improvement, but some people lamented the lack of surprise at the even intervals. A timing situation that may have worked well in a gallery context was clearly inappropriate for a rock festival.

For version three, timing was tweaked to run, on average, roughly equivalent to version two, with an interval time of twenty seconds. It also included uneven intervals, as well as some very short ones, between five and thirty five seconds.

Content: Across the discussions there was consistent excitement about the themes presented in the work and interest in the history of the island. Almost everyone who was interviewed became, or already was, intrigued by the island's past. There was

also, as with any technological sleight of hand, curiosity about how it was created and filmed: more than half the interviewees wanted to have the technical components of the work's creation and display explained. A few people expressed surprise at its minimalism compared to the over-the-top nature of the rest of the island's sights and sounds.

The only alteration that was suggested from the interviews and observations was to slow down the individual passes made by the ghost. Although this would have made it easier to see it as a woman, it would have meant that she would not be moving in a perceptible real-time and could impede the intended goal of providing a fleeting vision requiring further examination. I decided not to slow the individual crossings.

Detectability: Some recounted their difficulty seeing the work before the sun was fully set, or when there was a lot of ambient light. Early on each night, as staff were packing up and storing elements of the record and collectables fair, a lot of light would spill onto opposite building, reducing *Biloela Girls*' visibility. There was also a run of faerie lights strung along the other side of the lane. Another suggestion was that the area around the work should be marked in some way, to tell people about the work.

After talking to the staff of the fair I was able to get the lights in the rooms that directly faced *Biloela Girls* turned off after sunset, and I manually disconnected the faerie lights after dark. As specified in the experiential intention of the work, *Biloela Girls* should initially surprise, and, hopefully, reward those who pay closer attention, but it must remain up to the viuser to forge it into their own narrative of the island. Accordingly I did not add explanatory signage to the building facade.

Some unexpected things came out of the interviews that did not fit neatly into the above themes. For example, two people felt compelled to pass on the baton of attendance, or awareness, such that once they had seen a few different visitations, they would explain to passers-by what was in the room and encourage them to stay in the lane, witness the ghost and tell someone else about it before moving on. In some sense perhaps they/I hoped that there would be an accumulation of knowledge of the girl and the work's interface, which would build up as people passed on their knowledge to new guardians.

Observations of version three, Sunday the 27th of March, 2005

Sequence four: A group of three friends are searching the lane's windows, approaching from the north end of the lane. It later becomes clear that they are following instructions on how to find the work.

Two of the group are eating festival food, precariously, from paper plates and the other is drinking a beer. As they walk down the lane they look in all the windows until they get to *Biloela Girls*. By standing at the window and looking directly inside, if you are tall enough, it is clear there is a projector in the room. Satisfied that they had found the right place, the group retreated to the far side of the lane — directly in front of the observation point. To avoid discovery and complicated explanation, I also retreated and could not hear what they said. The three stayed for three or four full cycles of the video and only left after they had finished their food, drink and a long discussion. They made no attempt to include others in their discussion.

Interviews during version three, Sunday the 27th of March, 2005

As with version two, no one cited dissatisfaction with the period of the piece's crossings. Because the timing was conducive to spending more time with the work, all those interviewed saw most, or all, of the ghost's manifestations. They expressed their enjoyment of the mild surprise of each appearance, the anticipation and the different variations; one person called it "mesmerising". Two people believed, or suspected, that it was in some way intelligent, as they had an immediate response from the work: one asked "does it know I'm there?". All but one person found it easy to recognise a female figure, running, and most indicated that it seemed she was running away from something: one person said it was "hard to work out what it is". As with all the discussions people were universally interested in the revealed history of the island, and the methods used in *Biloela Girls'* construction.

5.5 Conclusion

To be usefully studied, *Biloela Girls* must be shown in context, in this case at an all-ages rock festival on an island. As such it presents vastly different conditions to the laboratory and office situations, where most HCI techniques are devised, refined and, primarily, implemented. This documentation has not been presented as a fully generalisable case study for the exact frequency for the appearance of visible elements in an ambient video display. It is, however, an example of human-centered

design working in the real world, on a non-traditional interface, in an artistic context and with some degree of success.

This is not a case study in HCI methodology, rather it is a small-scale illustration of the successful use of human-centered design, informed by a situated study of viuser experience, in a single-iteration computer-mediated artwork.

So much of art making is about manufacturing experience. In the case of *Biloela Girls* I witnessed surprise, confusion, frustration, excitement, curiosity, wonder and even a few arguments. On different nights I experimented with different frequencies, which meant that some people who walked by did not see it at all. It also meant that others, some of whom would never seek out art in their everyday lives, were surprised, and perhaps intrigued, by what looked like a ghost running scared across their peripheral vision.

Chapter 6: Study 2: Conversations

6.1 Introduction

Conversations is a multi-user, immersive, interactive art installation that was displayed in the Powerhouse Museum, Sydney, for two weeks in late 2004. It is also a research project that explores the way in which a distributed virtual environment can embody different modes of conversation and interaction: interaction between real people, in real-time, and interaction between real people and virtual agents or fictional characters. *Conversations* was developed by the iCinema Centre for Interactive Cinema Research at the University of New South Wales, in collaboration with a number of outside partners, under the artistic direction of Jeffrey Shaw, Ross Gibson, Ian Howard and Dennis Del Favero.

The *Conversations* narrative follows the story of Ronald Ryan's 1965 escape from Pentridge Prison, Melbourne, during which a prison guard, George Hodson, was killed. Ryan was a pretty criminal, without a violent history, who was sentenced to serve thirteen years in Melbourne's Pentridge Prison beginning in 1964. On December 19th 1965 he and Peter Walker escaped. They were re-captured nineteen days later, and both Ryan and Walker were put to trial for Hodson's murder. Despite the facts that all fourteen eyewitnesses heard only one shot fired and a jail warder, standing on a low wall, admitted to firing a shot, that the fatal bullet was never recovered, nor was Ryan's gun subject to proper analysis to determine if it had been fired, Ryan was convicted and sentenced to hang (Opus, 1997). Although the previous thirty-five death sentences had been routinely commuted, the Liberal premier of the day, Henry Bolte, was in the midst of an election campaign. Despite wide-spread protests, including a petition from seven of the trial's jurors, on the 3rd of February 1967, Ryan was executed (Richards, 2003). In 1973 the Federal Commonwealth Government abolished the death penalty. Ryan is famous to this day for being the last man legally hanged in Australia.

Visitors to the museum were invited to experience *Conversations* through a series of interfaces that encouraged them to be immersed in Ryan's time and world. The immersion was provided by traditional virtual reality hardware: a head mounted display, for stereoscopic vision, and a pair of high-fidelity stereo headphones to supply spatialised sound. Viusers witnessed a re-enactment of Ryan and Walker's escape from Pentridge Prison, before entering a dark, ghostly virtual world, inhabited by twelve characters central to Ryan's life, trial and death.

The software that drives *Conversations* was built primarily by Matt McGinity, Joachim Tesch, members of the CARlab team[1] and myself. Using the virtual reality development tool *Virtools* as a template, we created a complex software system that provided, amongst numerous less exciting advances, stereoscopic video playback, a spatialised sound score generated from numerous sources and spatialised voice communication, inside a multi-user virtual environment.

6.1.1 Outline

This chapter contains an in-depth study of the *Conversations* project. It begins with a discursive exploration of the situated experience of the work, in order to give the reader a coherent picture of the *Conversations* experience, to keep as a mental reference through the rest of the chapter. Following that is an account of the project's conception and planning, interwoven with excepts from interviews with the key investigators concerning their motivations. The development process is then chronicled, and my specific contributions are outlined. The last part of the chapter is devoted to reflections on, and assessments of, the work, its reception and its developmental processes, by various collaborators on the project.

6.2 Experiencing *Conversations* at the Powerhouse Museum, Sydney

some men are born into grace, the law of the land is not relevant to them

Ronald Ryan in *Conversations*, as written by Ross Gibson

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[1] The Computing and Audio Research Laboratory (CARlab), at the University of Sydney, specialises in two main areas, "Neuromorphic Engineering" and "Spatial Audio" (http://www.ee.usyd.edu.au/research/allresearch/?group=carlab). Their role in *Conversations* is described later in this chapter.

6.2.1 The exhibition space

The *Conversations* installation was situated in the *Cyberworlds* exhibition space on the ground floor of Sydney's Powerhouse Museum. The installation consisted of four distinct elements, situated in the same general vicinity, inside the exhibition space. The first element which visitors encountered was the waiting room, which doubled as a introductory space, where potential viusers could have the work explained and contextualised and they could access textual material and imagery from the time and the trial. This area also gave each visitor a chance to eavesdrop on another's experience. In the waiting room is an usher who briefs each visitor, answers any questions and organises for those interested to be taken to one of the three stylised cubicles that houses the immersive component of the experience[2].

Upon arriving at a cubicle, another usher, who is stationed constantly at that terminal, helps the visitor put on the complicated combination of a head mounted display (HMD), with a tracking device attached, a pair of headphones and a microphone with head strap. The HMD, coupled with good quality stereo headphones equipped with passive noise cancellation that removed the majority of the ambient noise in *Cyberworlds*, were used to provide an immersive experience. However it is important to realise that using a HMD is very different from entering a new reality. The experience that the HMD used in *Conversations* affords is akin to looking through a window, albeit a very small moveable one. It gives the viuser a responsive vision into the scene and can, for many people, induce a sense of "being there", of immersion. This "being there" relies heavily on the coherency of sound and image, which was a primary focus in *Conversations* development, and one of the most effective parts of the overall experience.

6.2.2 The immersive experience

The breakout

Once the viuser is comfortably wearing the headgear, the ushers asked if they are ready and then starts the experience. It begins with a splash screen that simply states, "PENTRIDGE PRISON DECEMBER 19TH, 1965" in white text on a black background. This fades away to reveal a calm scene, with a couple walking on a

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[2]The set-up, layout and contents of the physical installation in the Powerhouse Museum is detailed later in this chapter.

suburban street. By looking around, up and down, one can see the walking couple, an empty street, some shops, Pentridge Prison's large outside wall and guard towers, the grassed area outside the prison, a church, a number of trees and bushes and the blue sky above. After a short time a few other people, a car and a tram join the scene[3]. As the people walk they seem to drop in and out of focus, their movements are interrupted by a kind of visual stuttering, like a glitch in the video stream or noise in the signal. After twenty five seconds, a siren can be heard from inside the prison walls, and the guard patrolling the tower runs into his guard house to retrieve his rifle. As he points it into the prison grounds, the bystanders begin to hide or run away.

Shortly after the siren sounds, Ronald Ryan, followed by his partner Peter Walker, runs out of a small door in the base of the prison wall. Ryan, running quickly, is carrying a rifle, he can be heard clearly with each footfall on the dry grass. As Walker disappears behind a bush, Ryan turns towards the guard on the top of the prison wall, they aim their rifles at each other for a few moments before both decide not to shoot. Ryan continues his escape. A large, slow, prison guard then appears at the small door Ryan and Walker had used; this is the ill-fated George Hodson. Walker reappears, heading in Ryan's direction, Hodson is close and tries to hit him with a baton, but Walker is smaller, younger and quicker and easily dodges the blow. Walker begins running towards Ryan, across the grass between the prison walls and the road. The people of Melbourne are fleeing.

The driver of a car, that was approaching the scene, sees an armed man on the road in front of him and screeches to a holt. A guard from the prison's distant front entrance, rifle in hard, now joins the fray. He points his gun at the running Walker, and thus at the chasing Hodson. The guard from the tower points his gun over Hodson towards Ryan, whose gun is also raised near a now stationary car. A shot rings out and echoes off the prison wall. Hodson falls, grabbing his chest. At the moment when the fatal shot is fired, Ryan and the two guards are all in a firing position. After the shot, Ryan bundles two people out of the car and he and Walker duck inside. As they drive off, one guard gives half-hearted chase and another looks on as Hodson lays prone on the grass.

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[3]An initial period of calm was included to give viusers a chance to become familiar with navigating by head movement and to build a general mental picture of the virtual space.

With Ryan and Walker now gone, the remaining characters' focus is on Hodson. The couple from the opening sequence, who have been hiding behind a bush during the escape, creep forward towards him. Another couple, who have arrived by a car that is now stopped on grassy verge, approach the fallen prison guard. While everyone else stops at a distance, one woman approaches and kneels by him. As she kneels down, all the characters fade away, leaving only Hodson. As they disappear Hodson seems to say "Mother" in a deep rumble that sounds like thunder. All this has taken place in just two minutes. As the thunder fades so does the scene, growing fainter and then darker, until a new version of the Pentridge forecourt is revealed. This is *Ghost World*.

Ghost World

> Once you get into the ghost world, the sense of the information being somehow intangible, multifaceted, multi-opinionated becomes even more emphatic.

<div align="right">(Shaw, interview, 2005)</div>

In *Ghost World* the viuser is situated, virtually, in the same spot that they witnessed Ryan's breakout; beneath the prison walls. However the look and feel in the virtual environment has changed dramatically. The world is lit as though it is the very end of twilight, the prison façade is silhouetted against a dark brooding cloudy sky, the trees, shops and church that were clearly visible in day light, are now just hulking dark shapes and the ground below is a grey-blue concrete that appears to be spot lit from above.

The only thing that remains is the figure of Hodson, who lies on his side at the foot of the prison wall, at the edge of the area of light. The ground and horizon that surround this illuminated area are dark. Twelve ghostly apparitions emerge from the darkness, they float from left to right in a sleepy holding pattern. As the characters appear from the shadows a soundscape becomes audible, there is the intermittent sound of wind along with a constant whispering from all sides, audible but not intelligible.

The ghosts are dark and withdrawn until they are looked at, when they become brighter, as a luminescent blue or red smoke envelopes them, and their name appears above their heads. The twelve ghosts are all people closely related to the story of Ryan's escape, re-capture, trial and execution. Above their heads appear

the names Ryan, Walker, Mother, Hodson, Defence, Campaigner, Guard, Hangman, Chaplain, Premier, Judge and Prosecutor[4].

If the viuser looks at a ghost, its name appears and it edges forward. If the viuser maintains their gaze, the ghost will approach them. When they do, they come forward with a surge, accompanied by an audible rush of air, they stop close, in the center of the viuser's vision, and begin to speak. Their words come in insistent bursts, often whispered, which are made intimate by the content of their speech and its presentation; the way the spatial audio makes them sound physically present, as well as their close virtual proximity. The video characters speak in short, often prosaic, vignettes. Each vignette is separated from the next by a short flash of visual and auditory static, as if the characters are not settled in this world.

Figure 6.1 Ryan's Mother. The Hangman. Ronald Ryan. A prison Guard. Judge Starke.

"a man in power, he gets to define who is guilty… a man in power can afford to be polite… a man in power, is he capable of sin?"

"it's my son that you're killing… I brought him into the world."

Ryan's Mother in *Conversations*, as written by Ross Gibson

"I am the father in the law and Ryan has killed one of our family."

"there is always a deadline on justice… there's always a clock, ticking loudly."

"we're not embarrassed, not one bit, to differ from the rest of the world… they can think what they like about hanging and retribution."

Premier Bolte in Conversations, as written by Ross Gibson

"Many people had rifles that day, many people were panicking."

<clap> <clap> <clap> "How many claps did you just hear? …how many people were behind you?"

"Ryan grew up in violence, he lived in violence… do we succumb to that cycle and dispatch him with violence?"

Ryan's Defence lawyer in Conversations, as written by Ross Gibson

---

[4]These characters were selected and authored by Ross Gibson. They are fully explained later in this chapter.

> do you trust police and politicians when they have the right to go killing?
> …and would you gladly give them that right?
>
> Anti-hanging Campaigner in *Conversations*, as written by Ross Gibson

> Ron pretended we were the Kelly gang, he said we were bent on re-distribution… the idiot newspapers, the story caught on
>
> Peter Walker in *Conversations*, as written by Ross Gibson

> I do what you want me to do… and what you don't want to think about
> the rope should be placed on the left side of the throat… this is not science, this is tradition… the left side in the sinister side
>
> the Hangman in *Conversations*, as written by Ross Gibson

If the viuser looks away slightly or slowly, the ghost will attempt to remain in front of their eyes, if they look away quickly or dramatically, the ghost will retreat to its station outside the pool of light. The ghost's speech is presented as a series of utterances, never more than six, after which the ghost will retreat to its original position, or it will ask a leading question, in order to bring another character to speak to the viuser. The questions range from the specific, such as Ryan asking "Have you spoken to my mother?", to the open ended, such as "Who would you like to speak to?". After the question is put, the viuser is presented with set of contextual answers, such as "yes" or "no", or a short list of names, which appear in the centre of their vision, superimposed above the waiting ghost. The viuser can say yes, no, or any character's name, and the appropriate ghost will be summoned, or remain silent, and will be left alone.

Conversations is a multi-user experience, this fact is first exposed to viusers in *Ghost World*. Each viuser is represented by an animated avatar, each avatar has the same androgynous human shape, and is wearing the same apparatus that people have on in the physical world; head mounted display (HMD), headphone and microphone, as shown in the below image. As one viuser interacts with a ghost, any others present are able to see the ghost approach, speak to and then retreat from, the viuser's avatar. The avatars are animated in response to the data being received from the head tracker mounted on each HMD, as such, viusers are able to see who is, virtually, facing away or towards them. If someone speaks into their microphone any one else present in *Ghost World* will hear their voice, spatialised, to sound as if it had emanated from their avatar. If a viuser looks at another avatar, their field of view will narrow onto the avatar, giving the impression that the avatar is the centre of their focus. When someone begins or ends the experience, those present in *Ghost World* will see their avatar walk in from, or out into, the darkness.

Figure 6.2 Conversations *avatar with head-mounted display, headphones and microphone.*

In *Ghost World*, the body of Hodson remains clearly visible, where he was struck down during the breakout. If the viuser focuses their view on him, a bubble of video will appear, if they hold their gaze, they will be returned to the escape's filmic re-enactment. Further, when a viuser is viewing the Pentridge breakout, their avatar is surrounded by a semi-opaque video bubble. Their head orientation and movement, as well as what is happening in the film, can clearly be seen by others in the environment.

Each person can, at any time, remove the HMD from in front of their eyes and request to end the experience. In this case the usher will help them remove the combined VR apparatus from their head. Most people remain immersed for the full ten minute duration of the Powerhouse installation. At the end of this time, the visual and audio world fades to black and a series of three white text on black ground screens appear, giving further information on the Ryan narrative.

19 DAYS LATER,

RONALD RYAN AND PETER WALKER

WERE RECAPTURED IN SYDNEY

RYAN WAS CHARGED WITH THE

MURDER OF PRISON OFFICER

GEORGE HODSON

HE WAS FOUND GUILTY

AND SENTENCED TO DEATH

Ryan was buried somewhere on the Pentridge grounds in an unmarked grave. His remains lie there still, along with those of the outlaw Ned Kelly and the other 107 prisoners hanged since the prison was first established under impetus of the gold rush in 1850.

(McQuire and Papastergiadis, 2005)

Ronald Ryan was hanged in Pentridge Prison in 1967. The site has recently been converted from a men's gaol with a particularly brutal and bloody history to an inner-urban housing development with scarcely a pause for breath in between… it is hard to believe that the new residents can completely wipe away the stained history of the land they now inhabit. The ghosts are too recent, the memories too turbulent.

6.3 How *Conversations* was conceived

Part crime-scene, part meditation chamber, part court-room, *Conversations* allows participants to socially dialogue in virtual space with [ghosts of witnesses, perpetrators and victims], recasting the past as an ongoing conversation with the present.

(Favero and Shaw, 2005)

6.3.1 Motivation

Conversations is a research initiative with a creative artwork as its primary physical manifestation. For the different collaborators on the project, in their various complementary roles, there were a number of challenges, goals and areas of exploration. This section will focus on the motivations as expressed by the chief investigators.

Emergent narrative

> *Conversations* is an artwork that is also an experiment, it's an experiment into different ways which you might understand narrative [in an] interactive dramatic situation.
>
> (Gibson, interview, 2004)

The *Conversations* architecture was initially conceived by Jeffrey Shaw and Dennis Del Favero, as part of the ongoing investigations being undertaken at the iCinema Centre for Interactive Cinema Research. It extended work Shaw had previously undertaken on the *PlaceWorld* project, whose aim was to "inform the development of future large scale shared and social virtual environments" (eSCAPE, online). *Conversations* was funded by an Australian Research Council Discovery grant, with money provided to explore the "reformulation of narrative within digital cinema as the integration of three models of interactivity" (iCinema, a, online). The iCinema Centre engaged the writer/director Ross Gibson to provide written content for a immersive interactive installation that explored three particular modes of interactive narrative, described as branching, spatial and emergent. The branching narrative is reminiscent of a child's "chose your own adventure" book, where options are provided and the viuser is able to pick their way through the narrative world, one response at a time. The spatial narrative describes a situation where all the narrative options are provided at once, allowing the viuser to create a journey through the content, by calling up any piece, at any time. In an emergent narrative, depending on the choices the viuser makes, and the narrative elements they have uncovered, the system promotes certain further material to influence the unfolding story. Gibson suggested that the story of the last man hung in Australia, Ronald Ryan, offered an opportunity to effectively explore these narrative modes.

> So we knew we wanted to, all in the one piece, investigate those three modes of narrative. I went away and thought about it for a while, and thought that a historical event that has been argued over, an event that happens in… a crime scene… that has passionate aftermath to it. Where

> people argue about it through time. The sort of situation where something [has] happened… that you need to investigate, and the ghosts of the event [are still] hanging around.

(Gibson, interview, 2004)

Conversations was used to investigate a number of hypotheses, foremost amongst which were questions as to the nature of narrative in an interactive experience. The investigators were also interested in how virtual environments might act as social communities. These ideas stemmed from open-ended questions such as, for example, how do you encourage people to interact with each other, when they are not familiar with their surroundings or the technology? How do you best facilitate exploration of the massive amount of information held inside *Conversations*?

The *Conversations* aesthetic

> We didn't attempt to reconstruct the environment literally, as it was originally. So, even though it is a reconstruction, it's the memory of the escape… The aesthetic of [the] compositing was not hyper realistic, there are many glitches and aberrations… It is a reconstruction of the memory of the event, but it also mirrors the fuzziness of the memory of the event at that time. Because even then, in court, there was a lot of dispute about what actually happened.

(Shaw, interview, 2005)

During the design and planning phase of development there were a number of experiential and aesthetic challenges that needed to be addressed. The outcomes influenced the technological or engineering solutions that were proposed. As the technological production of the project progressed, it became apparent that some experiential and aesthetic goals were incompatible with the available technological implementation. This meant that for each technological decision there was reflection on the work's aesthetic, and with every aesthetic choice there were repercussions for the implementation. These two sets of challenges needed to be engaged with concurrently and collectively.

One example is viewing the breakout scene with the type of head mounted display (HMD) that was then available. Viewing a spherical movie through a HMD, with a very narrow field of view, such as the one we used, means that the viuser can only see a small section of the scene at any particular time, although they can hear everything. This was seen as "particularly appropriate" for such a disputed event,

the breakout, especially given the contested evidence presented in Ryan's court case[5] (McGinity, 2005). In addition, the breakout film was shot and composited in a way that, during the key moments, important actions took place in different areas of the scene. This meant that any two viewings of the re-enactment could provide contradictory accounts of the action.

> …being positioned as eyewitness to the crime does not resolve all questions. Critically, the origin of the fatal shot is left ambiguous. No matter how many times users examine the scene, the direction from which the bullet arrives remains unclear.
>
> (McQuire and Papastergiadis, 2005)

The work's visual aesthetic followed a similar developmental path. Although initially influenced by Gibson's idea of "ghosts hanging around" in a "passionate aftermath", and Shaw wanting to capture the "fuzziness of the memory" of the event, the final visual aesthetic was determined by a melding of various elements. It was as much dictated by the stretched limitations of the technology as it was by the ideas of the chief investigators. Also vitally important were the manner in which the software team chose to implement the system and the design choices made by collaborators such as Greg Ferris, who was the project's cinematographer and compositor, Robert Hindley, who provided the sound design, and Steve Weymouth, who created the 3D model for the *Ghost World* avatars.

6.3.2   *Conversations* and the iCinema Centre

Conversations is consistent with the iCinema Centre's stated research objectives of building "virtual environments that [are] content rich, and, at the same time, social spaces" (Shaw, 2005). The Centre's Director, Jeffrey Shaw states that iCinema deals explicitly with "immersive experiences, ways in which the viewer can enter content rich, information rich, virtual environments, or environments which are hybrid, ones which are virtual/real — acted/algorithmic" (Shaw, 2005). *Conversations* was one of the first projects that the newly formed Centre undertook. Its importance in emphasised in the introduction to the *Conversations*' digital monograph:

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[5]Some of the contested testimony is covered in this chapter. Ryan's full story is skilfully told by Mike Richards in *The Hanged Man: The life and death of Ronald Ryan* (Richards, 2003).

> *Conversations*' ability to provide virtual comprehension between participants and machine agents within a virtual 3D environment… has laid the foundation for the iCinema Centre's current research.
>
> (Favero and Shaw, 2005)

6.4 How *Conversations* was developed

Developing and exhibiting *Conversations* was a massive task, with more than thirty people involved in its creation, without counting actors, extras or Powerhouse staff. Although the team at the iCinema Centre undertook most of the work, *Conversations* would not have been possible without the specialist expertise of the Computing and Audio Research Laboratory at the University of Sydney, that of the National Institute of the Dramatic Arts and of freelancers such as Robert Hindley, Peter Murphy, Imogen Ross and Steve Weymouth. The technical development of *Conversations*, and the individual contributions of these particular groups, is detailed in this section. Also included is my specific contribution to the project, as well as a more comprehensive account of the set-up of the exhibition in the Powerhouse Museum.

6.4.1   The software development process

The *Conversations* installation uses readily available virtual reality (VR) hardware, such as the head mounted display (HMD)[6], the head tracker[7] and stereo headphones[8], along with other relatively common software technologies such as multi-user, distributed systems, voice over Internet Protocol (VoIP) and speech recognition. As well, this project also incorporated uncommon, and in some cases unique, software technologies, including those for pre-rendered three dimensional (3D) spatial sound, spherical stereoscopic video playback and 3D spatialised VoIP.

The viuser's experience of the work is split into two parts, a separation that was mirrored in the development process. The first element of the experience is the

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[6]For *Conversations* we used the *Daeyang i-visor DH-4400VPD 3D* which contains two 0.49 Inch LCDs, with an 800x600 resolution for each screen. The i-visor has two inputs, one for each eye. Manufacturers site: http://www.personaldisplay.com.

[7]An *Intersense InertiaCube2* tracker was used. It was attached to the top of the HMD. Manufacturers site: http://www.isense.com.

[8]*Sennheiser Evolution EH 2200* headphones were selected for audio quality and passive noise cancellation, so important in an area with high ambient noise such as the *Cyberworlds* exhibit. Manufacturers site: http://www.sennheiser.com.

cinematic re-enactment of Ryan and Walker's escape from Melbourne's Pentridge Prison. The second is *Ghost World*.

The escape

In order to re-create the Pentridge breakout, the first step was to generate two empty spherical still images of the scene. These images are required to generate a visual display that includes a sense of depth, regardless of where one looks, be it up, down, left or right. This is essential in order to trick the eyes into believing the film is three dimensional. A central position was chosen on a grassy verge, at the foot of Pentridge Prison's walls, that offered a clear view of a large section of the prison wall, a prison exit way and the street upon which Ryan and Walker would escape (see Figure 6.3).

Panoramic photography expert Peter Murphy shot the stereo stills in April 2004, very early on a Sunday morning to avoid cars and pedestrians. Murphy used a technique that requires a high-definition digital camera with a masked fish eye lens to be attached, using a special bracket, to a tripod, a short distance from the tripod's central axis. The camera is then slowly rotated a full circle, while Murphy takes one hundred and eighty photos. The process is then repeated, in the opposite direction. By taking a two degree wide, one hundred and eighty degree high vertical slice of pixels from each photo, he is able to generate a matching pair of spherical images, one for the left eye and one for the right[9]. These two images are used, by the VR system, to create the illusion of stereoscopy[10]. These images were used as a background, on top of which the moving elements of the scene, the cars, people and tram, were later composited.

---

[9]This technique is fully described, with the helpful examples, by Paul Bourke (Bourke, 2002).

[10]Stereoscopy is used to describe any technique that capable of delivering 3D information to the eye, generating the illusion of depth. There are many techniques for recording, generating and displaying stereographic imagery. Interested readers will find Paul Bourke's site contains excellent practical stereo imaging resources: http://local.wasp.uwa.edu.au/ pbourke/index.html.

Figure 6.3 Pentridge panorama. Shot by Peter Murphy.

The individual live action sequences for the breakout were shot in front of a green screen, in a studio at the National Institute for the Dramatic Arts (NIDA), such that they could be independently layered onto the scene. The green screen space was considerably smaller than the area depicted at Pentridge, which required the cinematographer, Greg Ferris, to shoot each character's action in small sections. Ferris calculated how each actor would have to orient themselves, with respect to the camera, for each section of their performance, whether they were running, hiding or shooting. Correct orientation is required to maintain continuity when each element of a character's action is composited onto the spherical image. The same set-up was used for the cars, although model cars were used, shot a close range.

In all, seven passers-by, Ronald Ryan, George Hodson, Peter Walker, two guards and three cars were filmed. Ferris used Adobe's After Effects to composite these live action sequences onto both of the stereo still images. Each eye had to be done separately, and carefully, such that the composited action would also appear in three dimensions. With the addition of a flag waving in the wind and a computer animated tram, Ferris was able to create a fully spherical stereoscopic film, to be viewed using a HMD.

Watching the two minute long breakout film is not a traditional cinematic experience. The viuser is placed in the centre of the virtual sphere, on which the breakout film is

projected[11]. This technique requires that the viuser remain locked to the centre of the sphere, in order to maintain the illusion of depth. With the aid of a HMD and a head tracker, they are able to look in any direction and witness the action unfold. Displaying this very high resolution spherical stereo movie, in real-time, was one of the most complex technical challenges the software team faced. The source images were 8,192 by 4,096 pixels, per eye, playing at twenty five frames per second, which is more than thirty times the resolution of high-definition television.

Real-time playback was made possible thanks to the development of a custom codec[12] by iCinema's lead software developer, Matt McGinity. Additionally, due to the resolution and field of view of the HMD, only a fraction of the whole sphere is visible at any one time (see Figure 6.4). By only loading the data required, according the viuser's head orientation, McGinity was able to avoid the major computational bottleneck of reading massive amounts of video data from the hard disk (without which a custom made and very expensive hard disk array would have been required).
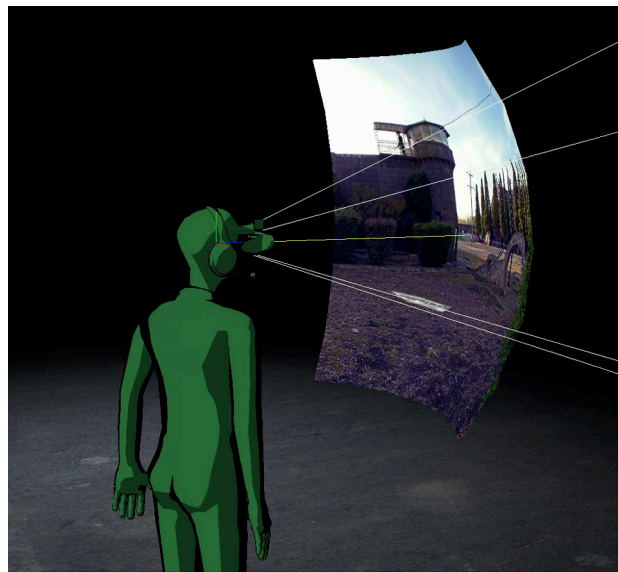
Figure 6.4 Screen grab from Conversations *development depicting the visible portion of the sphere, as seen by a viuser's avatar.*

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[11]Actually there are two spheres, one for each eye, virtually offset by 6.5cm, the average human eye separation (Howard and Rogers, 1995).

[12]Codec is a portmanteau of 'Compressor-Decompressor'. It describes a software code for compressing large files into small ones, as well as how to expand them to their original size later.

At the end of the breakout re-enactment the scene transforms into a dimly lit twilight. Floating ghosts appear from the shadows to form a loose circle around the viuser. The interface and experience is now *Ghost World*.

Ghost World

Ghost World is made up of four elements; avatars, ghosts, Hodson's prone body and the surrounding environment. I will discuss these four elements in turn, showing how they were chosen or designed, how they were created and their role in *Ghost World*.

Avatar: After initial conversations with Shaw, Gibson and McGinity, Steve Weymouth was engaged to design the high-resolution 3D model for the viuser's avatars. For many reasons, such as those relating to gender, age, race and self-identifiability, the chief investigators requested a non-gendered, non-photo realistic, human model, whose facial features would be partially obscured by the same head gear the viuser would be wearing in the real world. When in *Ghost World*, the avatars were animated using a cartoon pixel shader, to give them a less defined form, and coloured red, green or blue. These factors combined to make them as analogous as possible to the abstracted human representations that the investigators requested (see Figure 6.5).

The three avatars are positioned at three points of a triangle that is arranged around the centre of the virtual space. If someone begins the *Conversations* experience while another viuser was already in *Ghost World*, their avatar can be seen walking into position from the darkness, before the breakout film appears, on a semi-transparent sphere, placed around their head (see Figure 6.5). Each avatar's head movements instantaneously reflects the orientation of the corresponding viuser's head tracker, which would occasionally lead to bizarre movements, if a viuser prematurely removed the HMD from their head. However this precise physical/virtual correlation was considered very important for communication in the virtual space.

Figure 6.5 Screen grab from Conversations *development depicting an avatar viewing the breakout scene.*

The investigators required that the viuser would not physically move around, whilst immersed, except to turn on the spot. This is important for a number of reasons, the foremost amongst which was the investigators desire that viusers would not have to hold or mount a movement affordance device, but also due to the real possibility of cybersickness[13]. Thus the virtual environment is arranged around the viuser, both in the breakout scene and in *Ghost World*, where gaze acts as the main mode of interaction.

The idea of using gaze as the primary mode of interaction came out of group discussions between the investigators and the software development team. Such discussions were central to development of *Conversations*. In this case the developers built a prototype stand-alone system to test what "felt right", for the investigators, when interacting with the ghosts. This system was used to answer particular questions about the interaction, such as how far in the distance the ghosts should hover, how long they would have to be looked at before they approached,

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[13]Cybersickness is motion sickness experienced by users of head-steered Virtual Reality systems (McCauley and Sharkey, 1992). Cybersickness symptoms include nausea, eye strain and dizziness. Cobb, Nichols, Ramsey, and Wilson's study of 148 individuals showed that while only 5% of participants had serious adverse symptoms from HMD use, a large number of people had mild, although irritating, cybersickness symptoms (Cobb et al., 1999).

how close they should be to deliver their lines and what a viuser would have to do to break off contact.

Initially, when installed in the Powerhouse, there were no gaze-specific elements in the interaction between viusers, via their avatars. Viusers were able to talk to each other, via spatialised VoIP, such that their voice would appear to come from the position of their avatar, no matter the listener's orientation. During the installation it was found that most people, even though they were informed of the opportunity, would not talk to each other. To address this fact, some encouragement was needed. First a sign was added, similar to that which appeared over the heads of the ghosts, that read "*I'm another visitor… Talk to me…*", which appeared over the head of an avatar, when a viuser's gaze centred on them. Later, a system was employed to change the viuser's field of view, such that when they centred their gaze on another avatar, the avatar would seemed to grow and come closer, but it would not give the sensation that viusers themselves were moving in the virtual world. Despite these additions, people remained very reticent.

Ghosts: There are twelve ghosts, whom Shaw characterises as "narrative agents", in *Conversations*, each closely related to Ryan or his trial. The ghosts are Ronald Ryan, Peter Walker, Ryan's mother, George Hodson, Ryan's defence counsel, an anti-hanging campaigner, a prison guard, the hangman, the prison chaplain, Premier Henry Bolte, the prosecuting lawyer and Justice John Starke.

These characters were chosen and voiced by Ross Gibson, and were all played by professional actors. Ross Gibson commented that the actors needed to find new ways of pacing their performance. Because this work required a large number of "micro-dramas" and was not "the traditional feature film or drama theatre way of directing and acting". The actors may not have a beginning, middle and end to their performance, instead they have a "lot of quick divulgence or quick gestures" (Gibson, 2004).

The actors where shot on same green screen as the breakout sequences, over a period of a week. Ferris and Gibson developed a number of strategies for shooting the characters, such as giving the actors playing Hodson and Ryan blue toned makeup, as they were the only two characters who died as a direct result of this

story[14]. This effect was enhanced in post-production, where these two characters were given a blue smoky radiance. The other characters are shrouded in red smoke.

The process required to constructively embed Gibson's knowledge of the characters, and the texts he had written for them, into *Conversations'* database-driven, interactive virtual environment, was a complicated and revealing one. First, Gibson authored a selection of vignettes for each character, some of which were based on recorded testimony or quotes from newspaper articles, which he called "prosaics". These prosaics, which were usually limited to a single sentence, were not designed to be read in a narrative order to tell a story, rather, each revealed a little about the character or their motivations. Leading questions were also included, such as Ryan asking "Have you spoken to my mother?" or "Who would you like to speak too?".

During filming, each prosaic was performed a number of times, usually three or four, each time influenced by different emotions, sometimes angry, sometimes scared and other times dead-pan. Four different types of scenes were recorded; distant body shot, approaching the camera, speech to camera and eight-point turn. In post-production the recordings were separated and rendered, according to the overall *Ghost World* aesthetic, into individual clips by Greg Ferris (see Figure 6.1).

The next goal was to devise a way to combine these individual clips into sequences, between four and seven prosaics long, for the characters to deliver. Over a number of consultations between Gibson, iCinema software developer Joachim Tesch and myself, a system was designed to provide Gibson with the ability to influence how these clips were presented to the viuser. I created a custom application, over three iterations[15], that Gibson used to tag the individual clips with relevant metadata, which included the key emotions present, the type of clip and, if it was a question,

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[14]Although, evidence suggests that if prison guard Helmut Lange had been included in *Conversations*, he too would have required blue makeup. It is claimed that Lange had knowledge of the whereabouts of the bullet that was missing from the rifle Ryan had taken during his escape, information that would have cleared him of murdering Hodson (Ballantine, 1997). Lange committed suicide on duty at Pentridge on April 12th, 1969.

[15]See Appendix A for a detailed explanation of the application, its development and selected screen shots.

the type of question and the target of the answer[16]. Gibson used this application to tag each individual performance, and remove any compromised ones, for use by the narrative engine developed by Tesch.

Joachim Tesch developed the *Conversations* narrative engine, which used an XML prosaic schema and the clip metadata, to combine the clips into sequences on the fly. Gibson wrote the prosaic schema to Tesch's specifications, such that the narrative engine would know which clips could appear at the beginning of a sequence, which could appear in the middle of a sequence, and which were questions to be used at the end of a sequence. The narrative engine combined the clips, as viusers interacted with the ghosts in *Ghost World*, such that the sequences were as close as possible to being emotionally consistent, according to Gibson's tagging, and that no clips were repeated for any one viuser. The narrative engine engaged the speech recognition system whenever a ghost asked a question, and used the viuser's words to decide which ghost, if one at all, to bring to them next. The speech recognition system was tested, in the iCinema laboratory, with many people, of different ages and backgrounds. Once perfected, it was tested again, this time with talkback radio playing loudly in the background. Accordingly, the system was observed working for everyone who attempted to interact, from children to elderly German tourists.

Hodson: During the transition from the breakout scene to *Ghost World*, the silhouettes of the prison wall and the surrounding buildings and trees remain, as does George Hodson's prone figure. Viusers can, at any time after watching the initial breakout scene, use Hodson's body to transition between the re-enactment and the virtual space. The transition occurs through centring, and maintaining, their gaze on Hodson.

The environment: To make the spherical background environment for *Ghost World* dark, blue-tinted silhouettes of the two background breakout sills were used. An animated, although very slow moving, dark cloudy sky and a poorly illuminated concrete floor were added to give the impression of twilight.

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[16]Questions were either 'yes/no', or open-ended. If a question was 'yes/no', the narrative engine needed to be told which character corresponded to which answer. If it was open-

Viusers are able to witness each other's activity in *Ghost World*. For example, if a ghost approaches an avatar, the other viusers present will be able to see the ghost advance towards and harangue the avatar. Each ghost was filmed from eight sides, doing a simple action that could be looped, such that no matter what angle they are viewed from, they appear to be directly addressing the avatar. This allows the viusers to keep track of, and thus talk about, certain characters.

The immediacy, and intimacy, of the sound is critical to the sensation of immersion in *Ghost World*, as in all parts of *Conversations*. Here the soundscape consists of a constant audible, but not intelligible, whispering that surrounds the viuser, punctuated by an intermittent wind that blows through the virtual environment. The whispering was generated by Robert Hindley from the ghost's prosaics. These sounds were rendered into a three-dimensional (3D) sound score by the team at the University of Sydney's Computing and Audio Research Laboratory (CARlab). The CARlab also provided the software technology that facilitated the 3D voice communication between viusers and spatialised the speech and movement sound effects for the ghosts.

The sound

The limited field of view of the head mounted display (HMD), combined with a complete lack of peripheral vision, means that the wearer receives no visual queues about their surroundings, other than those coming from directly in front of them. In such a situation, especially for the surround, immersive experience *Conversations* seeks to provide, the audio display is of paramount importance. An accurate simulation of real world acoustic behaviour can balance the HMD's display deficiencies, as the audio can provide continuous peripheral information. The world outside the HMD's field of view is no longer a black void.

Conversations includes constant spatialised audio, sensitive to head orientation. For example, in the breakout scene, if a viuser was facing towards the prison entrance at a certain moment, they would hear a car's tires screech to their left, if they turned their head left, they would see the car. As it skids to a halt, the tires' screech appears to be coming directly from the car.

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ended, Gibson was able to provide three suggestions of characters, for the viuser to be prompted with onscreen.

Facilitating the spatial auditory experience was one of the most difficult technical challenges faced on this project. To provide the auditory elements that the chief investigators requested, developers from iCinema and the CARlab needed to create a spatial audio score, from as many sources as the breakout re-enactment required, that would instantly respond to any change in head orientation[17]. Further, in *Ghost World*, the score needed to be integrated with live audio from the viusers' microphones, and the audio triggered by the ghosts' movement and speech. To make this possible, CARlab developers took advantage of their familiarity with, and ability to manipulate, head related transfer functions (HRTF)[18].

Due to budgetary constraints *Conversations* was required to run on off-the-shelf personal computers (PCs), also outside fiscal possibility were the custom sound processing hardware solutions often used for projects of this kind. Current PC technology provides the processing power to calculate between five and ten HRTFs in real-time, however for the breakout scene, thirty to forty individual sources were necessary. These factors forced the team to design and develop a new technology, to provide the spatial breakout score. This technology worked on premise that all the computationally intensive audio rendering could be done off-line, and that the playback would be synchronised to match the listener's head orientation in real-time.

The CARlab devised a system, that they called the 3D Audio Soundtrack Producer (3DASP), which took mono sound source files, created by the sound designer Robert Hindley, and 3D sound trajectories, created using custom software I developed, to build virtual sound space (Jin et al., 2005). From this they rendered the stereo feed for some 393 head orientations. The playback system, called 3D Audio Playback Engine (3DApe) then smoothed over a selection of 50 of these feeds, selected according to the listener's head orientation, to create a fully responsive spatial audio environment[19] (Kan et al., 2005a).

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[17]Here instantly means, practically, a responsiveness fast enough that the human ear cannot detect the change. This requires a responsiveness below 15 milliseconds (Turner et al., 2005).

[18]HRTFs are, in essence, mathematical models of the human ear. They are used compute a binaural sound (to be delivered through headphones) from a single sound source and its location in 3D space.

[19]The design and implementation of this piece of software covered briefly later in this chapter and explored in some depth in Appendix B.

A second, concurrent, system was incorporated into 3DApe, one that allowed spatial rendering of a limited number of sounds on the fly. As well as the voice communication between each of the viusers, these sounds included those emanating from the ghosts: their approach, departure and speech (Kan et al., 2005a). This meant that compelling spatial rendering extended to every sonic element of *Conversations*.

Connecting the parts

> For me the first special thing about *Conversations* was that it was… to be exhibited in a museum. [It was] not a pure research project, like I was working on in the past, where you can have a component that doesn't work perfectly, but you can still convince people of the big advantage of your system… Whereas if you build something for a museum you have to make [sure] that it is [always] running.
>
> (Tesch, interview, 2005)

The *Conversations* installation at Sydney's Powerhouse Museum consisted of many integrated parts. Connecting these parts, in a robust fashion, proved very challenging. Because of the computational complexity of the visual and auditory displays, two computers were required for each station, one for the audio and one for the visuals. The output from these machines needed to be synchronised perfectly, to achieve a coherent experience.

The two machines communicated via a dedicated gigabit local area network and were connected with audio cabling. The sound machine housed 3DApe, which provided all the live and pre-rendered spatialised sound playback, as well as software to send and receive the live audio streams to and from other stations. The software technologies required for the vision system, such as immersive virtual reality, the narrative engine, speech recognition and the multi-user functionality, were authored around the commercial game engine software *Virtools*[20]. *Virtools* was used as a foundation, to which custom software components were added. Approximately 20% of the software used in *Conversations* originated from off-the-shelf products, and 80% from software created specifically for this project.

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[20]For more on *Virtools* see their website; http://www.virtools.com.

The development process

The very nature of the thematic, aesthetic and technical development of *Conversations* is a collaborative one. Partners came from many and varied backgrounds, and their different proficiencies and motivations fueled the project. On a macro scale, the project followed a single-pass development methodology, similar in many ways to the "waterfall" model described earlier. On the micro scale, it used various forms of intimate iteration[21], informed by close dialogue between the chief investigators and the various technologists and designers, and amongst the technologists themselves. Like all projects of this size and complexity, especially research art pieces, *Conversations* had its own idiosyncratic systems for making decisions and for developing the numerous different components and performances.

The overall development was separated into many different parts, from choosing costumes to 3D digital compositing. Nevertheless each part followed a similar developmental process. In each situation a specialist, or group, would meet with a selection of the chief investigators and the others members of the project whose work overlapped with or relied upon theirs. During these meetings technical and aesthetic questions would be raised, debated and decided upon at a conceptual level, after which the specialist, or group, were afforded great autonomy in taking their work forward. This meant that, not only technical implementation choices, but aesthetic, conceptual and experiential decisions, were made by those with greatest proficiency in the area. This applied at all levels of *Conversations'* design and development, from actors' freedom to interpret their character's motivations to Ross Gibson's suggestion of Ronald Ryan's story as a vehicle for the project's desires.

Due to the nature of the project, as well as the number of disparate partners involved, good communication was paramount. During the early development, monthly stakeholder meetings were held at the iCinema centre, in the College of Fine Arts. In the weeks preceding the Powerhouse installation, meetings were held more frequently. Between these meetings, various groups, with specific tasks, held their own meetings, and in some cases, for short periods, members of the development team met every day. When required, sustained email and phone conversations between collaborative, but disparate, development teams, such as between CARlab and myself occurred.

Throughout the whole process, and especially after the first wave of filming, compositing and programming was finished, demonstrations of elements of the experience were held for the chief investigators. These demonstrations, although very time consuming for the development teams, were instrumental in allowing the investigators to influence the practical design of *Conversations*. These demonstrations included important features of the work, such as the look and feel of *Ghost World*, the avatar design, the gaze system for selecting ghosts, the colour, hue and saturation of the breakout film and the layout of the installation stations. The aesthetic and experiential changes that arose out of these meetings and demonstrations required technical revisions, just as technical problems or compromises lead to aesthetic and experiential reassessments.

Time and budgetary constraints, coupled with the technically audacious nature of the work, meant that the final stage of development occurred right up to, and beyond, opening night. Unfortunately the first time anyone not intimately involved with the work's production experienced the *Conversations* virtual environment was during the two weeks it was installed at the Powerhouse Museum. Despite this, the development team, in particular Matt McGinity, Joachim Tesch and myself, and the project's chief investigators, were able to learn a considerable amount during the Powerhouse exhibition, and to implement some important changes to the system during this period. The most germane of these discoveries are presented in the final section of this chapter.

The overall developmental of *Conversations* followed, for the most part, a traditional customer-led software development methodology. It is difficult to determine how successful this was, in terms of viuser experience, as no empirical or anecdotal evidence was recorded. However the project proved very successful in terms of technical innovation, as evidenced by the process of collaborative design, followed by evolutionary iteration, that was used to create 3DApe, the breakout film and its playback system. *Conversations* benefited greatly from the eclectic group of developer's attempts to coherently articulate the chief investigators' complex, oftentimes novel, ideas, inside a multi-user distributed virtual environment.

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[21]Here I draw from ideas of intimate iteration in collaborative creative software development described in Weakley et al., 2005.

6.4.2 My contributions

These can be divided into two categories, the general and the particular. Mine was one of many voices heard during the countless conversations that were held during the design and development process. Further, as part of the core development team, my technical, programming and performative skills were utilised on numerous occasions, on a range of tasks, from digital media management, interaction design, software development, testing, sound editing and mixing, hardware installation and acting, for the breakout scene. Within this collaborative setting, I was designated primary responsibility for two particular software tasks: the 3D sound trajectory authoring environment and the *Conversations* video tagger. I also collaborated with Teewoon Tan and Matt McGinity on the design of 3DApe. Finally, it was my responsibility to ensure that the sound from the designated audio machine remained synchronized with the visual display from the video machine. This required me to produce original software and configure existing technologies. The following offers only a brief account of these tasks; for a full technical explanation of the implementation please see appendices A, B and C.

***SoundPath*: A 3D sound trajectory authoring environment**

During the breakout scene 3DApe provides the high-fidelity spatialised stereo audio score. This score is generated by rendering raw audio files, according to their individual trajectories through the virtual space, into a soundscape. For a coherent immersive experience, the visual and auditory elements of the re-enactment must appear in perfect unison. After the breakout film was completed I created *SoundPath*, which utilised the *Virtools* development environment and Matt McGinity's visual playback technology, to accurately map the 3D trajectories of each sound source. There was no commercial product that would enable us to create these sound trajectories.

Initially inspired by the idea of "sound painting", *SoundPath* was built such that the user, via the mouse, would place a coloured ball on a sound source, a car or a person for example, and then manipulate the ball to trace the source's movement through the scene. The coloured balls were useful for comparison, as they grew larger and smaller as their corresponding sound source drew nearer or further from the virtual centre of the scene. Each sound path needed to be recorded in 3D space to be accurately rendered, simply providing the correct direction was not enough. This required 3DST to have two complementary views: the escape film, as a viuser

would see it in *Conversations*, and a topographic view from above. This enabled angle and depth to be mapped accurately.

SoundPath provides two methods to create a sound path; firstly by following the visual sound source with the mouse as the re-enactment is replayed, or alternatively by selecting the source, with the mouse, at its start point and end points, and then using the timeline to establish the start and end times. *SoundPath* would then extrapolate the path from these two points and times. A combination of both methods was also possible.

Lastly, all paths could be saved, loaded or previewed together and edited. The system worked well, as it was easy to use, and provided very accurate results. Please see Appendix A for a thorough explanation and imagery.

Video tagger

One of the most exciting challenges in this project, from systems design and interaction/interface design points of view, was to provide Ross Gibson directorial power over what would otherwise be a purely mechanical experience. It was logistically impossible, as well as being contrary to the stated goals of the principal artists, to have Gibson orchestrate the *Conversations* experience live, like a 21st century Wizard of Oz.

During the planning conversations between Ross Gibson, Joachim Tesch and myself two important things emerged. First, that there were particular phrases that worked well when said together in any order, some phrases that worked well when spoken together in a particular order and others that could be used as closing statements. Second, that as there were multiple reads of each phrase, Gibson was able to group them according to distinctive emotional tone.

Joachim Tesch created the *Conversations* narrative engine, which required semantic metadata about the individual clips and their emotional tone. To provide these I created the *ConvoTagger* application, which allowed Gibson to specify the emotional attributes of each readings, the type of clip and whether a reading should be used at all. The *ConvoTagger* gave Gibson access to every movie in the database, along with its accompanying tagging options. The application development process included two stages of design, user testing and revision. After talking with Gibson and sketching out my ideas for the tagger I created a fully functional prototype, the most important part of which was to provide, for the first

time, access to the full database of performances. Gibson used this application to reflect upon on the emotional tags, or keywords, he had initially specified. This reflection lead to removal of some tags and the inclusion of some new ones.

The second version of the application included Gibson's new tags and a simplified interface, with more, on-screen, feedback. A system to quickly navigate to any clip, and therefore edit previously tagged clips, was also added. *ConvoTagger* was written in Applescript on Apple OS X, with Filemaker Pro used as the database, and the movies stored in Quicktime's movie format. Please see Appendix B for a thorough explanation and imagery.

The design of, and interface with, 3DApe and 3DASP

The spatial audio elements of *Conversations* resulted from a successful collaboration between the CARlab and the iCinema centre, which began in the winter of 2004. During the initial design meeting — attended by Matt McGinity, myself and the directors of the CARlab, Craig Jin and Andre van Shaik — McGinity and I outlined the project, CARlab's potential role and our conceptual design of what would become the spatial sound playback engine 3DApe and the spatial sound score renderer 3DASP.

The audio production pipeline, in terms of creative output, followed a circuitous route. For example the break out audio score required four stages. First, sound designer Robert Hindley created a sound track, using Foley and synthesised sounds, for each source in the breakout film. Second, using *SoundPath*, I generated 3D trajectories for these sounds. Then CARlab team members Dennis Lin, Alan Can, Craig Jin and Andre van Shaik used the sounds and mappings to generate the breakout score using 3DASP. Finally, the score is presented spatially to the viuser by 3DApe, which was built by CARlab's Teewoon Tan.

3DApe was used to provide all of the spatial audio required in *Conversations*. 3DApe was developed over a number of iterations, informed by internal testing by both Tan and myself. Finally, Tan and I synchronised the score, live triggered sound effects and VoIP with the visual elements of the experience.

Synchronising all the elements of the aural display with the visuals they represented, in real-time, and in reaction to quickly changing head orientation, was a complex task. However the task was made considerably easier by the hard work and technical proficiency of the CARlab team. A comprehensive account of this process

cannot be practically presented here, however those interested in the process will find a brief account in Appendix C.

6.4.3 The Powerhouse installation

> I can tell you this much, life is long, and there's tragedy in it
>
> Ryan's Mother in *Conversations*, as written by Ross Gibson

The Powerhouse Museum

Sydney's Powerhouse Museum is Australia's physically largest, "equivalent to three international competition soccer fields", and most popular museum, whose collection "spans history, science, technology, design, industry, decorative arts, music, transport and space exploration" (Powerhouse Museum, online). *Conversations* was presented from the 6th to the 20th of December, 2004, in the permanent *Cyberworlds* exhibition space, where there are numerous objects and interfaces with which museum goers are encouraged to interact. The Powerhouse is not an art gallery and attracts a diverse audience with many different interests.

The physical set up

The full installation consisted of a waiting room and three immersive stations, each of which could be considered a mini-VR cluster with one personal computer for sound and one for vision[22]. Each station was positioned in a different physical location, around the central waiting room. All six machines were connected via a gigabit local area network, that was created by running cabling in the exhibition's roof cavity to a gigabit switch that was hidden in the an annex behind the screen in the waiting room. This network provided connectivity for multi-user functionality, audio-visual synchronisation and VoIP. Initially the network was part of the Powerhouse's wide area network, but this lead to a number of problems related to latency and IP poaching[23]. Four ushers, who communicated via two-way radio, were present with the work at all times. Three of the ushers remained at their respective stations, as the fourth attended the waiting room, answered any questions, briefed potential viusers and escorted them to the stations.

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[22]The personal computers used in *Conversations* were Intel XEON 3Ghz machines, with 3Gig of RAM each. The vision machines also had NVIDIA Quadro FX 4400G graphics cards.

The station

Each station, in actuality a modular office cubicle, albeit a highly stylised one, contained the equipment required for the experience: two computers, a tracker equipped HMD, headphones and a microphone, as well as a large, nineteen inch, LCD computer screen and second set of headphones. There were included for two reasons; firstly, to enable the usher to verify the system was working correctly and secondly, to allow friends of the person immersed, or passers-by, a chance to eavesdrop on their experience.

The waiting room

Inside the waiting room were two large scrap books, containing clippings from Ryan's trial and punishment, mostly from newspapers. A projection of archival video material, featuring Ryan appearing in court and protests against his execution, appeared on one wall. A live video feed, from one viuser's experience, was projected onto a screen on the opposite wall, it was accompanied by a bank of three headphones and a bench to sit on. This set-up gave people the option, if they chose, to watch and listen to another's experience of the work, before beginning their own.

To aid viusers' introduction to, and contextualisation of, the work, the usher was able to explain many of the facets of the experience and the technology. Because *Conversations* employs a novel interface, one based on gaze and voice recognition, is was important to supply people with the best opportunity to explore all the distributed virtual world contained.

This waiting room also allowed people who were not comfortable with being immersed in the experience or using the technology, a chance to engage with the work passively. And finally, it allowed the ushers a chance to manage the timing of each person's experience, so that friends or family could be immersed in tandem.

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[23]The IP (internet protocol) addresses assigned to some of our machines were also assigned to other machines in the Museum, such that when people arrived for work on the opening morning, suddenly some of *Conversations* PCs could not find each other to communicate.

6.5 Assessment

> By approaching its subject matter through an integrated theoretical, experimental and technical framework, *Conversations* aims to allow the multiplicity, which is history, to be engaged by its users.
>
> (Favero and Shaw, 2005)

As we have seen, *Conversations* is, at its core, a collaborative research project. As such, any assessment of its successes and failures needs to address the project partners' motivations and goals, and their reflections on both the work itself and their involvement in its development and production. This section will explore many of these facets, primarily the achievements and reflections of the iCinema development team, the chief investigators and the CARlab, as well as my own analysis.

6.5.1 Collaborative partners

Conversations is, undoubtedly, important for the iCinema centre. As well as allowing iCinema to continue to explore "virtual environments that [are] content rich, and, at the same time, social spaces", it also provided tangible and institutional benefits (Shaw, 2005). Some of the project's technical outcomes, both hardware and software, are now used in iCinema's AVIE (Advanced Visualisation and Interaction Environment) in the Scientia research lab, at the University of New South Wales. Textual and videographic documentation of the work was used to create the second in iCinema's digital monograph series, *Conversations: The Parallax Effect*. And the advances in virtual reality research lead to the organisers of the 2005 IEEE Virtual Reality conference extending an invitation to McGinity to make a presentation about the project[24].

Conversations' institutional successes are not limited to iCinema. Both the Powerhouse Museum and the CARlab garnered their own rewards from the collaboration. The Powerhouse chose to continue their relationship with iCinema, and the themes presented in *Conversations*, when they included *Conversations@the Studio* in their Decorative Arts collection[25]. The University of

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[24]IEEE Virtual Reality is a conference that focuses on new VR technologies and innovations. In 2005 it was held in Bonn, Germany, from March 12th to 16th.

[25]*Conversations@the Studio* is an "innovative mixed-reality narrative" installation, that visualises a "360 degree global video recording, made on location at the Glass Studio" to

Sydney's Computing and Audio Research Laboratory (CARlab) produced two novel pieces of software, the documentation of which led to presentations at respected audio conferences, the International Conference on Auditory Display (Jin et al., 2005) and the Audio Engineering Society Convention (Kan et al., 2005a). Craig Jin, co-director of the laboratory, remarked that the CARlab was excited by the challenges *Conversations*' auditory requirements generated, and further that they were interested in working on a "real project, in a real setting, where it had to work", as distinct from a pure research project. During our interview he wondered aloud; "can we really do this in real time?" (Jin, 2005).

Projects such as *Conversations*, those with complex technical requirement that span a multitude of competencies, are not possible without willing, and close, collaboration. For such collaborations to be successful, especially in research art pieces, the project must provide outcomes that are valuable to each party, as judged by their respective fields. Clearly stated goals, from all collaborative partners in *Conversations*, be they artistic, technical or developmental, were central to any successes in the development process, as well as those in the work itself. As lead software developer on the project, Matt McGinity, remarked in his interview, for him the outcomes of the project were more than technological advances, also important was the experience of "how to build [such a] system" and learning "how to work in a cross-disciplinary team" (McGinity, 2005).

6.5.2 Technical and aesthetic challenges

> From an artistic point of view, *Conversations* really demonstrates that the success of such a project is predicated on the technical challenges that need to be resolved. But, as important, are the aesthetic challenges, which also need to be resolved to make it work. The two challenges run in parallel, the technology needs to operate, and the aesthetic needs to operate.
>
> (Shaw, interview, 2005)

However ground-breaking the technical achievements of *Conversations*, even to the point of creating world first technologies, each of these developments was created as a direct response to an aesthetic or experiential challenge. The success of the stereoscopic filmic re-enactment of the breakout can be measured as a recognised

provide the "telepresent experience of an actual visit to the Studio, giving full interactive freedom to the viewer's gaze" (iCinema, c, online).

technical achievement, but such an achievement would be in vain were it not for the immersive experience it provided. As cinematographer and compositor Greg Ferris states, "I'm very proud of the fact that we have managed to convince a number of people that we actually shot [the breakout film] at Pentridge [Prison]" (Ferris, 2005). The spatial audio display, although complex and labour intensive, simply sought to recreate real-world acoustic behaviour. Creating the intimate interaction that the prosaics' text and performance merited, or letting people believe that the action totally surrounded them in the breakout scene, was integral to the experience of the work. These elements were successfully and coherently combined to create an experience where "people really, I think, felt embedded in the scene. They forgot totally about the technology, and watched this prison breakout" (McGinity, 2005).

Generating, managing and navigating the large multimedia database used by the "narrative agents" in *Ghost World*, such that coherent, and emotive, prosaic combinations could be generated and delivered in real time, was another complex challenge successfully met. A challenge made more thorny, and interesting, by the necessary development of a methodology to enable Ross Gibson to influence how the performances were selected and combined.

As with all experimental research, there were inherent limitations, problems to overcome and failures to endure, that tempered the excitement derived from the work's manifest successes. One such limitation is the virtual reality hardware. Virtual reality is a complex and costly exercise, whose technological underpinnings are often at odds with the human perceptual system. The head mounted display used in *Conversations* has resolution of 800 X 600 pixels, per eye. The experience it provides is vastly different to normal vision: it bears a closer resemblance to looking through a pair of binoculars. Commercial, that is non-military, HMDs can, at best, offer a reactive window onto a scene. A problem, symptomatic of HMD use, is "Cybersickness", analogous to sea-sickness. In order to avoid this the *Conversations* experience was limited to ten minutes. Unfortunately for some people, especially older people, even this short period could cause visual discomfort. For others, however, ten minutes was too short a time to explore all the virtual environment contained. For some people this technology is off-putting, while others found the interactive element of the experience unsettling, with many preferring not to interact at all. The cultural and generational aspects of this preference for passive engagement are discussed below.

Pierce, Pausch, Sturgill, and Christiansen argue that, for entertainment applications, a successful virtual reality experience, which uses a head mounted display (HMD), needs to overcome particular set of problems. Their research uncovered five common drawbacks, namely that "entering a virtual world is a jarring experience, people do not naturally turn their heads or talk to each other while wearing an HMD, putting on the equipment is hard, and people do not realize when the experience is over" (Pierce et al., 1999).

Drawing on the chief investigators' and the development team's expertise in staging interactive experiences, *Conversations* was designed such that it addressed the majority of these problems. To avoid a "jarring" introduction, viusers began the experience in the waiting room where they were informed of the particularities of the experience and how to navigate in the world, as well as being offered a passive preview of both the audio and video elements of the experience. Further, the experience begins with a slow fade from a black screen, and the breakout action in the film does not begin for twenty seconds, giving people a short period to get acquainted with the interaction possibilities and the environment. The audio display and "gaze" interaction technique were successfully used to encourage people to turn their heads and look around. However, encouraging people to get past an aversion to talking, while wearing a HMD, was more difficult.

To avoid confusion when attaching the various elements of the VR apparatus, the ushers helped each viuser put on the gear. Further, as the HMD straps, when used with headphone and head mounted microphone, are very uncomfortable, the head strap was detached and viusers simply held the display to their eyes. This had the additional advantage of allowing viusers to quickly remove the display if they experienced unpleasant effects. Lastly, when the experience finishes, the scene fades to black, and additional historical information is displayed onscreen. These factors, it was hoped, would help viusers forget out the technology and focus entirely on the experience and the emotive content.

Although there was no logging, public testing or post-use viuser questionnaires or interviews, there was individual, unstructured, observational study of viusers' interaction, made by members of the iCinema development team and some of the chief investigators. One key point, referenced during a number of the interviews with the project's creators and developers, was a reticence, on the part of viusers, to interact with strangers. Matt McGinity believes that one of the most interesting parts of the project was "the one part of the system we couldn't control… the humans."

Further, that "[we] built this system to allow different players to speak to each other, on the premise that people would just want to speak to each other, and found that a lot of people didn't really" (McGinity, 2005).

Conversations was developed under considerable time and resource pressures, a common occurrence in art practice, and especially common in technically complex, interactive art research projects. Although its constituent elements had been integrated and tested in the iCinema laboratory in the weeks leading up to the opening, the first time all elements had been finished and combined, in the exhibition configuration, was the night before opening. Inevitably, a series of technical problems arose during the first few days, which required Joachim Tesch, Matt McGinity, Teewon Tan from the CARlab and myself to work around the clock.

The first three days of the Powerhouse installation were fraught by technical problems. For example, during the first two days, the VoIP between viusers did not work. This particular problem was made more difficult because it could not be re-created when the Museum was closed, and the developers could address it unimpeded. The solution was to remove *Conversations* from the Powerhouse network completely: although this made remote system monitoring impossible, it did resolve a number of connectivity issues, including the VoIP.

The developers and the artists learnt a lot about the *Conversations* piece during its installation in the Powerhouse. Since the exhibition, as well as during the Powerhouse installation, numerous, mostly minor, changes were made to the system. Some changes were motivated by observations of viuser interaction, while others were prompted by unforeseen technical problems. At present there are no future plans to exhibit *Conversations* as a distributed multi-user virtual environment.

6.5.3 Self-assessment

> This is not like "TV-only-better"… this is life.
>
> Lenny Nero in *Strange Days*, late on December 31st 1999[26] .

This section will address my relationship to the *Conversations* development process, the work itself and the experience of it. There were no formal questionnaires or interviews with *Conversations*' viusers during the exhibition, nor was public testing

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[26]*Strange Days* is a film directed by James Cameron (Cameron and Cocks, 1995).

undertaken during development or logging functionality included in the software. As such, the following draws from interviews that Greg Ferris and I undertook with key members of the development team and the work's chief investigators and interviews I conducted with the Powerhouse ushers[27], as well as my own observations of the work *in situ* and the development process.

My *Conversations* experience

Although it is almost impossible for me to view *Conversations* in an objective manner, I can report a subjective enjoyment of the work's immersive virtual environment and systems of interaction. The breakout scene, especially the coherency of the sound and vision, proved an exciting introduction into the world of virtual reality. Whilst experiencing *Conversations* at the Powerhouse, during the final week of its installation, I relished the opportunity to engage with strangers and friends in *Ghost World*, conversing with them whilst immersed in the work. This palpable enjoyment was mirrored in many people with whom I shared the interactive experience, as well as in others that I passively observed. A sense of wonder and excitement was common, especially among the young[28]. Further, due to the enormous database of prosaics and their different performances, during each experience of the work I witnessed new and arresting vignettes, despite my familiarity with the content.

Build it, and they may not come

The breakout scene was, almost, universally enjoyed by those that ushers and I spoke to. One usher recalled a visit by an anti-hanging activist from the Ryan case, who described it as very accurate. Perhaps the breakout was so successful because it was the least confronting element of the experience, one which has much in common with traditional passive media consumption. I witnessed a number of people who, despite being informed of the surround capabilities of the system, did not move their head from its original position throughout the experience. One usher

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[27]I undertook non-recorded interviews with four of the seven Powerhouse ushers. All were contacted, only four agreed to being interviewed. The interviews were face-to-face, in which I took written notes. Copies of the consent form and the interview questions are included in Appendix D.

[28]Two of the four ushers interviewed explicitly remarked that young people were, for the most part, comfortable with and quick to understand *Conversations*' interaction paradigms, in marked contrast to older people.

suggested that the more time people spent in the waiting room, allowing them time to learn about the case, the interactive elements of the work and to witness other's experiences, the better the experience they reported to have. Although anecdotal, this does indicate some of the difficulties people have navigating novel forms of interaction. Another form of interaction that the investigators, the ushers and I witnessed uncomfortable engagement with was verbal communication.

One of the main ideas that the chief investigators sought to explore with this work, one that gave rise to the work's name, is the social, conversational possibilities that a distributed virtual environment could afford. However, a large proportion of viusers maintained a passive observational mode of interaction. Engaging with the work as if it were TV, only better. A telling example of this phenomena occurred whilst I was attempting to troubleshoot the Voice over IP, on the third day of the Powerhouse installation. One of the ushers relayed to me that the VoIP was not working. I donned the VR apparatus and attempted to talk to the other viusers, no reply was forthcoming. A check of the software system diagnostic indicated everything was working normally. Moments later a viuser to my virtual left said "Ryan", in a tone of voice people usually reserve for automated telephone systems and elderly family members. This person was interacting with the voice recognition system, requesting an audience with Ronald Ryan, yet moments earlier that had refused to respond to my repeated initiations. This reticence was common but not universal. Those who did embrace the verbal interaction, tended to do so when immersed simultaneously with friends or family. Here, *Conversations* runs up against the limits of its attempt to challenge the conventions of communication in everyday Australian society. This raises questions as to the work's efficacy as a transformative social experience. I will explore this point further in my final chapter.

My assessment of the development process

The development of *Conversations*, as discussed previously, followed a traditional software development methodology, albeit under considerable time pressures. However, in direct contrast with the commercial sector where a product is brought to market when it is, hopefully, finished and tested, a work such as this is often displayed according a gallery or museum schedule. During early development meetings I suggested we develop a prototype system, for testing and revision, before completing the full system. Due to time constraints and the complexity of the work, this was not possible. Also during the development process, I requested logging be part of the underlying software infrastructure, to aid understanding of

viuser's approach to the interactive elements of the work, however this was not prioritised or implemented. Unfortunately producing the work requested by the chief investigators, and following an iterative development process, informed by rigorous public testing, in the time available and with the resources at our disposal, proved impossible. These constraints were exacerbated by the steep learning curve required to master each new technology, as it was included into the project.

Studying *Conversations* reveals how difficult it is to employ iterative human-centered design in an audacious research art project, with limited resources. But it is not impossible, as I will show in the next chapter.

6.6 Future work

> A project like *Conversations* is a really fundamental research initiative in relation to the future of communications, especially distributed internet-related communications. The internet will evolve, it's already evolving, into frameworks where, you can enter virtual information environments, that are populated with building, characters, other visitors [and] social communities. These are [similar to] parallel worlds, that will have an incredible richness of articulation. All that richness that we already have in the internet…in the text world…[will] blossom in audio visual directions.
>
> (Shaw, interview, 2005)

There are no plans, in the foreseeable future, to exhibit *Conversations*, as at appears in these pages, however is it currently being displayed at iCinema's Scientia Laboratory at the Univeristy of New South Wales, in a new configuration: a hemispherical overview of the virtual environment, and the breakout, is projected onto a vertically mounted three-meter diameter half dome. "This immersive visualisation system provides a highly effective technique for rendering a complete audio-visual observatory of the *Conversations* multi-user, multi-modal, virtual environment with all of its narrative and interactive components, and is a significant advance on the multi-screen monitor setups that have been used until now to elucidate the workings of such complex mixed reality situations" (iCinema, b, online).

Although *Conversations* was created as a way to approach the social memory of Ronald Ryan's escape from Pentridge Prison and his subsequent capture, trial and execution, many of the project's initiators and developers stressed, during their interviews, that the technology and infrastructure created during this project could be used to tell other stories. As Ross Gibson observes, "I've always thought that *Conversations* is the story of Ronald Ryan, but you could possibly repurpose this

work for any number of disputatious situations" (Gibson, 2004). Joachim Tesch asserts that now "we have this technology to, basically, recapture, in an immersive way, an historic scene and allow people to revisit it" (Tesch, 2005). Furthermore, this technology could be used to capture and revisit almost any scene, real or imagined.

6.7 Conclusion

Although *Conversations* required technical expertise as well as financial and institutional support on a scale that is unobtainable for most new media artists, it is commensurate with, and in many ways archetypal of, the large-scale research art projects currently being undertaken at research institutes, art labs and tertiary institutions[29]. Further, it is illustrative of artists pushing the boundaries of the available technology, their budgets and the technologists they are collaborating with. As such, it is an excellent prism through which to view contemporary software-driven interactive art development practices.

This project spawned technological innovations and collaborative partnerships that continue today, as well as providing a unique immersive investigative experience to those who attended the Powerhouse Museum. It is difficult to say how successful the work was as an aesthetic or artistic experience, because no metrics were recorded, nor critical reviews published. Through interviews and observations I have exposed the key successes and failures of the project and, to a limited extent, the viuser's experience of it. It is impossible to ascertain what an iterative human-centered design approach to the development process would have yielded, however the functional success of the speech recognition and the "gaze-based" method of interaction indicate its potential.

> On every level *Conversations* achieves levels of success, but those levels of success open the door to what you could do better. But that's inevitable with a project like this, and that's what it's all about, is actually finding certain limits, making certain bets and understanding where you need to take the research further.
>
> (Shaw, interview, 2005)

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[29]Examples abound of this sort of work, some of which appear in the literature review. Additional examples can be found in Brouwer et al.'s *aRt&D: Research and Development in Art*, the Media Museum at the ZKM in Karlsruhe, Germany or in the recent work of artists such as Rafael Lozano-Hemmer, Christa Sommerer & Laurent Mignonneau and Luc Courchesne, amongst a multitude of other artists, publications and venues.

What has been revealed since [the trial] has confirmed my view and I will go to my own death fervently believing that although Ryan was an unsuccessful small-time crook, he was not a murderer.

Philip Opus, Ronald Ryan's defence attorney, 1997

Chapter 7: Study 3: Day of the Figurines

7.1 Introduction

Day of the Figurines is an artistically driven, pervasive game for mobile phones, that utilises the phone's text messaging functionality to provide an episodic interactive experience[1]. The experience, and the narrative, of the game is long-term and slow-paced, it is interwoven with the player's daily life for twenty four days, requiring them to send and receive just a few messages each day. The twenty four days of the experience correspond to twenty four hours in the life of a dark and grimy, fictional, small English town "that shifts from the mundane to the cataclysmic" (Blast Theory, b, online). The fictional town is manifested, physically, as a large game board housed in a public venue, upon which the player's figurine is placed, and across which the figurine moves during the experience. *Day of the Figurines* is designed to be played by hundreds of people at once. As such, *Day of the Figurines* could be described as a massive multiplayer board game, albeit one that is played in 160 character chunks, on mobile phones.

In order to play *Day of the Figurines*, players must register in the public venue that hosts the game board and the figurines. At the time of writing, *Day of the Figurines* is touring the UK, previous installations include the National Museum of Singapore, the Sónar festival in Barcelona and the Hebbel am Ufer theatre (HAU2) in Berlin, as part of the First Play Festival[2]. To register players must first select a figurine, a very detailed two centimetre tall plastic human figure (see Figure 7.1), from a table of one hundred possibilities. They then provide their figurine with key characteristics, such

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[1]Pervasive games extend the gaming experience into the real world. The term describes games in which the player "becomes unchained from the console and experiences a game that is interwoven with the real world and is potentially available at any place and any time." (Benford et al., 2005d).

[2]For an up to date listing of venues and dates, please see the *Day of the Figurines* entry on the Blast Theory website.

as name and textual description. When this is done, and their phone number is recorded, players are free to come and go from the venue as they please. However, from this point on everything their figurine sees, hears and does is reported via SMS. Players control their figurine through a small set of predefined key words, such that each message they send to the game server begins with a recognised command. For example, to send a figurine to *Kath's Café* a player would SMS "go cafe". The other commands used to negotiate the experience are **say**, **find**, **pick up**, **drop**, **use**, **update**, **help** and **leave town**[3]. After being told their goal is to "help other people", these commands enable players to navigate their figurine through the steadily decaying and morally ambiguous *Day of the Figurines* world, where health is the main metric measure of survival and where the figurines can be incapacitated and even killed.

Day of the Figurines was conceived and designed by the artist group Blast Theory, and developed in collaboration with a number of partners under the auspices of the European Union funded Integrated Project on Pervasive Gaming (IPerG). The main developmental tasks were undertaken by the University of Nottingham's Mixed Reality Laboratory, of which I was a contributing member, with Germany's Fraunhofer Institute providing software for augmentation of the game board and Sweden's Interactive Institute providing ethnographic and evaluative support. All parties were involved in the many design, development and evaluation meetings and tests. As such, *Day of the Figurines* is part artistic performance, part research experiment into pervasive games.

Day of the Figurines was developed between mid-2005 and late-2006, with two major iterations. The first was publicly presented in Laban Centre in London over August and September 2005; the second was inaugurated at the HUA2 theatre, in Berlin, in October 2006. The Laban version of *Day of the Figurines* relied upon human operators to receive and interpret incoming messages and edit and vet outgoing ones. The messaging system for the Berlin version is fully automated, according to rules that were developed in response to the interviews, questionnaires and systems logs recorded during and after Laban. These rules were tested through the development of computational prototypes, and included a large-scale public test at the Sónar festival in Barcelona in June 2006. At the time of writing, this version of

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[3]The functionality of these commands is presented later in this chapter.

the work was on tour around the United Kingdom and had just received an Honorary Mention at Prix Ars Electronica 2007.

7.1.1 Chapter Plan

This chapter contains an in-depth study of *Day of the Figurines*. It begins with reflections on the experience of the work, as it was presented in Berlin. The account of the experience is split into the physical and virtual, and includes some examples of live message sequences. Following this is an account of how the project was conceived, the roles of the various partners and an explanation of why this narrative, in particular, was developed. The third section provides a technical explanation of the more interesting parts of the project, both physical and software, and of the development process itself, as well as detailing my specific contribution to the work's design and development. The last section of the chapter is devoted to reflections on the work, and in some cases its development process, by members of the development team and members of the public, as well as critical reviews.

7.2 Playing the game

06:08am, welcome to Day Of The Figurines. ANGRY JOE has been dropped by a truck at the edge of town. You are feeling OK. Where do you want to go?

7.2.1 Overview

The experience described in this section is that of the version of *Day of the Figurines* that was presented in Berlin, the same technology was used subsequently in Singapore and on the tour of the United Kingdom. It differs markedly from that of Laban, and may be changed again in future iterations. For ease of understanding, the theatrical elements of the game board and registration will be covered separately from the day-to-day experience of the game via SMS. In describing the player's introduction to the piece I will introduce some elements of the narrative's back story, but the motivations for, and the development of, the story will be covered in the following section. This section also contains a number of annotated sequences taken from live logs: these are included to give a clearer picture of the temporal slowness and episodic nature of the experience, as well as the language it employs.

7.2.2 The physical game board

Upon entering the foyer of the HAU 2 theatre, the clean white game board is clearly apparent. The game board is a large structure — around three meters long — with two reflective shields overhead; a juxtaposition of an organically shaped wooden undercarriage, and a metallic overlay with laser cut buildings (see Figure 7.1). The name of each of the fifty destinations is cut into their two-dimensional facades. When close to the board, the small figurines that inhabit the town are clearly evident. The figurines provide a physical overview of the activity in the game, they are seen grouped in twos in the streets or crowded into popular locations, such as pub, The Battle of Trafalgar Square, the sports recreation ground or the hospital. You can see who is talking to whom by reading the small name tags that are attached to each character, or by looking at the live flow of SMSs that is revealed on the small screen embedded into the far edge of the game board (see Figures 7.1, 7.2 and 7.3).

Figure 7.1 Day of the Figurines *set up in the HAU 2 theatre foyer with some close-ups of the figurines and some excited players.*

Sitting a few feet in front of this white metal town is a table covered by carefully arranged two centimetre tall figurines, each one beautifully rendered. The intricate painted figurines depict characters from all walks of life: a pregnant woman, a deep sea diver, a sandaled backpacker, the bride and the wharfie.

Day of the Figurines runs for ten hours each day, from midday until 10 pm. During this period the game board is tended by a team of human operators. The operators register new players by first prompting them to choose a figurine. The player then names and describes their figurine. With these details, and a contact email address and mobile phone number, the operator registers the player, places the figurines on the edge of the game board, representing the edge of the virtual town, and their experience begins. Within a few minutes, usually while the player is still in the venue, the first message arrives. Players are told, ambiguously, that their goal is to "help other people", yet how to do this is not revealed. They are shown the website that will house an archive of all their messages, as well as a map of the board and some explanatory texts. They are then given a business card sized laminated reference card, which depicts the fifty destinations on one side and the recognised game commands on the other, and fits snugly into a wallet.

The operators provide another important theatrical element of the experience. The operators manually move the figurines across the board, following the directions given by the game engine, which are projected directly onto the table (see Figure 7.4). The operators are, in a sense, publicly performing in the inner workings of the game. Whilst providing entertainment, it also promotes interest among bystanders and serves to frame the overall experience for new players.

7.2.3 The virtual town

The second place that *Day of the Figurines* inhabits is the mobile phone network. Conventionally this is limited by a provider's billing area, such as a country or continent, however with global roaming enabled, I concluded my playing experience of the Berlin installation of *Day of the Figurines* whilst in Australia. It is, perhaps, more rewarding to think of the virtual town as inhabiting the player's daily lives, via their phone. Players receive their first message from the game a short period after they sign up, usually whilst they are still milling around the game board. As with all messages from the game to players, this message is prefaced by the time, in game time. This is then followed by a welcome message that suggests three things, that the interaction with the game will be first-person, that important elements of the experience will appear in capital letters and that players can move their figurine anywhere they want. *06:00am, welcome to Day Of The Figurines. PLAYERNAME has been dropped by a truck at the edge of town. You are feeling OK. Where do you want to go?* By replying to this message players can control their figurine's journey

through the town, as it meets and talks to other figurines, visits destinations, finds and uses objects, resolves dilemmas and undertakes missions. As players navigate the virtual town, operators physically move their plastic figurine across the game board.

Game commands

Players control their figurine through a small set of predefined commands:

- **GO <destination name or code>** - move to the specified destination

- **SAY <message>** - send a message to all nearby players

- **FIND <player name>** - this special command checks whether the specified player is in player's the current destination, and if they are, the player is moved to be within talking distance of them

- **PICK <object name>** - pick up the specified object

- **DROP** - drop the currently held object

- **USE** - use the currently held object, triggering its particular effect

- **UPDATE** - inform the player of their current health, which other players and objects they can currently see nearby and, if applicable, what their current mission or dilemma is

- **HELP** - automatically returns a message directing players to the online help, and logs a help request in the system, for operators to deal with, potentially by sending a custom message

- **LEAVE TOWN** - end the experience

Messages that cannot be parsed into one of these commands are responded to with a standard error message, which includes most of the possible commands as a prompt. Also, an error is flagged for that player, to which the operators can respond with a custom message if required.

Game elements and messages

Players receive messages due to game activity, such as when their figurine arrives at a destination, hears another figurine say something, uses an object or has an object used on them, or is given a dilemma or a mission. As *Day of the Figurines* is primarily a text-based work, a clear picture of how it is experienced is best established by revealing messages that are illustrative of those the players receive. All messages are anonymised so that the players only see each other's figurine names, not real names or phone numbers.

Figurines can visit any of the town's fifty destinations, and each time they arrive at a destination they receive its description and any relevant information about that destination. In this example a figurine has just arrived at TH Plating, *12:15pm, you've arrived at TH Plating, the counter is unmanned. DJ RAJ, carrying a CROWBAR is here. There are many CROWBARS here.* When a player uses the **SAY** command, any players who are nearby will hear them speak, for example, *12:16pm, NIKITA said: "pls help me. I hv a defibrillator. I am going to pass out soon. Use e defib on me."* TIKKO, AIDAN and NIKITA are here.

Objects play an important role in the game, both to enrich the town and give people an alternate mode of interacting with, potentially by helping, each other, as well as being used extensively in missions. In this example, SAMMI receives a message after using a defibrillator on JUNOIR, *12:13pm, you power up the DEFIBRILLATOR & apply the pads to JUNIOR's chest; he bucks & sits up, eyes flickering. They're revived! Well done.* This act also instigates a message to JUNIOR, *12:13pm, SAMMI leans over you. A bolt of electricity jumps through you from a DEFIBRILLATOR; you convulse and sit up; feeling much better.*

As well as actively interacting with the game by moving around the town and using objects, and with other players through chatting, players encounter various types of pre-scripted content, that is triggered at certain places at certain times. There three main types of pre-scripted content, in order of increasing complexity, are local events, dilemmas and missions. Local events appear as authored messages, which are sent to all players in a small set of destinations at a specific time. They provide the game with a basic underlying narrative, which unfolds over the 24 days, such as the fete, the solar eclipse or the appearance of soldiers in the town.

04:27pm, the Fete is winding down. A young girl in a navy blue velvet pinafore dress sobs gently as her mother shoves her into a 4x4.

A special example of the local event is the opening message, which is sent at the beginning of each day's play, in this case to all players in all destinations. Local event messages are often designed to include any relevant local information for a player, to encourage their participation, such as this opening message, *12:00pm, two lovers have been found dead in the cemetery. NADJA, sharp, carrying a SLEEPING BAG, and HUNX, with a dimple, are here.*

Dilemmas are events that demand a multiple choice response which, in turn, triggers a subsequent message and can affect a player's health. For example, *08:12am, a blotchy looking young man clutching a Product Barn carrier bag is doubled over on the kerb. Do you A: Ask if he's OK B: Keep going?* To which the player replied *A*, and the system responded with, *08:14am, the man looks up, puzzled. Checking you up and down for a moment, he grins and pulls a receipt from his bag. On it he scribbles: Car Park tonight 7pm.*

The most complex element of *Day of the Figurines*, in terms of authoring, implementing and player completion, are missions. Missions combine multiple events, dilemmas, destinations and objects into, potentially, long-running narrative adventures. For example, at a certain time, all players at the Internet Café will be given a mission to free the dogs from the Rat Research Institute (RRI). Completing this mission involves finding a stepladder (a game object which can be found at the Lock) and taking it to the RRI, then using it to scale the walls to get inside. Once inside they have to correctly answer a dilemma about where to run to next. Choosing the correct answer brings a response telling them to pick up the *SICK DOGS*, at which point the mission is completed successfully, their health increases and a heartening message is delivered. However they fail the mission if they give the wrong response to the dilemma, or fail to complete all of the steps within the prescribed time limit, in which case their health decreases.

When a player's health deteriorates so much that they become incapacitated, such that they can talk but not move or use objects, a special 'help player' mission may be automatically generated. This mission begins with a message that encourages other players in the game to find them and restore their health, for example *11:58am, new task: a woman stops you in the road, she smells of soap: "One of yours: MR RUMBLE is ill at Kath's Cafe, go help them."* Player's health is measured from zero to one hundred and they begin with fifty. When they fall below twenty they are incapacitated and when they fall below zero they are dead. Players are reminded of their health whenever it changes, this information appears as text

appended to the first available message, for example eighty eight is "hot to trot" and five is "fading fast" [4].

The town is often a dark place for the figurines to navigate, full of urban and human debris, unfamiliar turns of phrase, aggressive locals and unexplained soldiers. When combined, missions, dilemmas, local events and inter-player conversations, fill the textual space of *Day of the Figurines* with rich ongoing content, that players can interact with as much, or as little, as they please. Players know that they can, at any time, retreat to a quiet area, such as the cemetery, if they do not want to head to the pub and see a Scandinavia death metal band, or leave town.

Pacing and aggregation

Before, during and after the first iteration of *Day of the Figurines*, interviews were undertaken, questionnaires were filled in and system logs where scrutinised. In response to these investigations, Blast Theory devised an episodic model of interaction, where the game would respond promptly to any message sent by the player, but would quickly back-off from players who were not actively engaged, so as not to flood them with messages. The development team attempted to create an experience that was, in some ways, like reading a book for leisure, such that whenever a person chose to interact with game it would provide a timely response and would remain engaged with that player until that player chose to stop sending messages to the system. However the system would still send players messages deemed important by the authors, such as the local events that drive the narrative and other players' chat messages. The implementation and design on this model is discussed fully in the next section.

SMS is a difficult medium with which to provide any sort of narrative or interactive experience, its primary constraints are that it is slow, often unreliable, low-bandwidth and expensive (especially when measured in dollar per byte of information). To address these deficiencies a system was developed, through a series of prototypes, that took advantage of aggregation and pacing to provide the most relevant and timely information possible. This system used a message aggregation mechanism to include additional information, about nearby players and objects and even a player's current health status, to any triggered outgoing messages, until it reached the 160 character limit. This information was also, somewhat, context aware; for example, if

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[4]A full list of health bands and descriptions appears in Appendix F.

a player arrived at a destination with a defibrillator and an incapacitated player was present, the incapacitated player would be listed in preference over any other player or object.

06:41pm, after searching Max Agra's DIAL, with his muscles flexed, finds you; he is feeling OK. There are many CURRIES and a DEFIBRILLATOR here.

Fine tuning the pacing of *Day of the Figurines* was very important to Blast Theory and the other collaborators. It was decided that whenever someone chose to interact with the game, a response would always be forthcoming in a little over five minutes. Often times this response is a natural one, say, retrieving or using an object, moving around town or requesting an update. But other times, such as using the **SAY** command, this is less straightforward. In cases such as these, if no other message, such as another player's chat message, is forthcoming or pending, players are notified of any changes to their health or surroundings. The movement model was specifically designed to address the issue of pacing. Whenever a player chooses to travel to a new destination, using the **GO** command, they receive content rich engagement along the way. Thus players who engage with *Day of the Figurines* by moving around the town, receive a dilemma, witness a local event or meet another figurine. Again, the particulars of the implementation are tackled in the next section.

7.2.4 The back story

> *Day Of The Figurines* is part board game, part secret society. The game is set in a fictional town that is littered, dark and underpinned with steady decay… Scandinavian metallists play a gig at the Locarno that goes horribly wrong as troops invade the town from the west.
>
> <div align="right">http://www.dayofthefigurines.co.uk</div>

The town into which the figurines are "dropped" is both familiar and foreign, it is a projection of the present into the near future. A deteriorated future which is darker, more violent and less forgiving than the present day. The figurines are treated as refugees by the locals, they are the recipients of nearly constant random acts of unkindness and require the help of other figurines, or perhaps the newly arrived "Arabic" soldiers, whenever their health declines dramatically. Players are told, during their initiation, that their goal is to "help other people", yet how to do this is deliberately not specified. They are left to uncover the rules that govern the virtual town alone, or in collaboration with other players. In many ways the players must

form supportive communities to survive. Perhaps Blast Theory believe that the future, although damaged, has the potential to be habitable, if our societies, and the people within them, can find a way to productively and cooperatively improve it.

Blast Theory refer to the *Day of the Figurines* as a both a morally ambiguous universe and an embodiment of a distinctly English town, destroyed by Thatcherism and bypassed by Blair's Cool Britannia. All of the game-wide narrative elements enforce the notion of a steady decay: the sudden solar eclipse, the fight at the fete, the reporting of two lovers found dead in the cemetery, the troubled gig at the Lacarno and the appearance of the troops. The refugee figurines must learn how to navigate the town and its occupants, how to survive and, ultimately, to decide whether or not to side with the soldiers who enter the town in the final few days of the experience. Blast Theory sought to construct an involving, provocative experience where players explored and constructed the narrative, and thus it does not include a traditional gaming structures, such as points, or winning and losing. As we have noted, players are constantly reminded of their health, as their actions as well as those of the game and their fellow figurines can make them more or less healthy, become incapacitated and even die.
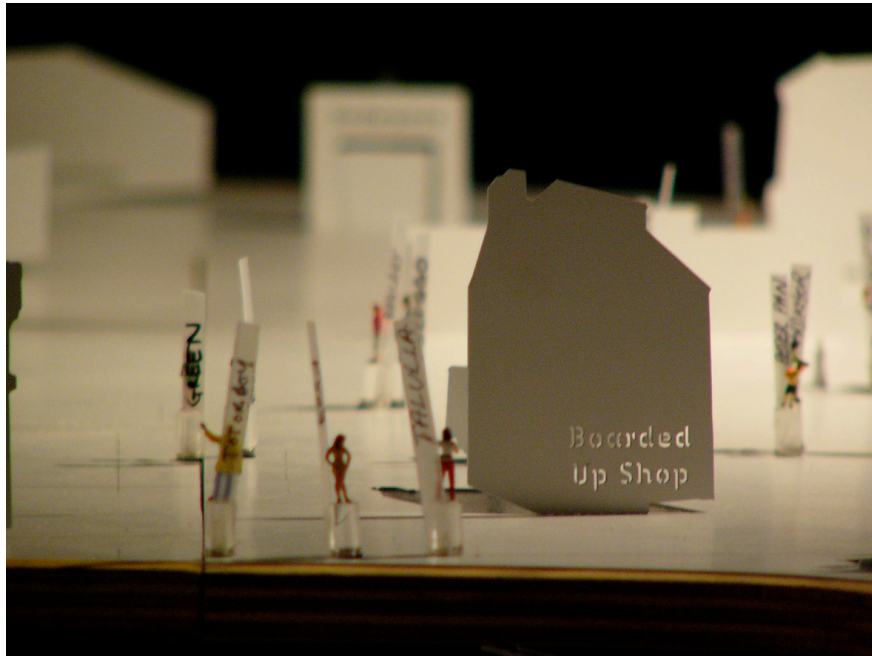
Figure 7.2 Figurines mill around the front of the Boarded Up Shop.

7.2.5 The lived experience

To illuminate the lived experience of *Day of the Figurines* a selection of single player experiences, taken from Singapore and Berlin, are presented below. Four examples are presented which depict typical elements of *Day of the Figurines*: the beginning of the game, using objects (alone and as a weapon), chatting, missions, dilemmas, moving around town and the end of the game. The time each message is sent by or received from the system, in player's local time, is listed in left hand column. This is included to further illustrate the overall slowness and episodic nature of the experience. Messages sent by players are highlighted for readability.

Let the games begin

The following except begins when a player, FLOSS, receives the opening welcome message. Some hours later FLOSS decides to go to Kath's Cafe, and along the way she is presented with a dilemma. Because she does not respond within the allocated time frame she is given a default response and, soon after, arrives at her destination.

Received 10:02 am	06:00am, welcome to Day Of The Figurines. FLOSS has been dropped by a truck at the edge of town. You are feeling OK. Where do you want to go?
Sent 04:49 pm	Go kaths
Received 04:54 pm	06:41am, a cloud passes; a chill runs through you; in the distance shouting. Do you A: Continue on to a street corner B: Rest a moment?
Received 05:29 pm	06:45am, you carry on; a group of men, pre-occupied with a figure on the ground, are shouting. They notice you. The shouting changes. You keep moving.
Received 05:38 pm	06:46am, you've arrived at Kath's Cafe, brickies demolish white food. There are many steaming hot mugs of TEA here. You are feeling OK.

Drums and sticks

In this sequence ANGRY JOE arrives at the canal looking for MARTIN. When ANGRY JOE finds MARTIN he is promptly hit in the face. A rapid-fire exchange follows before ANGRY JOE tries, unsuccessfully, to retaliate using a DRUM KIT.

Sent 12:36 pm	Go canal
Received 12:41 pm	07:00am, a jaunty red and yellow poster reads: "Closing Down Sale: Everything Must Go Today. Products Slaaashed! " - in biro below it reads: Ted is a wanker.
Received 01:24 pm	07:05am, you've arrived at the Canal, a puddle of melted plastic along the path where someone set the dog shit bin on fire. There are many DRUM KITS here.
Sent 13:53	Find martin
Received 02:57 pm	07:14am, after searching the Canal, you find MARTIN, he seems to be run down. You are run down. There are many DRUM KITS here.
Received 02:58 pm	07:14am, MARTIN lashes you in the face with a whippy, leafy branch of English oak (in other circumstances a very fine timber) lacerating your face.
Received 03:04 pm	07:15am, MARTIN said: "bet ur angry now, eh joe?"
Sent 03:12 pm	Say leave me alone you ruffian, your just jealous of my luscious locks, i'm going to hit u wit mi kit, innit
Sent 03:14 pm	Pick drum kit
Received 03:17 pm	07:16am, you pick up a DRUM KIT.
Sent 03:19 pm	Use

Received 03:23 pm	07:17am, you take a whack at a drum. The mood is wrong, the place is wrong, the crowd is non-existent. You can't even rock a baby. You are run down.

Rescuing the sick dogs

This sequence depicts the closing moments of a longer mission where the player must rescue the SICK DOGS from the Rat Research Institute (RRI). It begins when the player returns to the RRI carrying a stepladder. They use the stepladder to gain access to the RRI, however they give the incorrect answer to the dilemma they are posed once inside. They fail the task, which was to free all the SICK DOGS, but they are able to free one.

Received 05:01	10:36am, the fence is high. A passing workman gazes up at that high fence: Gor blimey, guvnor, you ain't getting over that without a step ladder, so you isn't.
Sent 05:05	Say hey everyone, i found a load of stepladders at the lock. Let's see if they get me in.
Sent 05:06	Use stepladder
Received 05:08	10:36am, You are feeling OK.
Received 05:11	10:37am, you nip up the steps and jump down inside the yard. Fantastic work, liberator! Wait for a second to catch your breath.
Received 05:36	10:39am, now do you A: Run across the car park in a crouch to reception B: Creep around the perimeter to a fire exit C: Smash a slot window at basement level?
Sent 06:01	A

Received 06:06	10:42am, you stumble on a patch of greasy substance, alerting a guard in reception. Task failed. You head for the exit and come across a SICK DOG. Pick it up.

Game over

In this excerpt a player joins one of the groups who have gathered at the Recreation Ground. As the game finishes these lucky players are airlifted to safety, everyone else dies.

Received 03:20 pm	05:21am, DELIGHT said: "I'm ill but don't think i should leave this place if e helicopter is arriving here right?"
Received 03:38 pm	05:23am, MIDNITE said: "delight why not?"
Received 03:51 pm	05:24am, DELIGHT said: "THERE'S A HELICOPTER COMING THAT'S SUPPOSED TO SAVE US"
Received 03:14 pm	05:27am, CHERYL said: "its not time yet."
Received 03:16 pm	05:27am, DELIGHT said: "isn't e game ending today?"
Received 03:29 pm	05:28am, CHERYL said: "yeah. Thats what i thought too. I think it does at 9 in the night."
Received 03:42 pm	05:30am, as you all wait, a soldier moves down the line. He stops and shoves you. Do you A: cower B: stare him in the eye C: shove him back?
Received 04:21 pm	05:34am, you can smell sweat mingled with aftershave as he leans close. He flicks you on the nose, giggles and moves on. You are feeling a bit well.

Received 06:09 pm	05:45am, soldiers shove you onto a metal ramp and into the back of the helicopter. It's a crush: HALO, MIMIMOMO, SAMANTHA and PUPPET are here.
Sent 6:14 pm	Say Looks like this is the survivors party. At least i hope so
Received 06:18	05:45am, SAMANTHA said: "i hope this is not a one way ticket to the concentration camp..."
Received 07:18 pm	05:52am, the metal door of the helicopter slams shut, plunging you into darkness apart from a tiny port hole. Through the scratched perspex you can see grass.
Received 08:07 pm	05:57am, with a roar the chopper sways and takes off. Below in the town you see scattered refugees stranded as you bank away into the grey dawn light.
Received 09:17 pm	06:04am, dawn rises over the town as refugees flood the streets. 75 people have died but some have survived. The day is over. Thank you for playing Day of the Figurines.

7.3 Competing and complimentary motivations

Pervasive games are a radically new game form that extends gaming experiences out into the physical world. To achieve a high quality interactive experience for these games, new technologies to support the creation of new compelling forms of content will be explored by this consortium.

IPerG welcome, http://www.pervasive-gaming.org

7.3.1 Overview

Day of the Figurines is a manifestation of IPerG's intent to explore, amongst other research initiatives, "artist-led pervasive games, drawing on the talents of artists to create novel and compelling experiences that offer visions of how more mainstream games might be in the future" (Benford et al., 2006). IPerG, the Integrated Project on

Pervasive Gaming, is a European Union funded research initiative into the future of pervasive gaming. Blast Theory and the Mixed Reality Laboratory, at the University of Nottingham, are active members of IPerG, and took the lead on this project.

7.3.2 Meet the partners

IPerG's members are drawn from commercial, tertiary and arts sectors, to work on a variety of projects loosely grouped into "workpackages" and "showcases"[5]. *Day of the Figurines* was developed as part of the "City as Theatre" showcase, which has three central motivations:

• Artistic uses of new technologies that draw upon the creativity and vision of artists can pave the way for more mainstream commercial applications.

• Staging artistic works at new media festivals provides access to public audiences as experimental subjects for IPerG research and also raises the public profile of the research.

• Artistic performance is a culturally important application area in its own right, and one that can successfully draw on emerging game technologies. (Benford et al., 2006)

Of the many partners involved in IPerG, *Day of the Figurines* was developed, primarily, by four groups: the Mixed Reality Laboratory, Blast Theory, the Interactive Institute and the Fraunhofer Institute. I will now briefly describe each group's interest in the project's themes, their core proficiencies and their roles in its development.

The Mixed Reality Laboratory (MRL) has been involved in the development of, and study of the experience of, pervasive and ubiquitous technologies ever since those technologies became available[6]. *Day of the Figurines* could be seen as forming part of a suite of pervasive experiences, such as the *Augurscope* (Schnädelbach et al., 2002) or the successful "pervasive performances" developed in collaboration with Blast Theory, *Can You See Me Now?* (Flintham et al., 2003) and *Uncle Roy All*

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[5]The full list of workpackages and showcases, as well as all project partners, and links to their sites, can be found on the IPerG website; http://www.pervasive-gaming.org/.

[6]The MRL, and its work, is discussed in section 4.3.

Around You (Benford et al., 2004). Yet all these works were limited in scale — in terms of the number of people who experienced the work — and tied to specific locations. The MRL also has a strong history of real world ethnographic studies, (such as Crabtree, 2004b; Benford et al., 2005e), and is especially proficient investigating the situated experience of novel interactive artistic interfaces (Koleva et al., 2001; Flintham et al., 2003; Crabtree et al., 2004; Benford et al., 2005b). For *Day of the Figurines*, the MRL team, of which I was a member, was responsible for developing software for the game system, content authoring and input, live orchestration and interfacing with the board's visual augmentation and display. The team also lead an ethnographic study of the work.

Blast Theory seek to explore "interactivity and the relationship between real and virtual space with a particular focus on the social and political aspects of technology" (Blast Theory, b, online). This exploration is driven by what Blast Theory cofounder Matt Adams describes as a "fiercely held belief in the political consequences and ramifications of personal actions and behaviour". This concern, in many of their works, "takes a clearly political stance" (Dekker, 2002). In *Kidnap* 1998 they addressed the question, "can you consent to a crime that is perpetrated against you?", by inviting people to sign up and agree to the possibility that they may be kidnapped (Rampton, 1998). Subsequently Blast Theory, after subjecting a small number of these people to extensive surveillance, chose two and kidnapped them. They then broadcast their hooded images live on the internet[7]. Another example is the ephemeral video work *TRUCOLD*, for the 2002 Biennale of Sydney. Long takes from a fixed camera of empty, darkened urban settings in London and Karlsuhe, devoid of human activity, this is a product of the group's interest in "physical displacement, amnesia and time travel" in urban spaces (Blast Theory, f, online). *Day of the Figurines* extends the politico-technical narrative of Blast Theory's recent artistic output, namely *Can You See Me Now?* and *Desert Rain*, by engaging with contemporary themes such as migration and what has been called "refugeeism", the telecommunications invasion of people's private time and private space, community building versus social isolation through internet communications and the rise of gaming.

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[7]Details of the work, including the advertisement used to encourage people to sign up, at: http://www.blasttheory.co.uk/bt/work_kidnap.html.

Blast Theory's art practice uses non-traditional mediums as part of a commitment to reach "a culturally literate audience outside those typically addressed by performing arts, visual art or digital art". They "seek to use forms… that operate outside spaces traditionally associated with art, that appeal very widely and provide a powerful hook to draw people in" (Dekker, 2002). In *Day of the Figurines*, gaming is the hook and the mobile phone is the console, a ubiquitous device that offers the widest possible use. Blast Theory first started using games in 1997 because games offered a "different route" to those found in theatre and film, and because they enabled the group to "move beyond narrative as a way of communicating ideas" (Dekker, 2002).

Blast Theory exemplify the contemporary practice of artists who produce "frequently challenging, provocative, and 'difficult''' works that do not sit neatly in a single craft-based fine art category (Hopkins, 2000). They "combine interactivity, installation art, performance and game structures within a single work" (Dekker, 2002). Further, their creative methodology does not follow the traditional artists-as-genius model, as seen in painting, nor the artists-as-auteur model seen in filmmaking, rather they see their art projects as active collaborations. These collaborations, with specialists from various fields, are driven by experimentation, feedback and the collaborators' attempts to understand the audience experience: "great emphasis is placed on the audience and focus is on the experience. As the group's work has become more complex this process of assessing what is happening and why is of increased importance" (Blast Theory, e, online).

For *Day of the Figurines*, Blast Theory provided all the narrative and textual content. They defined all parameters that related to the game's experience, such as pacing and aggregation architecture (that is, how text message elements were created and combined), induction into the game, the board's overall design, the website and a myriad of other details[8].

The Fraunhofer-Gesellschaft is a large publicly funded research institute in Germany, with some 50 departments, more that ten thousand staff and a wide remit to undertake "applied research of direct utility to private and public enterprise and of

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[8]Discussion of Blast Theory, and some of their work, also appears section 4.3. A list of their work can be found at their website: http://www.blasttheory.co.uk/bt/chronology.html.

wide benefit to society" (Fraunhofer, online). The Fraunhofer's Institute for Applied Information Technology was responsible for developing the game board augmentation software, which was used to help the operators move the figurines, in batches, around the board.

The final active partner is the Swedish non-profit, experimental IT-research organisation, the Interactive Institute. Interactive Institute researchers were involved in the experiential and systems design of the work, as well as the ethnographic study in Barcelona and observational study in Berlin[9].

7.3.3   Articulated motivations for *Day of the Figurines*

> One of the motivations for this work is to make a morally ambiguous universe. We're making a case here for how games — which tend to be morally dry and lifeless — might be made to work…Can art exist on your mobile phone? Can it exist in your pocket, rather than in a gallery or a museum or a theatre?
>
> (Adams, interview, 2007)[10]

The process of designing, developing and evaluating the two *Day of the Figurines* iterations is documented by a series of large, collaboratively written specification and review documents, that signpost the project's progress. In *Design Specification and Development Report for the first City as Theatre Public Performance*, the first iteration, and its predecessors, are described (Benford et al., 2005c). In this document Blast Theory and the MRL detail their motivations, mainly in terms of the experience they intended the work to provoke. With the ideas for the game board, general narrative, figurines as avatars and navigation via mobile established in the previous iteration, this document outlines the two main themes that influenced the design of *Day of the Figurines* game play.

Firstly, whilst the game should supply specific tasks, or pose particular questions, "the general focus is on setting an imaginary society into being and allowing the players wide agency to determine the nature of what happens", such that the "focus of the game is on social interaction and emergent behaviour". Secondly, the authors intend that *Day of the Figurines* be "viewed as a cultural experience", one that is an

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[9]You can learn more about them on their website: http://www.tii.se/.

[10]Taken from an interview with Blast Theory's Matt Adams in *The Times* (Coleman, 2007).

"intellectually and emotionally engaging experience", and that promotes active reflection upon contemporary culture (Benford et al., 2005c).

Outside of these two main themes, a number of more practical elements needed to be engaged. Specifically, that the "targets underlying its design are to: support one hundred simultaneous players; run for four weeks; and be playable by members of the public using their own phones" (Benford et al., 2005c).

Supporting these requirements, in many cases, made other decisions easier. To support player numbers in the hundreds an automated system was needed, yet a manual one was used during the initial round of testing and development in Laban. To allow *Day of the Figurines* to run for nearly a month, an intentionally slow game was required, one that players could dip in and out of, episodically, and one that would be part of the their lives. This leads us to mobile phones, and in particular SMS. Although mobile phones are owned by 85% of the adult population in the UK (Collins, 2006), the majority of these phones do not have MMS or web access, and very few have an operating system capable of supporting a stand-alone application (Greenhalgh, 2007). To enable all interested players to play, SMS was chosen in preference to a stand-alone application or web interface. The aim of *Day of the Figurines* is to provide "a rich narrative experience through the relatively sparse medium of SMS messaging that combines interactivity and improvisation, but in a scalable way" (Benford et al., 2005c).

7.4 The development

10:12am, a heavy jawed woman enters shaking a Blue Cross collection box - an emblem of a sick looking dog. She smiles at you sympathetically and moves on.

7.4.1 Overview

Before the process of designing, developing and evaluating *Day of the Figurines* began, a comprehensive review of the pervasive game literature, focusing on methodologies for development and evaluation, was undertaken. The review resulted in the specification of what could be best summarised as a "public performance as a research method" for the project (Benford et al., 2005a). Also prior to the commencement of the design process, a series of small-scale pervasive works were undertaken by the MRL and Blast Theory to tease out the some of the themes that would be addressed more directly with *Day of the Figurines*, and to learn as much as possible about the form and the experience of it.

This section describes how *Day of the Figurines* operates, both in the physical and the virtual space, as well as the project's design and development process and my particular contribution to it. Also included is a series of SMS exchanges; annotated as to reveal the workings of the underlying technology.

7.4.2   The physical space: the game board and the figurines

10:06am, you've arrived at the Locarno, "Satan's Bubbly Fjord, 9pm tonight"
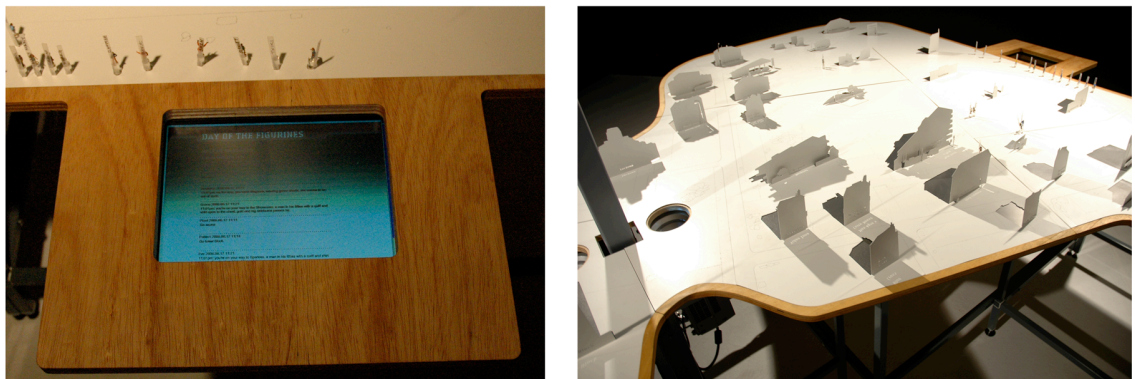
Figure 7.3 The game board. The live SMS flow. Laser cut features of the town.

The most important part of the physical, performative element of *Day of the Figurines*, apart from the figurines themselves, is the game board. The game board surface consists of a wooden underbelly, supported by lightweight metal legs, with a mild steel overlay, into which the fifty locations have been laser cut. The individual destinations are cut in such as fashion that they can be bent, once, into place like a pop-up book (see Figure 7.3). From this point on, however, they must remain upright. The board is made up of six individual pieces that fit together like a jigsaw, and can be easily separated and returned to their flight cases for touring. From the centre of the board, two metal poles extend more than two meters above the town, affixed to the poles are two surfaces that act as mirrors for the board augmentation system. They are made by stretching heated foil over an aluminium frame, this material was chosen as it is lightweight, and thus easier to suspend, and much cheaper than a conventional mirror. Two projectors are mounted in the board's undercarriage, and set to point up through two holes cut in the board's surface (see Figure 7.5). These projectors are aimed at the suspended mirrors, and are bright enough to provide a visible display on the board, even in a space with a large amount of ambient light.

A small LCD screen is set into the board's surface, it protrudes from the town midway along its longest edge. The LCD screen reveals a real-time view of incoming and outgoing messages from the system (again, see Figure 7.3). The display is generated by a simple Adobe Flash application, embedded in a web page, that polls an XML file that contains a list of new messages. The XML file is generated specifically for this purpose by the game server, which makes it publicly available on another website.

The figurines play three important roles, firstly to personalise the experience and give people the option of playing a fantastic persona, secondly as a physical manifestation of virtual game activity and lastly, as a focus of

Figure 7.4 Visual augmentation of the board being used to help operators move figurines

attention, that can encourage new players to join the game (see Figure 7.1). The figurines were bought pre-made from Preiser, a German model railway company, and mounted onto a small plastic cylinder, which in turn is glued to a tiny magnet[11]. The cylinders are used to keep sitting and lying characters off the ground, to give the operators a way of holding the figurine without damaging it and to attach the figurine's name tag. In Berlin and Barcelona the figurines were presented on a square topped table, which allowed potential players to browse a large number of figurines at once. This presentation also worked to attract attention and its fair share of amateur photographers.

About once an hour, during the ten hours of game play per day, the game board is updated. In this procedure the operators, usually local volunteers, remove the projective caps from the projector lenses, lower the house lights and start the board

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[11]Preiser have an amazing array of figurines. For detailed pictures and a catalogue see; http://www.reynaulds.com/preiser/preiser.html.

augmentation software. This software keeps track, internally, of where each figurine should be placed on the game board, it also polls an XML file that is made public on the game server's website. This file contains movement information for each figurine, basically; the name and game ID of the figurine, where it is moving from and to and the time it requested to move. The augmentation software uses this information to work out which figurines need to be moved, and to generate new positions for each one that does. One by one the figurines are moved, by first projecting a circle around the figurine in question, and then by drawing a line, headed by an arrow, to the point that the figurine must be moved to. The figurine's name is projected onto to two obvious places on the game board so that the operator can easily read it and verify that the correct figurine is encircled. Although the projection can be seen in relatively bright light, the house lights are normally dimmed to draw attention to the theatre of the update. In some cases, the operators ceremonially read aloud the figurine's name and destination.

The board was designed by Blast Theory and ActionTimeVision in Brighton, England, with construction, using a laser cutter, by a metal worker under the direction of Ulla Winkler from ActionTimeVision. The board specification was informed by reflections on the prototype version built from card for Laban, and the changed requirements from the Laban to the Berlin versions of *Day of the Figurines* (see Figure 7.5).
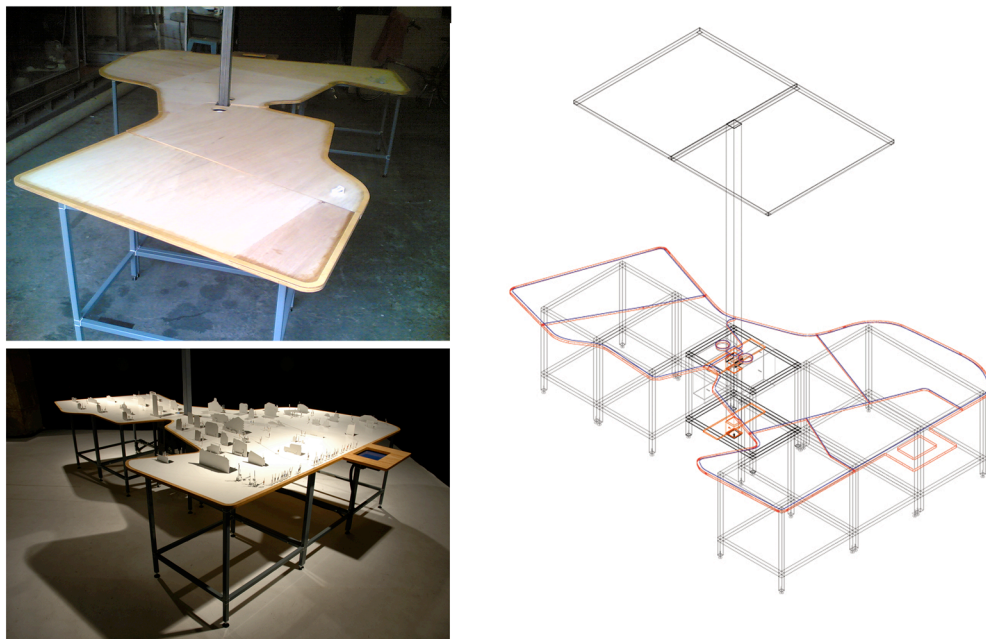
Figure 7.5 Building game board. The design, the board during fabrication and the finished product.

7.4.3 The SMS space: the game engine and its components

Day of the Figurines' software infrastructure was developed over two major, and a number of minor, iterations. It consists of many parts, from authoring and orchestration to message processing and figurine movement. To properly understand how the development process unfolded, and how the final version worked, it is important to examine the first iteration (referred to as DoF Laban hereafter), and to understand how it was used to influence the ongoing development process. Before explaining how the engine, monitoring, authoring and orchestration environments work, in detail, I will briefly describe DoF Laban and the results of its evaluation. An investigation of the development process will follow; covering what process was used, why it was used and how faithful it was to the intended developmental methodology.

DoF Laban

For DoF Laban a system akin to a paper prototype, an HCI technique often used in interface design, was created[12]. A massive paper spreadsheet — containing the narrative streams and specific events that fill the game — was stuck to a wall which Blast Theory and the volunteer operators used, in conjunction with player location and player activity, to generate the messages players received. The messages were a mixture of pre-scripted content and improvisation. The narrative themes, place names and key cathartic events were very similar to those in Berlin, previously described. Sending and receiving messages was aided by a semi-automated system, built in php and MySQL on an Apache Webserver, with messages delivered via a commercial SMS Gateway.

Before DoF Laban was built, two private tests were undertaken, the first ran for four days in April 2005, with ten players, and the second ran for five days in June 2005, with twenty five players. This iterative game design process was used because it "allowed the first tests to take risks. In particular, the designs of the first two tests prioritised a non-didactic approach to game

Figure 7.6 The Laban game board.

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[12]A paper prototype is "variation of usability testing where representative users perform realistic tasks by interacting with a paper version of the interface" (Snyder, 2003)

play in order to allow the widest possible modes of game play" (Benford et al., 2005c). A semi-automated system was used in the second test, which allowed messages to be typed in and easily sent to a single player, as well as keeping a record of player's message activity and providing basic handling of incoming messages. It soon became apparent that "improvising conte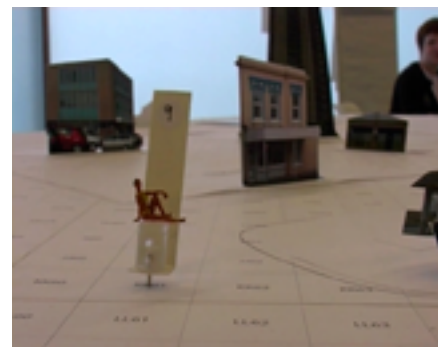nt to respond to all of the players' actions was impractical", especially with the stated intention of growing the game numbers into the hundreds (Benford et al., 2005c).

The two private prototype tests influenced the design and development of the first stable version of *Day of the Figurines*, which was presented at the Laban School of Contemporary Dance in South London, over twenty four days in August and September 2005, with eighty five players. Once players have undergone the familiar induction process[13], their figurine, in this case mounted on a pin, is stuck into the game board at a randomly chosen position. DoF Laban followed a turn based model, which extended to figurine movement, such that every seventy five minutes the game engine moves each, currently moving, player a small distance towards their destination. At which point the operators update the figurine's placement on the board, process any messages players have sent and send them any messages they are due. As such there is a direct correlation between the distance from one building to another, and the time it takes a figurine to 'walk' there. The figurine's position, the surrounding town infrastructure and details about the players they meet, are displayed via a web interface hosted at http://www.dayofthefigurines.co.uk. Players were also given a small map of the board when they sign up. Figurines who are loosely co-located can talk to each other; when conversations occur outside one of the distinct locations they are managed, or improvised, by the operators.

DoF Laban was supported by a suite of custom built web-based tools. These included an authoring tool to seed content, such as destination descriptions for different times of day, an operator tool for stepping through a turn in the game and a tool for reviewing, and editing, all outgoing text messages before they were sent to players. The operator interface also revealed an indication of the player's current level of engagement with the game (engaged, dormant, disengaged or 'game over').

DoF Laban was designed as an experiment, a first draft, and it yielded a wealth of information about how such a game can be designed and is experienced. The key

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[13]The script for this induction process can be found in Benford et al., 2005c, page 39.

elements of this investigation, which greatly influenced the ongoing development of *Day of the Figurines*, are presented in the following section on the development process. A full account of DoF Laban can be found in (Benford et al., 2005c) and (Tandavanitj and Flintham, 2005).

Day of the Figurines: Berlin, Singapore, the UK and beyond

The planning and design of the second iteration of *Day of the Figurines* began early in 2006. As their starting point the authors agreed that, in order to properly respond to the recommendations outlined above, *Day of the Figurines* must become a stand-alone, technologically stable, automated software system. The software development process is described in detail later in this chapter. Through a series of in-house tests — and a single large public test at the Sónar Festival in Barcelona, held from the 15th to the 17th of June 2006, with one hundred and sixty players — we developed a suite of software tools and a stand alone game engine, that I now will describe in detail[14].

The software infrastructure for *Day of the Figurines* can be neatly divided into two parts, the game engine and the supporting tools[15]. I will begin by describing the game engine. The game engine was written by Martin Flintham, researcher and developer at the MRL, and myself. To facilitate independent testing and verification, to assist logging and debugging and to clearly delineate tasks, we broke the engine into three parts, linked by the idea of a "game event". The core game engine parses incoming messages and responds to time triggered local events to make changes to the internal game state and to create a series of "game event" objects, each one representing an action in the game. These game events are used by the message renderer, according to rules developed by Blast Theory, to decide when a message should be sent to a player, and what that message should contain. This allows developers, and operators, to easily follow all the activities of a particular player,

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[14]The following draws on Flintham et al., 2006 a 20,000 word IPerG report on *Day of the Figurines* that I co-authored with other members of the development team.

[15]The game engine and the majority of the supporting tools were implemented using a software platform called EQUIP2. An EQUIP2-based server component, hosted by an Apache Tomcat instance, enabled the developers to access a relational database (MySQL) through JSP pages on a public web-server. For an in-depth technical discussion of the underlying software infrastructure upon which *Day of the Figurines* is built please see "Addressing Mobile Phone Diversity in Ubicomp Experience Development", a paper I have contributed to on this particular topic (Greenhalgh, 2007).

object, destination or even mission or dilemma. The final part is the SMS Handler, which receives and processes incoming messages from players to be delivered to the core game engine and delivers outgoing messages to the SMS Gateway (see Figure 7.7). This allowed us to easily fake incoming messages to test the system, and to create outgoing messages without actually sending, or paying for, them.
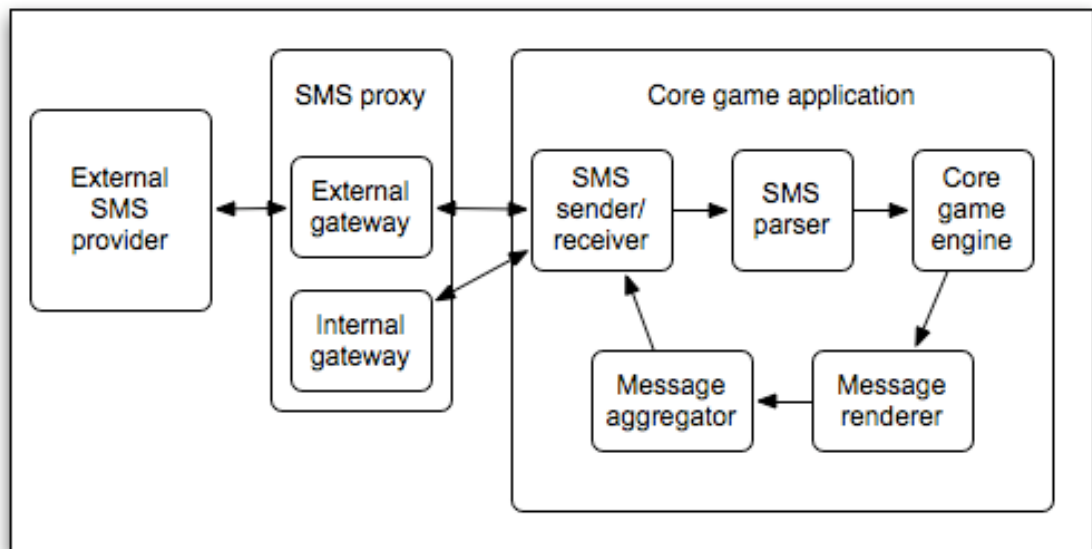
Figure 7.7 The core game software architecture.

A clear understanding is best obtained through example. Described here is the situation mentioned earlier where SAMMI revives JUNIOR using the defibrillator. The action starts with SAMMI sending a message to *Day of the Figurines*, *use defib*. The core game engine recognises this is one of many allowable aliases and misspellings for defibrillator. As SAMMI is holding a defibrillator, the game engine searches for a player near SAMMI who is incapacitated, it finds JUNIOR. The game engine creates a USE OBJECT event for SAMMI, which contains all the details of the event, such as where, when, on whom and what object. As SAMMI has successful revived someone, he 'feels better' and receives a health bonus, consequently the game engine creates a health change event, which includes SAMMI's details, and the health change amount. It also creates a OBJECT USED ON event for JUNIOR, with the same details to the USE OBJECT event. Finally it creates a health event that indicates JUNIOR's health has changed. The core game engine has now finished its job, and goes back to waiting for new incoming messages, or triggered local events. The message renderer 'listens' for the creation

of game events, many of which it ignores, but the USE OBJECT and OBJECT USED ON game events are the sort it is waiting for.

The message renderer uses the details inside particular events to turn the 'message specification' for this event, into an actual message. Every message, or part of a message, that a player receives from the system, begins life as a message specifications authored by Blast Theory. In this case the message specification reads;

> *you power up the DEFIBRILLATOR & apply the pads to* RECIPIENTNAME's *chest;* HESHE *bucks & sits up, eyes flickering. They're revived! Well done.*

After it has been processed by the message renderer, it reads;

> *12:13pm, you power up the DEFIBRILLATOR & apply the pads to JUNIOR's chest; he bucks & sits up, eyes flickering. They're revived! Well done.*

Once the message is created, the message renderer then checks its length to see if there is room for further information, in this case there are 141 characters, leaving only 19 to spare. It then checks to see if any information, relevant to that player, can be squeezed into the available space. Examples of this process at work can be seen dotted through this document, many displaying one of the three main forms of information that can appended to messages; who is present, what is present and how the player is feeling. The most obvious time to include this information is when a player arrives at a new destination.

For the tests in Laban and at the Sónar Festival in Barcelona large poetic destination descriptions were supplied whenever a player arrived at a new destination. Studying the feedback it was clear that players enjoyed the evocative language of these messages, but wanted to know who and what they could engage with in a new destination. In response we developed a two-tiered system of destination descriptions, such that if no player or object is present, and it was the player's first visit to a destination, they received a long embellished description. If the player is returning, or the destination was populated, a brief description is used with additional information appended. Further, when there are many people and objects present, information is provided in such a way to imply there is more to know, for example; *08:05pm, you've arrived at the Trafalgar Sq, it's busy - every ashtray bulging. SCOUT is nearest. There are many PINTS here.* Finally, to avoid

repetition, the message renderer records what information it includes in each message, such that a player is only informed of who is present in their destination if someone new has arrived, for example. Once a message is ready to be sent, it is passed of to another part of the system, the SMS Handler, for delivery.

Additional to the shift to full automation, there are a number of key advances from DoF Laban to the current *Day of the Figurines* system. The three most important are the change to a hub model of travel, the inclusion of missions and the use of pacing and aggregation when sending messages.

A hub model of movement was introduced, in part, to enable the game to always respond, whenever a player choose to interact. The act of 'going', sending a **GO** message to the system, results in the player receiving dedicated content on their way to their destination, in the form of a mission, dilemma, local event or meeting with another currently traveling player. This response always arrives within the chosen game response time, usually about six minutes. Again for example; *10:09am, you're on your way to a street corner. You meet CONSTANCE, She has a spy-umbrella, she seems to be poorly.* A further forty-five minutes after this interaction has completed, the player will arrive at their stated destination[16].

Missions, described earlier, are allocated to players one at a time, according to player's presence at certain destinations in certain time windows. Each mission has a set period before which it expires, at which time it triggers a message and, possibly, a detrimental change to player's health. In terms of authoring and programming, missions were one of the most challenging and time consuming elements of the project; despite this fact fifteen missions were authored for Berlin. Blast Theory strongly believed that the development and inclusion of missions was required to realise their intended game play experience.

The terms "pacing and aggregation" are used as convenient short hand for a series of measures undertaken to prefect the 'flow' and content of messages. Aggregation is described above, however perfecting message flow provided a different, and interesting, technical challenge. The first challenge was to understand how players' experience of the game was affected by the number and the individual, and

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[16]The 45 minutes listed here is the amount of time it takes to travel from any destination to any other, regardless of their position on the game board. As with all time-outs, it is initially set by Blast Theory, and can be altered whilst the game is running.

collective, timing of the messages they received. Secondly, how to expose elements of the system to Blast Theory, such that they could tweak the message flow and positively affect the resulting experience. The first step was to prioritise all possible game play elements, from witnessing another player pick up an object at one extreme, to telling a player their figurine has died at the other, then work out at which point a single action requires a message be sent to the player. Information deemed less important was then earmarked for aggregation. Further, every possible response time, be it due to a player sending a malformed message, a local event occurring or a player moving around the town, had its own alterable time frame. The result was that developers during testing, or Blast Theory when the game was live, could easily affect the game's overall or individual element's pacing, and even the game clock itself could be speeded up. Another development initiated by the testing and feedback was in the introduction of "silos" in destinations.

Internally, destinations are divided into multiple invisible silos which are used to group players into conversational subgroups, such that each **SAY** message is only distributed to the other players in a particular silo. Each destination has its own silo size, enabling some destinations to feel lively or crowded (for example the Locarno nightclub has a silo size of ten), while others feel quiet, even solitary (for example the Cemetery has a silo size of one, so that you are always alone). If a player arrives at a destination looking for someone, but ends up in a different silo, they can use the **FIND** command. This extends the metaphor that some places are large, like a nightclub, but if you look around, you can find who you are looking for.

> *08:50pm, after searching the XXX Cinema, you find DR NO, he seems to be mortally ill.*

I will now very briefly describe the software tools that were developed to allow the onsite operators, Blast Theory and the development team to input narrative content, test prototype versions, monitor the live game, troubleshoot problems and orchestrate the players' experience.

The core system, and its helper applications, all run on a single remote web-server; this means that any web-enabled computer, via a browser, can be used to monitor or orchestrate the game. The only part of the system that is built as a stand-alone application is the board augmentation software, due to it requiring a locally configured display for rendering figurine movement on the game board.

The orchestration of *Day of the Figurines*, by the local operators, takes a number of forms. Primarily the operators entice and induct new players, monitor the game play and move figurines around the game board. Monitoring the game play includes responding to **help** messages from players, monitoring messages from players that the system does not understand and if necessary crafting tailored help messages to them, checking for failed messages to the commercial SMS provider and starting and ending the game each day, all of which is done through a series of web pages (see Figure 7.8). The operators can also view player profiles (which include all information about a player, including their message history) and the overall game activity, as well as send custom messages to particular players or generate graphs of activity trends.

Figure 7.8 An example operator interface. In this case the operator is able to see all relevant information about a particular player, including their recent message history.

The content authoring system provides a number of ways of creating, editing and reviewing any element in the database, from mission stages to destinations

descriptions. At the most basic level are generic, automatically generated, web-forms that allow modification of all aspects of each content type, with user friendly names hiding underlying system descriptions. However, most content was added to the author database using a high-level authoring applet that displays all currently authored content, ordered by space and time. The author database is kept separate from the live database, and only replaces the live content once it has been thoroughly checked. This system offers three advantages over offline authoring with a stand-alone application.

First, multiple authors can work on the content at the same time and there is no need to merge content, which is notoriously problematic. Second, it allows a series of content snapshots to be taken, such that the content can be rolled back to a known good version, at any time. Finally, the generic nature of the web-forms mean that if any element of an object is changed or added, for example including a default response for a dilemma that a player does not answer, the authoring interfaces will automatically reflect these changes. Being able to avoid hard coding aspects of an application is generally considered good programming practice, however it is of paramount importance in the volatile world of art making.

Day of the Figurines is an exceptionally content rich experience. Although it is impossible to provide a thorough explanation of the all the elements in the work in the space afforded in this study, is it illuminating to see some of the numbers. Below are details of the exhibition in the First Play Berlin Festival.

- 50 Destinations
- 228 Destination Descriptions
- 27 Dilemmas
- 70 Dilemma Responses
- 251 Local Events
- 78 Message Elements
- 93 Message Specifications
- 17 Narrative Arcs
- 26 Missions
- 77 Mission Criteria
- 33 Things

The final elements of the software suite I will describe are the SMS Handler and SMS Gateway. The SMS Handler takes a generated message, and the name of the player, and builds an SMS. The SMS Gateway acts as an intermediary between the SMS Handler and the commercial SMS service provider, which does the job of actually delivering messages to phones. These two tasks are separated to allow the game engine to work in isolation from the actual sending and receiving of messages, which in turn allows the SMS Gateway to work online or offline. The Gateway can be easily configured to send messages to player's phones, to post them on a website or a combination of both. The same website can be used to send messages to the game without using a phone. This facility is instrumental for testing *Day of the Figurines* prototypes, as well as the live game. The SMS Gateway has two other useful attributes, it checks with the SMS provider to make sure that each message has been successfully sent to the player's phone, and alerts the operators when a number is incorrect, and provides graphical mapping of trends in SMS activity over time.

All the computational elements described in this section were proposed and argued over in meetings, tested using prototypes and, almost universally, adjusted in response to feedback.

7.4.4 The iterative development process

Overview

For both major iterations of *Day of the Figurines*, or for many of the elements within each, a description the length of this chapter could be presented, without repetition. My task here however is to crystallise the interviews, reports, charts, questionnaire answers, correspondence, butcher's paper sketches, design schematics, photos and documentary video into a coherent narrative that follows the ideas that drove *Day of the Figurines*, through the development process to the final work.

This project began its life in the second half of 2004 in the form of a series of workshops, during which two exploratory pervasive games were proposed. These works, *Single Story Building* and *Hitchers*, were designed, built, performed and evaluated during 2005 (Benford et al., 2005c, Drozd et al., 2006). The first *Day of the Figurines* prototype, described above as DoF Laban, followed on from these initial experiments.

As noted above, the planning and design of the second iteration of *Day of the Figurines* began in early 2006. It was at this point that I joined the project. I read the relevant framing and evaluation documents[17] and began attending the series of workshops that were used to make decisions, assign tasks, report on independently developed computational elements, collaboratively solve problems as they arose and plan for the next round of design, development and evaluation. These workshops ran throughout 2006, mainly clustered around the exhibitions in Barcelona and Berlin, with the last ones held in the weeks preceding the work's premiere in Berlin. Each workshop was attended by a sub-set of the project's stakeholders, however a few regular faces, myself from the MRL and Matt Adams and Nick Tandavanitj from Blast Theory, were present at all. Outside of the these general meetings, MRL meetings were held sporadically during 2006, and every Friday in the two months preceding the Berlin show. During the final month weekly live in-house tests were undertaken, featuring all currently stable elements of the software infrastructure. For singular or specific development or authoring questions, email and phone communication was used. Additionally, an email list was established which distributed design decisions, test results, meeting minutes and also acted a lively conversational hub for the disparate partners, between the scheduled meetings. The final collaborative resource used was the Fraunhofer BSCW (Basic Support for Cooperative Work), a website that acts as a 'shared workspace', or more specifically a "system which supports document upload, event notification, group management and much more" (Fraunhofer FIT, online).

Prototype evaluation

The first order of business was to effectively respond to the key recommendations from the evaluation of DoF Laban. A number of different data capture methods were used during DoF Laban and combined to create a coherent evaluative insight into the work. These methods were; entry questionnaire (filled in by fifty two of the eighty five players), exit questionnaire (filled in by twenty seven players), follow-up telephone interviews (with eleven players), system logs, ethnographic observation recorded on video and mobile phone cell-id logs (for eight players).

The entry questionnaires were used to gauge player's familiarity with interactive art and communications technology, as well as demographic information. The forty

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[17]Benford et al., 2005c; Tandavanitj and Flintham, 2005; Benford et al., 2005a.

seven question exit questionnaires covered a wide range of topics, such as player's feelings about their figurine, the duration and timing of the game, the places and times they played and their preferences, the message flow, the personalisation of the messages and general feedback[18]. It is important to note that ten of the twenty seven respondents were associated with the MRL or Blast Theory in some capacity. The phone interviews were used to follow up particular details of a subset of exit questionnaire responses. System logs were recorded for all messages that were received from players, sent to players or generated by the system but not sent. Two ethnographic observations were made of the operators at work, one during the opening week and again during the last week, "giving us the opportunity to observe the way in which the operators' activities evolved during the experience" (Benford et al., 2006). Mobile phone cell-id logs were recorded for a small group of players who were given dedicated phones with custom software, this was done to help the team "explore whether such a mechanism might provide useful contextual information for managing a player's experience (e.g., automatically recognising when/where they prefer to play and not to play and tailoring the delivery of messages accordingly)" (Benford et al., 2006).

An extended coverage of the breakdown of the captured data, including diagrams, figures and some pie charts, can be found in *Evaluation of the first City as Theatre Public Performance* (Benford et al., 2006). For the sake of brevity and coherence only the key points, analysis and resultant recommendations are included here. Benford et al. split their recommendations for the next major iteration of *Day of the Figurines* into several categories: creating greater structure, clearer overall purpose and adding specific missions, managing conversations, managing engagement, scaling up the experience and the role of the game board.

Analysis of player feedback, and reflections of the Blast Theory artists, suggested that the experience would benefit from greater structure and a clearer sense of purpose for players, both for the overall narrative experience and for moment-to-moment interaction. They recommended that some form of "mission" functionality be added, the inclusion of information about key narrative events into the other parts of the game, via graffiti or in the daily messages for example, the use of a clearly defined, and limited, rule-set for interacting with the game and changing error messages to incorporate clues and advice.

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[18]A transcript of the questionnaire appears in Appendix G.1.

The mechanism for maintaining conversations was revealed as, perhaps, the most problematic element of the DoF Laban experience, especially for conversations occurring in the street. This lead to three problems, players complaining of a flood of messages in popular locations, message inconsistencies during meetings and partings and the development of many special cases by the operators, for managing particular conversations, as uncovered in the ethnographic study. Suggested responses to these problems were; adopting an explicit conversational model where players talk until one of them chooses to break off the thread, supporting sub-grouping in destinations, allowing players to journey together to other destinations and providing operators access to a history of messages in a conversation.

During the interviews and questionnaires a lot of attention was paid to the pacing of the game, the number of messages players received and the time and location of players when they did so. In terms of favoured locations, home was universally popular, as was various forms of transport, however work was more controversial. There was a peak of interaction midweek, and a trough on Sundays, and many players reported enjoying playing when friends and colleagues were nearby, although some unmistakably did not. Generally, players found interruptions from the game more pleasant than annoying. In terms of pacing, message numbers and message content, the *Day of the Figurines'* creators appear to be "engaged in a careful balancing act. We need to respond quickly when players chose to engage, back off quickly when they do not, and yet not completely back off unless they chose to leave the game" (Benford et al., 2006).

Another element of DoF Laban that required investigation was its operator intensiveness, especially in the face of an intended ten-fold increase in player numbers. The authors presented some cursory ideas about how further automation could occur, however the development of an 'intelligent' system to properly handle all game functionality was beyond the remit of their comprehensive survey.

The final set of recommendations related to the game board, and how it could be changed to better respond to three key ideas: framing the players' experience, supporting orchestration and providing a public spectacle.

Evaluation response

The work's creators and developers responded to these recommendations with a series of stated objectives for the further development of *Day of the Figurines*, key amongst there were;

- support scalability
  - automate the game rules and message generation
  - create a simple game grammar for incoming messages
  - make the game board more efficient

- support episodic play
  - use a 'hub-based' movement model that enables player's to move more quickly through the virtual town while also enabling them to be allocated small episodes of play

- control flow of messages
  - use 'silos' at destinations to manage the volume of chat
  - introduce message aggregation

- improve the game board as to provide a more compelling spectator interface and to make its operation more efficient
  - physical redesign of the game board
  - develop digital augmentation

- provide powerful, universal and flexible interfaces to the game's content and operation
  - create sophisticated authoring, operation and orchestration interfaces
  - build back-end database and web server for managing the game content
  - build interfaces dynamically from underlying database content

(Benford et al., 2006)

These objectives were used to create a detailed system design, allowing the software development to began in earnest. Partly in an ambitious attempt to speed up development, but primarily to test the game in the harshest of conditions, a public first draft was planned for the Sónar festival in Barcelona, in June 2006. A slightly simplified version of the final *Day of the Figurines* experience was intended for Sónar, but due to time and personnel shortages and some poor communication, a heavily compromised work was presented. The following account is an illustrative example of the pitfalls of presenting an incomplete, untested, interactive experience to an unsuspecting public.

Best laid plans

Sónar is a Barcelona institution, a self-described festival of progressive music and multimedia art, with an attendance of roughly 80,000 people over three days each Summer[19]. As many who have attended such populous events in recent years can attest, mobile phone coverage is intermittent at best. This reality, coupled with the fact that the *Day of the Figurines* installation was situated in a basement area of the festival space, led to delayed, repeated and disappearing SMSs. This caused havoc in the game engine and greatly affected the intended episodic nature of the experience. However, the two main procedural problems occurred even before we reached Barcelona.

The first problem was one of programming resources. Due to competing commitments in the Mixed Reality Laboratory, I was joined by a number of junior students to develop the game engine and supporting software suite for Barcelona. I took the role of building the core game engine, and my programming partners undertook to build the authoring and operator tools and help, when possible, with elements of the game engine. Creating an application for authoring multiple interconnected narrative streams, which run over twenty four days and fifty locations, proved to be a complex and fatally under resourced task. A number of key elements of the detailed feedback from Blast Theory, on the DoF Laban authoring interface, were not implemented and what was implemented was unusable. As such the initial content authoring environment was shelved and another was created from scratch in the 11th hour, by a senior member of the MRL. Thus the authoring environment, although competently written, was not iteratively developed in consultation with its eventual users, the Blast Theory artists, and, as such, suffered from a number of usability flaws that led to erroneous data appearing in the final authored content. This content was only added to the system the day before Sónar opened. Unsurprisingly, there were teething problems.

The second problem was communication, although only for one part of the project. The digital board augmentation was not submitted, nor tested, before the installation bump-in at Sónar, three days before the festival opened. Months before Sónar, the MRL provided dummy figurine movement information for the software developers Fraunhofer FIT to work from, and we believed that the augmentation software had

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[19]Details of the festival, and archival information about previous years, can be found at; http://www.sonar.es/.

been thoroughly tested inhouse, as the physical board was not available to them. However, this was not the case. The digital augmentation worked for each figurine's first movement, but not for any further movements. Fraunhofer had elected not to send their developer to Barcelona, and during the run in to the festival it was a public holiday long weekend in Germany. Only when this holiday finished were we able to track down the developer in question, and have him fix the problems. Unfortunately, this meant that the game augmentation only worked as it should for the third day of the festival, and intermittently during the second.

Although fraught, the public test at Sónar was instrumental to the overall development of a fully automated *Day of the Figurines* experience. The team learnt an immense amount during those three days, and progressed *Day of the Figurines* in a way that would have been impossible without challenging the work to respond to real people, in a live art context. A robust, affective, *Day of the Figurines* evolved in response to the failings, and measurable successes, of the Barcelona exhibition.

On tour with the *Day of the Figurines*

After Barcelona a series of changes were made to the software system, aided by additional resources, with two highly experienced members of the MRL undertaking active developmental roles in the project. Martin Flintham began working on the core game engine and Chris Greenhalgh implemented or oversaw all elements of the support software suite, and thus enabling the team to properly respond to the evaluation of the Sónar exhibition, leading to a number of improvements and replacements. The revision process was prefaced by the generation of a complete game model specification, by Flintham, Greenhalgh and myself; this document described how every piece of the software system would work[20]. Once this document was finalised, and agreed upon by the other key stakeholders, the internal game logic was revised, the core game engine re-written and missions added to the experience. All game controls, such as timing, wording or relative possibilities of players receiving different types of content, were exposed to live alteration and tuning. A comprehensive brief of requirements for the board's digital augmentation system was written and resulted in a vastly improved, and rigorously tested, application.

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[20]This document is thirty seven pages long and, as such, does not appear in this thesis' appendices, however it can be found in the appendices of Flintham et al., 2006.

Further, the authoring system was greatly enhanced and systems were put in place to handle malformed content. A set of internal scripts for 'sanity-checking' were added, these ensure that the content does not contain mistakes, for example that textual content is not longer than 160 characters. These scripts also checked that authored objects made sense within the game logic, for example each destination description was linked to a actual destination. These scripts presented the results of their tests in human-readable form, via a web page.

Lastly, in response to the myriad problems we had with SMS delivery at Sónar, the SMS Gateway was upgraded to include comprehensive error checking, to quickly address incorrect phone numbers or problems with sending messages and provide operators with the facilities to rectify problems as they arose.

With these changes in place *Day of the Figurines* was ready for its Berlin premiere. Although confident about the stable nature of the software, the team was still anxious to understand how the substantial revisions in game play, from DoF Laban to the version presented in Berlin, would affect the experience of the work. As such informal interviews and formal questionnaires were undertaken and system logs were recorded and examined. For the subsequent exhibition in Singapore, which was subject to a more though investigation of player experience, only the timing and ratios of certain content elements were adjusted (Flintham et al., 2007).

As is clear from earlier sections' accounts of the *Day of the Figurines* experience, and the description of the board, game engine and supporting software suite, the version of *Day of the Figurines* described here was initially developed in response to the recommendation from DoF Laban's evaluation. However, as the project progressed, and especially after the major test in Barcelona, the work evolved to be meet the new demands under which it was placed. Informed by continuous feedback and review, the authorial and development teams were able to create a successful, award-winning, interactive experience, one capable of being toured internationally.

7.4.5 My original contribution

> *08:54pm, new task: a rat faced man in a waistcoat rushes up: 'The drummer's been arrested. Find a DRUM KIT and get to the Locarno by 10pm to take his place.'*

My input into the software developed for *Day of the Figurines* is extensive, as has been indicated. Furthermore, as this project was developed, evaluated and revised

by a collaborative group of artists, designers and technologists, my involvement was not limited to software development. With the other lead programmers, my opinions and ideas were sought and valued by the authorial team, both during the stages of intimate iteration preceding each exhibition and in the many meetings, meals and arguments that constituted the overall development process.

The majority of my participation in the *Day of the Figurines* project has been catalogued or referenced in the preceding sections. For completeness, these, and other, elements will be briefly summarised here. I produced the majority of the code, and all of the system design, for the game engine that drove the Sónar exhibition. Chris Greenhalgh, Martin Flintham and I designed the current software architecture, and all of its composite parts. Flintham and I collaboratively developed the core game engine, in which I developed the message generation and delivery system. This system decides what to send to players and when to send it. It encompasses a number of novel technologies, primarily message composition, aggregation and pacing for a live interactive narrative experience. As with all parts of this project, my expertise were deployed in the evaluation, revision and description of these technologies (Flintham et al., 2006).

7.4.6 Annotated message sequences

In order to help reveal the internal working of the game engine we return to a familiar example, first presented in 7.2.5, in which ANGRY JOE is hit by MARTIN at the canal. After each message a short summary of the game engine's activities and choices is given. The simplified version of game engine events presented here is by no means exhaustive, but it is, hopefully, illustrative. Again, for readability, messages sent by the player are highlighted.

Sent 12:36 pm	Go canal
Received 12:41 pm	07:00am, a jaunty red and yellow poster reads: "Closing Down Sale: Everything Must Go Today. Products Slaaashed! " - in biro below it reads: Ted is a wanker.

The game engine processes the message as a **GO** request, with the argument "canal". As ANGRY JOE is not already at the Canal, and he is not incapacitated, he begins travelling to the Canal by being moved into the hub. Whenever a player

interacts with the game they must receive a timely response. Here ANGRY JOE receives a descriptive text on his way to the Canal.

Received 01:24 pm	07:05am, you've arrived at the Canal, a puddle of melted plastic along the path where someone set the dog shit bin on fire. There are many DRUM KITS here.

ANGRY JOE arrives at the Canal. He is given a short description of the location and told of any present objects or players. The silo size in the Canal is one, so ANGRY JOE is alone.

Sent 13:53	Find martin
Received 02:57 pm	07:14am, after searching the Canal, you find MARTIN, he seems to be run down. You are run down. There are many DRUM KITS here.

ANGRY JOE is looking for MARTIN at the canal. They are both at the Canal, however they cannot talk to or interact with each other as they are in different silos. ANGRY JOE uses the **FIND** command. As MARTIN is also at the Canal ANGRY JOE is able to find him. The system allows for MARTIN's silo to temporarily grow in size to allow the two to meet. The message aggregation system has plenty of space to augment this message so it informs ANGRY JOE of his health, MARTIN's health and any objects in the location.

Received 02:58 pm	07:14am, MARTIN lashes you in the face with a whippy, leafy branch of English oak (in other circumstances a very fine timber) lacerating your face.
Received 03:04 pm	07:15am, MARTIN said: "bet ur angry now, eh joe?"
Sent 03:12 pm	Say leave me alone you ruffian, your just jealous of my luscious locks, i'm going to hit u wit mi kit, innit

After ANGRY JOE arrives in MARTIN's silo (MARTIN is informed of this fact immediately), MARTIN **USES** his leafy branch. The leafy branch, when there are other players present, acts as a weapon.

Sent 03:14 pm	Pick drum kit
Received 03:17 pm	07:16am, you pick up a DRUM KIT.
Sent 03:19 pm	Use

After they have finished talking ANGRY JOE picks up a DRUM KIT. Players can only hold one object at a time. If they pick up another one, the object they are holding is automatically dropped. Once a player is holding an item they do not have to specify it when they **USE** it. Players can pick up and use objects in one command. This is done by sending **USE** OBJECTNAME, assuming the object is present in their location. Picking up an object does not automatically make players use it. This is because players often go in search of objects to use in a specific place, such as searching for the defibrillator to revive an incapacitated friend.

Received 03:23 pm	07:17am, you take a whack at a drum. The mood is wrong, the place is wrong, the crowd is non-existent. You can't even rock a baby. You are run down.

Unfortunately for ANGRY JOE the DRUM KIT does not act as weapon. Rather, if it is used outside the Lacarno nightclub, it produces the above message and lowers the player's health a small amount. As ANGRY JOE's health has just been reduced, by being hit by a branch and failing to "rock", he is reminded of his health.

7.5 The assessment

This section will explore the internal and external assessments of *Day of the Figurines*, and the process that was employed to produce it. Primarily, this assessment will draw from the authors' and developers' own writings on the project, critical reviews in the media, interviews, questionnaires, players' realtime blogs of their experience and the reflections of the commissioners of the project from First Play Berlin. It will also include some interesting, hopefully generalisable, reflections from players on their experience of this mobile interactive game, taken from the

Laban study. This section concludes with my own, admittedly subjective, opinions of the successes and failures of the work.

7.5.1   Seen from an author's perspective

As mentioned in earlier sections, the different members of IPerG have different motivations for their involvement in the project. For the Mixed Reality Laboratory, the Interactive Institute and Fraunhofer FIT, the creation a novel research experiment and the development of novel technologies is paramount. Further, in this age of publish or perish, the ability to turn these end products into papers published in respected peer-reviewed journals or conferences is also important. For Blast Theory, however, a different metric applies: they are motivated by the artistic performance aspect of the project, in the production of an affective experience for the players.

In the paper "Day of the Figurines: A Slow Narrative-Driven Game for Mobile Phones Using Text Messaging" (Flintham et al., 2007), presented at PerGames2007, the authors position *Day of the Figurines* as building on and extending observations and design guidelines that have emerged from previous text messaging games (Jegers and Wiberg, 2006b), and as a work that embodies Montola's proposition that pervasive games can broaden the limited remit of mainstream computer games (Montola, 2005). Montola argued that pervasive games have the potential to extend conventional computer games in three dimensions; *spatially*, to enable players to roam around the real world while playing, *socially*, to build new and build upon existing social relationships among players and bystanders, and *temporally*, to be played over an extended time frame, such that they exist in the backgrounds of players' lives, interwoven with their other daily activities. Throughout the research literature there are many examples of games engaging with one or other of these expansions, for example by revisiting classic console games Quake (Thomas et al., 2002), Unreal Tournament (Mitchell et al., 2003) and Pacman (Cheok et al., 2004) or the new long duration games Mogi Mogi (Joffe, 2005) and Feeding Yoshi (Bell et al., 2006). However, we argue that *Day of the Figurines*, a work that is "fundamentally concerned with how an ongoing pervasive game can be interwoven with the patterns of players' daily lives", that runs for 24 days and that enables emergent narrative and social spaces, successfully engages all three.

Day of the Figurines was implemented using, and co-developed with, a software platform called EQUIP2, a thorough description of which appears in (Greenhalgh, 2007). This platform is now being used to drive a number of pervasive and mobile projects undertaken by the MRL, and has recently been added to sourceforge, the world's largest development and download repository of open source software projects[21].

Blast Theory prioritise artmaking over publishing academic papers and developing new technologies. When describing the work's production, Blast Theory state that a "great emphasis is placed on the audience", with a focus on their experience (Blast Theory, e, online). Perhaps the most illuminating reflections on this experience can be found by surveying the players' response to the work.

7.5.2 The players' response

Although critical review is important in the art world, it is less so in the context of this thesis' central argument, namely that the application of iterative development techniques, informed by situated viuser feedback, can enable artists to build interactive works that, as close as possible, realise their experiential intent. In such a case, the recorded viuser feedback for the work, in its various incarnations, is of paramount importance to the authors. In this section I will explore the most common praise and criticism of the final work, overall trends between the iterations and anecdotes that reveal noteworthy elements of the experience of *Day of the Figurines*, through the players' own words and the occasional statistic.

The summaries, quotations and statistics presented below are drawn from electronic questionnaires completed by players after finishing the experience in Laban, Barcelona, Berlin, Singapore and Brighton. The quotes are primarily from players in Singapore and Brighton. These responses are favoured as these players were presented with the final *Day of the Figurines* experience and a large number of players completed the survey. The questionnaire texts appear in Appendix G.

Retention/enjoyment

In *Day of the Figurines* Blast Theory deliberately set out to make a morally ambiguous universe. The work, in contrast to imperatives of commercial gaming, is

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[21]EQUIP2's page on sourceforge is: http://sourceforge.net/projects/equip/.

a performative artistic experience, one that engaged some and frustrated others. The task of the creators, in developing, assessing and refining the experience, was to ensure that player did not get lost in, or put off by, the mechanics of the game. Further, that players who choose to leave town did so because the content or concept did not excite them, and that those who played until the end had an enjoyable experience. Examination of players' responses to questions about their enjoyment of the experience and their intention to play again in the future, reveals improvement, in both accounts, between each revision and each new exhibition.

17 players, not related to the project, were asked if they enjoyed DoF Laban, on a scale of -5 to +5, the average response was 0.7, showing a slight lean towards enjoyment. When asked if they would play again, 35% said they would and 6% would not, which left the rest undecided. Despite this, only 11 of the 85 players chose to actively leave the game during DoF Laban, although a number of players took on a purely voyeuristic role for periods.

It is difficult to assess the veracity of the numerical analysis from Sónar and Berlin, as only 13 people at Sónar and 10 in Berlin responded to the survey. Further, the Sónar installation only ran for 3 days, which also compromises the value of these results in establishing a wider understanding of the player's experience. When asked to rate their enjoyment, 9 of the 13 players survey at Sónar felt neutral, with 2 not enjoying at all and 2 really enjoying it. A similar response was recorded in Berlin, where 7 felt neutral, 2 did not enjoy it at all and 1 enjoyed it. Further, 7 out of 10 from Berlin said they would not play the game again.

Incorporating major revisions undertaken between Sónar and Berlin, and minor changes made in response to the evaluation from Berlin, *Day of the Figurines* was presented in Singapore before being toured throughout the United Kingdom. In Singapore 24 people, with an average age of 27, responded to the questionnaire. When asked, "would you like to take part in future games of *Day of the Figurines*?" 71% of players said they would, and 29% said they would not. The same group was asked, "overall, how much did you enjoy *Day of the Figurines*?" On a scale from -5 to +5, their mean response was 1.5, tending towards enjoying the game. 18 players, 13%, chose to "leave town" during the game.

The exhibition in Brighton marked *Day of the Figurines'* cultural and lingual homecoming. Brighton provided an especially appropriate UK debut, as the *Day of the Figurines* town's virtual locations are inspired by Port Slade, a small town a few

stops west from the Brighton railway station. When asked, "would you play this game again?" 47 of the 60 respondents, or 78%, said "yes". When asked about their overall enjoyment of the game, the vast majority responded positively, with no one selecting the lowest option on the scale and 6 people selecting the highest. The mean response, again when measured from -5 to +5, was 1.7.
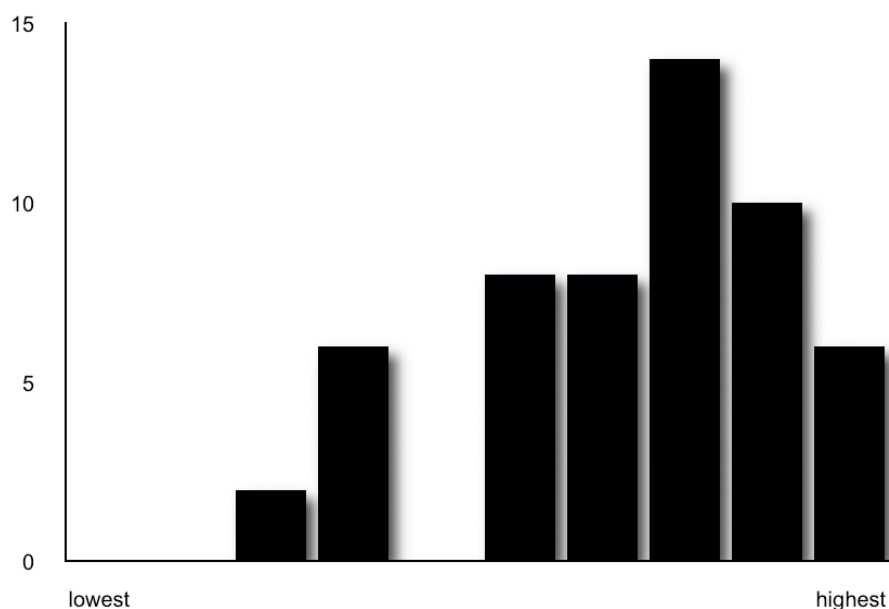
Figure 7.9 Brighton players' response to the question: Overall how much did you enjoy Day of the Figurines*?*

There is a distinct positive trend in player retention, enjoyment of the game and willingness to repeat the experience over the life of the development process. Perhaps most revealing is the gradual, although consistent, improvement in the player's experience of the fully automated system, which culminates in *Day of the Figurines'* positive reception in its place of birth. Although valuable, these statistics do little to convey the players' lived experience of the work. The following sections contain answers and anecdotes, presented thematically, which yield a fuller understanding.

The experience of *Day of the Figurines*

In order to coherently represent the players' experience of *Day of the Figurines*, I have broken their responses into six categories; language, narrative structure, social interaction, missions and tasks, health and the supporting website. The quotes presented here are taken from responses to three leading questions; "What was the

most exciting part of the game?", "What was the least exciting part of the game?" and "What do you think would have made your gaming experience even better?".

Language: *Day of the Figurines* offers a distinctly English vernacular, presented amongst distinctly English landmarks[22]. Some players, outside England, found this difficult to negotiate, especially in Singapore where a player complained of *not being able to understand some of the messages* and another would have preferred *a localised version for Singapore… with… less violence*. However others, mainly in Berlin and Barcelona, felt this was not a problem and, in a few cases, felt it was an important and enjoyable part of the experience.

it didn't reflect my cultural background and that's why I liked it. it was so british: rough behaviours, people drunk, dark places, etc. very exotic!

Narrative structure: The majority of players enjoyed the open nature of the story, that it offered them a situation that they could explore, and the freedom to do so. However, others found this attribute frustrating and called for a more distinct storyline. A stated goal of *Day of the Figurines* was to provide players with a episodic experience. In Brighton, when asked "How would you describe your pattern of play?", 23% of players chose 'frequently', 18% 'seldomly' and 58% 'occasionally'. More than half of the players engaged with *Day of the Figurines* as the authors intended, and almost a quarter of players engaged even more frequently.

When asked what was, for them, the most exciting element of *Day of the Figurines*, some people chose the storyline…

Customisable. Interesting storyline

I liked how it ended

it made me laugh

the messages received had a good impression made on me

…in particular the "dark" and "sinister" elements…

I like the vaguely sinister, apocalyptic atmosphere of it

---

[22]For a list of locations in the town see Appendix E.

obscure, dark, overarching

the JG ballard feeling

…while others enjoyed the way the game the was played and how they could interactive with the narrative.

I liked that the game required logic - things had to be figured out. The game could take so many different paths. Also, that it was somewhat obscure and amusing and that I could interact with other players (real or not) and help each other.

The mystery and turn of events in the town. Not knowing what will happen with every step I take

How it forces one to use their imagination and how players are able to shape their characters

it was like being in a sectret (sic) world yet at the same time being in the real world, i felt important, like i had tasks to fulfill and i ppurpose (sic) in life

The unusual things that happened to my figurine

Carrying interactive drama with me all the time

fun interesting interactive story line

liked it was virtual and physical - that interaction

I liked that it was like a choose your own adventure game or a role-playing game

When asked what was the least exciting part of *Day of the Figurines*, some of the these elements also appeared.

there is no clear instruction on what to do to remain healthy and not much help was given when I feel lost in playing

was very cryptic at times

It was sometimes hard to know what was going on

it had no objective and was cumbersome and not that engaging

Lastly, there were those who enjoyed the game, but felt that certain elements of the experience were lacking, such as the those who wanted a faster game with…

quicker replies

faster moving between places

…and others who found interacting via text difficult at the most basic level.

The lack of a visual made the game challenging

well it's mostly text based, so it did get a bit dull at times

Social interaction: Once prospective players have chosen and named their figurine, they are told that they are to "help people". Consequently the ability to interact with other players, through chatting with, feeding, attacking or reviving, is central their experience of the game. This was reflected by the number of people who referenced social interaction as the "most exciting part" of the game.

when I started communicating with other players and we started helping each other and strategizing with each other

Linking up with other players for mini adventures

Able to mix with other players

However, other found the social interaction, and in particular player chat, a troublesome experience.

Too many msgs. form unknown unrelated people saying random things

Some unpleasant chat experiences

Missions and tasks: Missions were added to *Day of the Figurines* in response to feedback received in Laban. Although more players cited social interaction and storyline in response to the question, "What was the most exciting part of the game?", missions and tasks also proved popular for giving players a sense of continuing involvement and a reason to engage with other players.

Having tasks to do in a certain amount of time; almost dying but having someone save me at the last minute

Saving the sick dogs from the laboratory or flying off in the helicoptor at the end

following quests and helping people

The most common problem people had with these tasks was that they felt there were not enough of them.

There weren't too many choices as to what I could do

When asked what could be done to improve their experience, players consistently requested…

More inventory and more quests

More tasks

More involved missions, more multi-choice options, more en masse cooperative action

Health: Another element added to the *Day of the Figurines* experience in response to feedback in Laban was a measure of health, including enabling figurines to die. A descriptive measure of health was first used in the Sónar exhibition, but players found constant reminders of their health distracting, to combat this the system was changed so that players were only told of their health when they changed from one description to another. Although some players felt that becoming ill or incapacitated was "the least exciting part" in *Day of the Figurines*…

being mortally ill and not actually being able to do anything about it

being bloody ill all the time 'you are feeling ill/mortally ill'

…others, felt that the possibility of ill health and reviving or being revived by other players was the highlight of the game.

Thrill. The fact that I could die anytime

Helping other players and fetching them items to come to their aid, it felt as if not only was I responsible for my own figures outcome but also for that of everyone else around him

Getting 'saved' by the altruistic action of another player

Website: *Day of the Figurines*' authors are aware that in trying to create a game that runs on almost any mobile phone, therefore using SMS, means that they cannot provide the richness of communication or support that a stand-alone application could. In order to address this problem, a public website was created and hosted at http://www.dayofthefigurines.co.uk/. Players were able to use the site to view their message history, the background to the game, a map of the town and a list of commands. Although the site proved useful and well trafficked…

I was happy to read my progress on the web, so saved important moments to remember what I was doing when not able to access the internet

I like the record of messages on the web

… it lacked a real-time representation of the board, which many players stated would have made their gaming experience better.

more of web presence of the physical board

to see [the board] via webcam views, etc.

more online interaction

Another potential measure of player of engagement is the number of players who saved the messages they received from the game. In both Singapore and Brighton more than half the players choose to keep either some, or all, of their messages. In Brighton, 20 players saved all their messages, 26 saved some of them and only 14 deleted them "as soon as I finished reading them".

The final recorded display of player engagement, one which also acts as an annotated reflection of certain players' experience of *Day of the Figurines*, comes via blogging. Two blogs in particular, both started and maintained by players, provide an interesting counterpoint to the regimented question and answer format used previously in this section. Gabriella Giannachi, Senior Lecturer in Drama at Exeter University, is a regular contributer to the Presence Project which seeks to engage "with a wide range of practices and technologies of presence to advance a series of explicitly interdisciplinary investigations" (Giannachi, online). Giannachi played *Day of the Figurines* in Berlin; over 24 days she recorded her every interaction with the game, where and when these interactions took place in the real

world and her reaction to them, as part of the Presence Project[23]. Another group, RATPICK, Dr WATSON, Mr.CRUZ, BUNKER and SAMUEL, started a collaborative blog *FIGJAM: So far in Day of the Figurines…*, to provide a "general collaborative space for players to tell their stories, vent their spleens & find their way around their oddly blinkered world" (RATPICK, online). *FIGJAM* contributors made online profiles for their figurines, recorded the messages they sent and received, presented their plans and reactions and commented on each other's posts. Both of these blogs provide a public record of interaction, but they can also afford the uninitiated with a detailed insight into the lived experience of *Day of the Figurines*.

7.5.3 Critical review

> …art is particularly valuable in this country as it suggests there are greater things in the world beyond our petty, pragmatic lives. It alters reality. And "Day of the Figurines" is particularly effective in accomplishing just that.

> (Ng, 2006)

Coupled with a measure of audience attendance, critical review is the traditional art world metric for measuring success. Although I have favoured audience feedback in this thesis, a brief commentary on the media coverage *Day of the Figurines* has received is relevant. During its exhibition in different cities around the world, *Day of the Figurines* has been reviewed and reported in multiple formats and languages, from online and in print in Berlin, Singapore and the United Kingdom, to Danish radio (Christophersen, 2006) and Japanese television (AAL, 2006). This section will summarise the main themes arising in the various reviews, and include elements of the critical feedback received from the commissioners of the work for First Play Berlin, Miles Chalcraft and Anette Schafer.

Overall the feedback, through both informal and formal media channels, has been largely positive, with the narrative, language, board, figurines and overall experience eliciting the majority of the praise. The cost, the strict command schema, how the game ends and, from reviews in Berlin, its English-centricity, all came in for criticism. However, these negative criticisms are somewhat balanced, except in the case of cost, by others having a positive view of the same attributes.

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[23]Interested readers can follow her journey starting from the opening day;
http://presence.stanford.edu:3455/Collaboratory/758.

The language used in the game, which appears dotted throughout this text, is inspired, unashamedly, by small-town England. Although the language is a "wonderful encapsulation of every nondescript place in Britain" and often "laugh out loud " funny, it could be "difficult for those outside the UK to appreciate" (Chalcraft, 2006). Conversely Nick Coleman, of *The Times*, sees the "the 160 characters of SMS text" as "locking into the limitless potential… of my imagination" (Coleman, 2007).

Reviewing *Day of the Figurines* in Singapore, Ng Yi-Sheng, despite being killed by a "serial killer" in the game, argues that it is "rare for such an experimental piece of art to have such broad, sustained and intimate outreach [in Singapore]". Ng's reflections on the work centred on the way the characters interacted, noting that a woman was able to "buy a car off another player by performing a 'virtual chair dance', via SMS". Ng interviewed one of the volunteer operators, Rohan Narula, who saw strange phenomena as he monitored the game, "I've seen virtual sex scenes, people going on killing sprees, people helping each other for no reason" (Ng, 2006).

The ability to interact and collaborate with other players was critically important to reviewers positive perception of the game, First Play Berlin codirector Anette Schafer for example found herself attached to her figurine and also the 'friends' she made in the city, to the point where an encounter with a figurine she had previously met was a great joy, "like seeing an old friend" (Schafer, 2006). First Play Berlin codirector Miles Chalcraft warmed to the "urban decay set against an eclectic cultural soup" and the "catastrophic feel" of the work. He also felt that the themes of "migration and 'refugeeism' [were] politically poignant" (Chalcraft, 2006).

Although *Day of the Figurines* provided a "good sense of impending doom or something sinister about to happen", the "abrupt" and "disappointing" last message from the game in Berlin had a "tone… so at odds with the tone of the rest of the game that I find it almost spoiling to the aesthetics" (Schafer, 2006, Chalcraft, 2006).

> *06:00am, The day is over for NURSE BETTY. Thank you for playing Day Of The Figurines.*

Blast Theory responded to this criticism by changing the final sequence of messages. A player's lived experience of the end of the game is present earlier, in section 7.2.5, which ends with the message…

> *06:04am, dawn rises over the town as refugees flood the streets. 75 people have died but some have survived. The day is over. Thank you for playing Day of the Figurines.*

Chalcraft describes the game board as having a "simple, beautiful, efficient and functional top surface", onto which the figurines are placed, who, despite their size, "demand the attention of the viewer and draw an audience into the scale of their surroundings allowing one to lose oneself in their world" (Chalcraft, 2006).

Lastly, another way of measuring value in the art world, one usually associated with film making, is awards and prizes. Arguable the most prestigious such award in the field is the yearly *Prix Ars Electronica*, in Linz, Austria. In 2007, *Day of the Figurines* was awarded an Honorary Mention in the Hybrid Art category, equivalent, perhaps, to being short listed for the prize[24].

7.5.4 My assessment

This section outlines my own highly subjective experience of playing *Day of the Figurines* and the process of developing the work.

I was not able to properly enjoy *Day of the Figurines*, or fully embody my figurine's character, during the in-house tests, nor during the exhibition at the Sónar festival. During these periods troubleshooting, refinement, logging and evaluation took precedence. However, during the Berlin exhibition I was free to roam the town and explore its contents. Although I had intimate knowledge of town's layout, placement of certain objects and overall narrative threads, I had read only a tiny fraction of the textual content and had only experienced the set of missions that were devised for testing. As such, my figurine ANGRY JOE and I were able to experience the town, and its inhabitants, with fresh eyes.

I took great pleasure in meeting with other figurines, in the accurately dark portrayal of small town England and in the juxtaposition of a supportive and optimistic sense of community and the steady decay and impending doom of the narrative. Further, I enjoyed being able to play the game whilst waiting for planes and trains, or in social situations, where friends would join me in concocting messages. And I enjoyed the fact that I could play *Day of the Figurines* on a five year old Nokia mobile phone in

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[24]Details about the award, and the other prize winners can be found at;
http://www.aec.at/de/prix/winners.asp.

Germany, England and upon my return to Australia. Perhaps my most enjoyable experience was become incapacitated at the fete, a result partly of my own making, and then revived a day later, after a generous figurine had gone in search of help.

The *Day of the Figurines* development process is described in detail in preceding sections of this chapter, yet, in reflecting on the process and my role within it, it is important to note that I joined the team of artists, programmers, designers, theorists and researchers responsible for *Day of the Figurines* after its first iteration. Throughout this process, from the initial review, brainstorming and planning workshops to the final display in Berlin, the diverse team discussed ideas, argued their points and collaborated on solutions. Great emphasis was given to testing, feedback and evaluation of the audience experience in the real world and, as much as was possible, control of the underlying 'algorithms' of *Day of the Figurines* were exposed to the artists for minute tinkering. I am consistently attracted to this method of production. The elements of the project for which I was responsible benefited greatly from the employment of collaborative iterative human-centered development, as, I believe, did the rest of the work.

7.6 Future work

Blast Theory and the Mixed Reality Lab (MRL) continue to try to respond to problems as they are discovered as *Day of the Figurines* continues to tour. One problem previously outlined is the authoring interface. Although stringent checks are in place to avoid malformed content, it is far from the expressive authorial environment hoped for. Another problem is the potentially prohibitive cost of sending a mass of messages over the twenty four days, especially for very active or 'chatty' players. Although free, or very cheap, SMS bundle plans are common, they are not ubiquitous. Many players cited price as either the "least exciting" part of the game, or referenced it when asked what could be done to improve their experience. As evidenced by one player who commented, *at times I was thinking that TDOTF was in cahoots with mobile phone companies*. A more cost-efficient method of presenting the game, perhaps by giving players a bundle of free messages when they signup or allowing players to send multiple commands in one message, could improve the overall experience[25].

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[25]For more on price, and statistics and graphs of player use, see Benford et al., 2006 and Flintham et al., 2007.

Day of the Figurines is an important part of IPerG's (the Integrated Project on Pervasive Gaming) continuing research effort. In particular, IPerG researchers are exploring how pervasive games can be effectively interwoven in player's lives, with an emphasis on where and when to play. Each questionnaire included questions about where and when players preferred to play which, coupled with message statistics for different times of day and days of the week, are being used as a starting point for this research (Benford et al., 2006).

Day of the Figurines' underlying software architecture is built on, and co-developed with, the EQUIP2 software platform, which, at the time of writing, is being used on a number of active and planned projects at the MRL (Greenhalgh, 2007). The software system was built independently of narrative, content or timing, enabling the authors to change the content without requiring programmatic refactoring. A 'space age' or Jurassic narrative could be supported, or the number of destinations and players could be increased into the hundreds, even thousands, without changing the underlying code. Further, the system is not limited to SMS, it could be configured to operate with any text based medium, such as email or instant message. These factors open up a multitude of unimagined possibilities for future work.

7.7 Conclusion

> *06:40pm, TIN MAN said: "pls spread the the word that if you need help to revive someone or yourself you can call for tin man"*
>
> *08:44pm, BERNARD said: "It's Dr.No and DJ Ray. Already 5 were killed. Let's meet at 9:40 at the Allotments. SPREAD THE WORDS."*
>
> *09:39pm, BERNARD said: "Hi tinman. I have been looking for you. Will you help me stopping the killings?"*
>
> *09:40pm, TIN MAN said: "sure! Wat to you have in mind"*
>
> *09:40pm, BERNARD said: "we have to find more people supporting us and then atacking him all together...?"*
>
> *09:41pm, TIN MAN said: "then we will become like them?"*

Although the motivation for, the story of, the mode of interaction with and the ideas being explored by *Day of the Figurines* remained constant, from the first public exhibition at the Laban School of Contemporary Dance in South London to its premiere at First Play Berlin, many elements of the experience and the internal mechanics changed dramatically. For example, to respond to the feeling among some early players that they were on the periphery of the action, missions were

added, a hub model of movement was introduced, suggestive ideas were included in the daily message and more interconnected content was written[26]. Or on a technical level, message generation moved from partially improvised and operator intensive to fully automated, which required the development of nuanced message pacing and aggregation techniques, and the implementation of methods for the artists to test and tweak these elements. These examples are, perhaps, best evidenced by the changing ratio of messages sent from, versus those sent to players. During DoF Laban the system sent five messages to a player for everyone one it received from them, in Brighton and Singapore the ratio was approximately 1.7 to 1, providing a more balanced communicative exchange between player and system.

Day of the Figurines is an example of the effective application of iterative human-centered design, informed by situated viuser-driven feedback, to the creation of an interactive artwork. The artists intended to build a virtual SMS space where players "not only inhabit the city…[but] give rise to it as well", and to create a slow game, that would coexist with players' lives, one that allowed them to interact with it episodically, of their own accord (Benford et al., 2006). A dark and grimy place where bad things happen, 160 characters at a time. A place, nonetheless, with a community, one filled with refugee figurines who, in many cases, perform altruistically and cooperatively. In delivering these intentions, augmented by the key experiential concerns of providing an engaging, largely enjoyable game that could retain a player's interest throughout a month, *Day of the Figurines* proved increasingly successful with each iteration of its development.

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[26]Player responses to DoF Laban are detailed in Benford et al., 2006.

Chapter 8: Conclusion

Over the past four decades, the Human-Computer Interaction (HCI) and Software Engineering communities have learnt a great deal about the delicate art of creating software for human interaction. During this period, ideas and techniques that appear under the banners of Human-Centered Design (also called User-Centered Design) and Iterative and Incremental Design (IID) have become increasingly popular. The "waterfall" method of strict sequential production, in accordance with an overall software plan, is being replaced by the various agile programming methodologies now available (Larman and Basili, 2003).

As I have shown, the most effective way to inform each iteration of the development of an interactive software system is to look beyond the customer who commissioned the software, as is suggested in many IID specifications, to the human who will actually interact with it, as advocated by a number of influential authors. Further, the most effective way to understand how viusers navigate a particular novel interactive experience is through a lived, situated evaluation — techniques such as ethnography and those outlined in section 4.7 are designed expressly for this purpose. These methodologies enable practitioners to create computer-driven, interactive experiences that are as close as possible to their author's experiential intent. It is, I have argued, precisely this approach that is most suitable for contemporary computer-mediated interactive art.

Computer-mediated interactive art is an emerging practice, one that, in many ways, epitomises the "mutually reinforcing, polymathic collaborations" between different mediums that colours contemporary art practice (Taylor, 2004). As I have shown, since computers became available to them, artists have been exploring the possibilities they afford and collaborating with technologists of all types. Further, since the early 1990s there has been an explosion of interest in the work these explorations and collaborations have produced, manifesting itself in books, conferences, art shows, galleries, museums, research centres, blogs, journals and,

most excitingly, "art objects… that bear no resemblance to the art of former times" (Taylor, 2004).

The majority of this artmaking relies upon software, primarily off-the-shelf software. In many cases, however, software is written specifically for a particular work, predominately by software engineering professionals although occasionally by the artists themselves. It is this specific case, where artists and developers create software systems that provide an aesthetic experience for an audience, that I have investigated in the two main case studies of this thesis. The ideas that drive this research, however, extend beyond these concrete examples. The literature review explores a particular `area of overlap between the study of Human Computer Interaction and the practice of new media art. The specific convergence of skills and interests presented in the review, and explored practically in the case study of *Day of the Figurines*, concerns the application of interactive human-centred designs processes to the iterative development of computer-mediated interactive artworks. This review represented the views of some of the key authors and practitioners in the fields of Human-Computer Interaction, Human-Centered Design (often called User-Centered Design) and interactive new media art. My central argument has been that creative processes which incorporate user-tested, iterative development are applicable and beneficial in all situations where software systems are used to provide an aesthetic interactive experience.

Iterative human-centered design, informed by situated user feedback, offers interactive art a wealth of valuable knowledge in what is currently described as a "conflicted convergence" (Sengers and Csikszentmihályi, 2003), but may in the future become a truly productive exchange. HCI researchers are already using interactive art as a fertile field for their own research agendas, with a number of conferences hosted by the Association for Computer Machinery fielding specific streams for interactive art. In the past decade a growing number of artists and arts groups have begun successfully incorporating such techniques into their practice, as evidenced by the quantity of submissions to conferences such as *Interaction: Systems, Practice and Theory* and *Engage: Interaction, Art and Audience Experience*. These artists and groups epitomise the artists-as-collaborator model set out in the investigation of contemporary new media artists practice in the review of literature. This is at odds with the artist-as-genius model – as seen in painting, sculpture and other craft-based fine arts, with its implication of a relatively passive viewer – and the artist-as-auteur – where a directorial voice makes decisions that

skilled practitioners enact to create an object or experience that viewers consume once it has been it is completed. The notion of an artist being a member of a collaborative teams enables, and supports, this thesis' core argument that creative processes used to create software systems that provide an aesthetic, interactive experience are improved when they incorporate user-tested, iterative development.

Through a review of the literature — examining human-computer interaction, new media art and the intersection between to two — and three case studies, I have shown that the most effective method for artists to ensure their work reaches its experiential intent is through iterative human-centered design, driven by the study of viusers — particularly those unconnected to the work, or even the artist — in real-world (or art-world) interaction with it. The first study, of the work *Biloela Girls*, demonstrated the benefits, and ease, of employing these techniques on a small scale. The second study, *Conversations*, presented an audacious and technically complex, multi-user, immersive, interactive art installation. The third, *Day of the Figurines*, chronicled the employment of feedback-driven, iterative, human-centered design in a pervasive game for mobile phones that was part artistic performance, part research experiment.

My collaborative involvement in these three projects provided me with a rare and intimate view of their development. Further, it enabled me to tackle significant, and novel, technological challenges. These became more taxing with each project. As my first, independently-authored artwork, the generation and display of the content in *Biloela Girls* followed well-established technical paths and common aesthetic themes. *Conversations* and *Day of the Figurines*, however, required multiple innovative technical and technological solutions for both content generation and exhibition.

I was a member of the core team of technologists, lead by Matt McGinity, that built *Conversations*' main technical components. We collaborated with other groups and individuals on some elements of the work, in particular the 3D sound environment, live action filming and the 3D modelling and animation. Although I was involved in many aspects of *Conversations*, my primary role was to incorporate the three dimensional (3D) audio elements, provided by members of Sydney University's Computing and Audio Research Laboratory (CARlab), into *Conversations*' visual environment. To make this possible, I developed spatial scoring software that was used to position each element of the score in 3D space. It was thus possible to perfectly match the sound of Ryan's footsteps, as he escaped Pentridge, to his

visual position seen through the head-mounted display, no matter which way the viuser was looking. I also worked with the CARlab team on the design and development of their audio rendering and playback systems, as well as working on the system that allowed multiple viusers to have real-time spatial audio conversations with each other, whilst the ghosts of Ryan's story provided the intimate, spatially accurate whispers, entreaties and invocations that played an important role in the viuser's experience of the *Conversations* ghost world.

I played a central role in the technical development, and interaction design, of *Day of the Figurines*. Although I was not involved in the first version of the project exhibited in the London's Laban Centre in 2005, which was operated mostly by hand, I was one of the principal developers for all subsequent automated versions of the work. As well as my developmental role I was an active member of the team that defined the user experience and game play elements of the work. For the first computer-mediated exhibition of *Day of the Figurines*, at the 2006 Sonar Festival in Barcelona, I developed the majority of game engine, which handled all mobile phone interaction the interaction with the game. For the final version of the work I focused primarily on the generation, aggregation and the pacing of the delivery of the messages that the viusers received on the mobile phones. Martin Flintham, a senior member of the Mixed Reality Laboratory's development team, built the system that managed the state of the *Day of the Figurines* world, and the figurines within it. The messaging system I developed used game state, viuser's messages to each other and the game, the proximity of figurines to each other and to local events and the challenges and problems set for the figurines by Blast Theory to build coherent, appropriate and timely messages to be sent to viusers. These messages, and the messages they themselves sent, are the fundamental interactive elements of *Day of the Figurines*. In these ways, my novel message system was integral to the success of the work as an interactive experience.

Beyond these exciting innovations, the two major case studies provided me with valuable exposure to two groups of highly accomplished collaborators, whose insights and processes have helped inform this thesis.

In these concluding remarks, I will explore *Conversations* and *Day of the Figurines*, remarking on the similarities and differences between them and their respective areas of success and failure.

First, the similarities. *Conversations* and *Day of the Figurines* are both novel, artist led, collaboratively developed works, that provide multiple forms of interactive narrative in a virtual space. They allow interaction between players and with, in Jeffrey Shaw words, "narrative agents" (Shaw, 2005). They present complex and challenging, yet poetic, content which they draw from a large database of narrative possibilities. They require the viuser to physically attend an exhibition space where operators or ushers acquaint them with the work's themes and mechanics. They have both been exhibited outside the traditional gallery art space, instead appearing in a science museum and a theatre foyer. Both works presented complex software and hardware challenges, prompting innovative solutions. Both relied on existing software architectures and, at the same time, spurred the creation of new software that is being reused in other projects, by iCinema and the Mixed Reality Laboratory (MRL). They were designed, and then built, by large teams which were, during development, subdivided into smaller groups responsible for particular tasks. Lastly, they were both funded as research experiments as well as creative art projects. These two projects were selected for this research as they illustrate the technically complex interactive experiences that have become common in contemporary new media art practice.

Second, the differences. The display technologies for *Conversations* and *Day of the Figurines*, and their corresponding resolutions, are quite distinct. *Conversations* provides an immersive visual experience, with spatialised stereo audio, through a head-mounted display and high-fidelity headphones, whereas *Day of the Figurines* has a resolution of 160 text characters. The temporal length of the experiences differ from a maximum of ten minutes for *Conversations* to a maximum of ten hours a day over twenty four days for *Day of the Figurines*. The stories that inspire the two works are obviously very different; *Conversations* draws from a highly conflicted historical happening, that remains contentious today, and *Day of the Figurines* looks at the politics of the present projected into the near future.

Conversations and *Day of the Figurines* were produced by two groups with different histories, different production methodologies and different organisational structures. *Conversations* was the first project undertaken by the newly formed iCinema Centre, as such its development was influenced by factors triggered by the Centre's simultaneous formation. Fundamental elements of the iCinema team's interaction were unformed, such as how meetings are run, how individuals work together, what are team members' strengths, weaknesses and interests and the formalities of

communication and task allocation. Although this is in direct contrast to the well established relationship between the MRL and Blast Theory — the relationship that was the foundation for the collaborative development of *Day of the Figurines* — it is consistent with much new media art production, especially in cases where the technologists and artists involved do not have an established relationship.

The final point of difference I will focus on is the works' respective development processes. Overall, *Conversations* followed prescriptive sequential development, with some elements built iteratively in response to evaluation. In contrast, *Day of the Figurines* was developed over two major, and many minor, iterations. Each iteration was tested and evaluated, from the author's as well as the viuser's perspective, with any knowledge gained fed back into the work. The use of these techniques follows MRL's established developmental *modus operandi*. Even though a group of artists shared its authorship, *Conversations* embodies the artist as auteur model of production, whereas *Day of the Figurines* is an example of the artist as collaborator and facilitator; collaborating with technologists from various disciplines, and the viusers themselves, to create an aesthetic experience. I will now consider these points in more detail.

The audio-visual trickery in *Conversations* — its virtual sleight-of-hand — gave viusers a rare sense of immersion inside an interactive virtual world. The breakout scene, the immediacy of the spatialised sound and the conspiratorial, prosaic ghosts of Ryan's past, all combined to produce unique aesthetic experience. Although no formal evaluation was undertaken, the artists and developers on the project learnt a lot about *Conversations* during its exhibition. The project also provided a chance to learn "how to build [such a] system" and "how to work in a cross-disciplinary team" (McGinity, 2005). *Conversations* has only been exhibited once, in the form presented in this thesis. Laying dormant is the enormous potential the *Conversations* infrastructure offers for truly contemporary storytelling in a wide variety of settings, and addressing a potentially limitless range of content.

It is difficult to confirm how successful *Conversations* was as an aesthetic or artistic experience for those outside the project, because no evaluation was undertaken. The project has, however, generated a series of technological innovations and a digital monograph, as well as collaborative and institutional partnerships that continue today (McQuire and Papastergiadis, 2005). *Conversations*' principal deficiency was the inter-viuser interaction in the work as exhibited — as lead software developer Matt McGinity put it: "the one part of the system we couldn't

control [was] the humans" (McGinity, 2005). One cannot be certain that an iterative human-centered design approach would have produced a work that engendered a lively conversational space for viusers, nevertheless, the functional success of the speech recognition and the 'gaze-based' method of interaction — both of which were subject to this process — indicate its potential.

Day of the Figurines, as I have shown, was able to create a community of players who "not only inhabit the city…[but] give rise to it as well" (Benford et al., 2006). The majority of these players helped each other navigate the work's disturbing, occasionally violent, narrative world. Relative to the goals set out by the authors, perhaps best summed up in the framing document as providing "a rich narrative experience through the relatively sparse medium of SMS messaging that combines interactivity and improvisation, but in a scalable way" (Benford et al., 2005c), it is evident that *Day of the Figurines* achieves its intent. Yet the project's most apparent, demonstrable and confirmable success is the trend of increased player retention, enjoyment, engagement (as show in the ratio of messages sent to those received) and intention to play the game again, from each iteration to the next.

Obviously *Day of the Figurines* benefits from its continuing exhibition, allowing feedback to lead revision and refinement. This has enabled the creators to attend, where appropriate, to some of the outstanding problems noted in this thesis, namely; the price of playing, the limited authoring interface, a lack of online presence of the game board and the requests for more tasks and missions. Yet, equally clear is the benefit of employing an iterative development process leading up to its premiere in Berlin. Beyond its experiential successes, as an artwork in its display venues, *Day of the Figurines* also contributed to the developing field of pervasive game study — for example, revealing where, when and how often people are comfortable playing such games (Flintham et al., 2007) — and has been rewarded for its innovation.

Conversations and *Day of the Figurines* share more similarities in their technical realisation than they do differences. The distinguishing aspect of the works most relevant to this thesis is their contrasting developmental ideologies. *Conversations*' many successes are centred on audacious technical innovation. For *Day of the Figurines*, the measured successes presented here, as the viusers' own words demonstrate, come from experience.

When reflecting on these two works, in the context of the wider realities of interdisciplinary collaborations to creating technical complex artistic experiences, a few important factors must be acknowledged.

Importantly, the type of interdisciplinary teams — consisting, potentially, of institutions, artists, programmers, designers, engineers, researchers and others — assembled to create such works will include a variety of members, with differing interests and proficiencies. These inherited proficiencies will guide how the challenges the work presents are confronted. In many instances, these teams are brought together in an ad hoc fashion and, as such, the methods of production they employ will be established in a similar manner. In such circumstances — especially if no member of the team has a specific human-centered design background — the project, I have argued, would benefit from the aesthetic author's explicit articulation of the intended viuser experience and the employment of iterative human-centered design methodologies to manifest it. This development methodology is driven by, but not limited to, interactive artworks where the final experience of the work is of paramount importance to the creative team behind the project. For many artists, however, other factors — such as the creative process itself — are the principal motivators for the work's production, the actual audience experience can be seen as being of secondary, or even tertiary, importance.

When discussing the utilisation of evaluative techniques in artistic practice, the inherent proficiencies of artists and technologists must be acknowledged. Most artistic practitioners and their collaborative partners build up a body of knowledge, through making works and experiencing others, which enables them to generate certain kinds of works, or elements of works, that they can be confident will be experienced in a certain manner. This thesis does not advocate that practitioners must reinvent the wheel with each work and then test that it is round and rolls. This research is focused on novel experiences and novel interfaces. In such cases before it is demonstrated even experienced practitioners can, at best, speculate about the lived experience of the work by an uninitiated viuser.

Situations in which the experience of a novel interactive work is confusion or incomprehension does not necessarily represent a failure by the creators of the work. Interactive art, like all art, has the potential to be fundamentally innovative and, in doing so, has the potential to educate its audience and reshape the discipline. The methods presented in this research are not inimical to developing such works. Undoubtedly, artists must be able to create works that are outside the

common experience. All interactive works, however, can benefit from an understanding of how viusers experience them, even if the experience can seem to be total confusion. How the work's creators incorporate this manner of feedback, is their own concern. Creating a truly novel, aesthetic, interactive experience often comes from mixing the methods of interaction with which we have all become familiar, with elements that deliberately challenge this familiarity.

There are many facets to the success of an interactive experience, in the arts context or any other. Some can be predicted and adjusted for, some cannot. The process used to create *Day of the Figurines* is not presented as a step-by-step blueprint for successful interactive computer-mediated arts practice. Nevertheless, as this review and studies have shown, in situations where the facilitation of a particular audience experience is the prime motivator — as contrasted by a focus on the creative process itself, for example — best-practice is to employ iterative human-centered design, utilising appropriately selected methods for situated viuser study. Although it is impractical, if not impossible, to provide a one-size-fits all approach to creating computer-mediated interactive art, some general, consistent guidelines can be drawn from the literature and the case studies presented here.

First and foremost, iterate. A prescribed, approach to building a novel interactive system—sometimes called "waterfall"— has been shown, in the context of commercial software engineering projects, to be consistently less successful than an iterative approach. The most successful iterative projects are those that provide a working system, with a subset of the intended range of functionality, at each iteration (Larman and Basili, 2003).

Second, test between iterations. Testing each iteration of an art system enables the author(s) to make informed decisions about what to change, and what functionality is required in the subsequent iteration. There are a multitude of methods to examine a new interface. These range from simply showing it to peers or friends, and observing their interactions, through to a full beta test with members of the public in an art world setting, potentially in collaboration with usability professionals. There is a growing body of research that seeks to provide tools that inform an understanding of the audience's experience of media art, such as Personas & Scenarios (Kan et al., 2005b), Video-Cued Recall (Costello et al., 2005) and Future Workshop (Muller et al., 2006b). Alternatively, Turner has shown that if technologists can supply their artistic collaborators with working, configurable versions of the art system (especially if it the artist(s) can change the configuration in real-time or "play" with the system),

artists are then able to test the boundaries of their ideas with these "toys" without requiring the technologist to rebuild the system each time (Turner, 2006).

Third, listen to different voices. Simply watching people use and interact with the interface or work helps build an anecdotal insight into how the work is experienced. Talking to viusers (either in a free form manner or via survey, questionnaire or structured interview) and recording the results helps build a more comprehensive understanding of how the work is being experienced. Another method that is especially applicable to computer-mediated works is to log viusers' actions. This yields insight not only into those interactions, but also those of the machine itself. The output can become a useful analytic resource, one related to the particular nature of the work. Most importantly, artists and technologists alike should be explicit about what they are trying to understand. During the development of *Day of the Figurines*, the team had a series of metrics they were trying to improve upon and, as such, tailored the questionnaires (and follow up interviews) to help them better understand specific elements of the lived viuser experience of the work (see full text of questionnaire is available in Appendix G).

Finally, be brave. Be humble enough to incorporate the feedback you have gathered into the development of the work. If securing a particular (set of) viuser experience(s) is your motivation, then the power and the affect of the work will be improved if you are brave enough to incorporate stranger's feedback into the interface/interaction design and exhibition of the work, changing the experience of the work and, thus, its very nature.

It is to be expected that the methods artists and technologists choose to realise their work will be dictated, primarily, by the contexts of use and the intended outcomes. I hope that I have shown, however, the measurable benefit of expressly acknowledging the viusers who will experience the work, and by engaging with them in its iterative development.

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Appendix A   SoundPath

A.1. Introduction

When immersed in the *Conversations* installation, viusers are presented with a three-dimensional (3D) sound score that perfectly matches the action in the spherical stereoscopic movie. To make this possible a number of disparate technologies needed to work in harmony. During the development of the work, a system was created that would allow us to accurately, and spatially, score the opening two minute video. This appendix reports on the design and implementation of one part of this system, *SoundPath*. This software was used to generates 3D trajectories for each sound in the breakout scene's score.

A.2. Requirements

The key requirement for *SoundPath* was that the sound trajectories could be created and edited visually such that they were visible concurrently with a faithful playback of the breakout scene. This would enable trajectories to be accurately synchronised with the visual elements in the escape. Other requirements included preview functionality and a usable interface.

A.3. Design

The *SoundPath* user interface enables the user to view a square window of the spherical breakout film. If the user's mouse reaches the edge of the square the camera pans or tilts accordingly. A timeline, that can be easily manipulated, appears at the bottom of the interface. Above the timeline is a series of buttons to create and edit balls, change editing mode and save and load the trajectory data.

Two systems have been implemented for drawing trajectories. In the first method, the user uses their mouse to follow sound emitters — such as people, trams and cars — as the film plays, in real-time, in a square window. These mouse movements are recorded and used to generate the orientation of the object with respect to the

user. Another technique is used to generate the distance between the user and the object. After testing this system, and observing the most common ways objects moved around the scene, a second system was implemented. The second system allows the user to draw a line between start and end points, and to set a start and end time. The system then extrapolates the object's movement between the two points.

Coloured balls are used to represent sound emitters, the balls grow and shrink as the visual object they portray moves closer to and further from the user. The relative ball sizes can be used for visual comparison of object depth.

To accurately specify the distance from the sound source to the central viewer a second, top-down, view was needed. This allows the user to change from a filmic view to a layout, or plan view. The view they are presented with was generated from a detailed layout of the front of Pentridge Prison, created by Volker Kuchelmeister.

A.4. *SoundPath* implementation and use

It was immediately clear that using *Virtools* was the quickest and most accurate way of creating this application. The spherical video playback technology developed by Matt McGinity for *Conversations* was used as a base for *SoundPath*. Although problematic in other instances, *Virtools* was perfect for this sort of rapid prototyping and iterative development.

Using SoundPath to create sound trajectories is a simple task. To create a new trajectory, the user must click the "new ball" button. This will create a new, randomly coloured, ball — centred in the current view. When the ball is clicked, it follows the mouse, clicking again releases the ball. To draw a trajectory, click the ball and navigate to the object to be tracked. Pressing the space bar will start the film playing, the user can record the object's movement in real-time, by flowing it with the mouse. Alternatively, the user can release the ball and click the "line mode" button. In line mode, the user cans specify start and end points, and a start and end time, and *SoundPath* will fill in the gaps. The start and end times — for example when a person walks into view from behind the prison, or when the tram rolls into the scene — are set using the time line, which can be dragged using the mouse. The start and end points are created by dragging the representative coloured ball onto the object, using either the filmic or schematic view.

After creating the sound path for an object, the user can playback the film and confirm that the ball is accurately superimposed over the object it represents. When a number of sound paths have been traced, the user can watch the movie in layout mode and observe the balls tracing the virtual movements of the characters, such as Ryan or Walker and objects, such as the tram or siren.

A.5.   Output

To communicate with the 3D sound renderer 3DASP, created by the CARlab (Jin et al., 2005), *SoundPath* provided a simple list of vector positions — presented in the form "x, y, z, t", where x, y, z describes the sound's position in 3D space, and t denotes the time — for each sound over the entire period of the score. Sound trajectories are supplied as a set of keyframes, one for each change of direction. CARlab's 3DASP was able to accurately spatialise the sounds as they moved between each key point. The sound trajectories have the same resolution as the video — namely, twenty five samples per second, or a minimum forty millisecond gap between any two movements.

The sound track for the Pentridge breakout scene includes a wide variety of sounds, from quiet foot steps on grass and birds singing to revving car engines, skidding tires and gun fire.

A.6.   Conclusion

To create and maintain the sense of immersion required for *Conversations*, estimating sound trajectories, or generating them from the object's position on the breakout film alone, would be insufficient. Due to the novel nature of both the *Conversations* video playback and the CARlab's audio renderer, generating the sound trajectories using off-the-shelf software was not possible. *SoundPath* was built, over a number of iterations, to enable visually and spatially accurate trajectories to be generated and edited by any diligent user.

A.7.   Future work

The majority of spatial sound, as typified by Dolby 5.1 audio encoding, is two-dimensional. That is to say the sound can be heard in front or behind but not above the listener. *SoundPath*, and the ideas it presents, would struggle for a wider application outside the custom generation of spatial scores. Especially as, even

within spatial sound, there is very rarely the set of constraints that were present in *Conversations*.

SoundPath was limited to visual editing, it contains no facility for aural feedback. An interesting, and purely conceptual, addition to the software would be the inclusion of a single orientation, aural preview, allowing the user to listen, while viewing the visuals, to the spatially rendered sound and enabling the user to change the trajectory of the sound and perform a computationally simple, single orientation render before listening to and watching the updated scene.

Appendix B   ConvoTagger

B.1.   Introduction

Ross Gibson scripted and directed the ghosts that inhabit *Conversations' Ghost World*. He authored a set of prosaic vignettes for each of the twelve characters, and directed the actors' performances of them. Greg Ferris took the video recordings of these performances and, using a visual effects software package, rendered media files that were aesthetically consistent with the rest of *Ghost World*. This process produced more than 900 media files, one for each performance. Joachim Tesch and I were charged with the task of giving Gibson dramaturgical control over the recombination of these recorded performances into short series. Each series of clips was generated on the fly as the viuser interacted with the ghosts in *Conversations*.

Briefly mentioned in the thesis body, are the two factors that influenced the creation of a set of systems to provide Gibson with influence over the combination of the clips. The first factor was that Gibson felt that there were particular phrases — or clips — that worked well when said together in any order, some phrases that worked well when spoken together in a particular order, some that could be used as opening statements and others that could be used as closing remarks. The second was that, as there were multiple reads of each phrase, Gibson was able to specify a distinctive emotional tone for each reading. Further, that there was a limited list of emotional tones present in the performances.

B.2.   ConvoTagger

ConvoTagger allows the user to annotate a folder of clips with their particular attributes. The attributes are selected from a limited set of possibilities. Gibson used it to annotate each clip with its emotional tone as well as specific information about the type and usage of the clip. This information was later delivered to the narrative engine.

ConvoTagger was developed over two stages of design, user testing and revision. The first iteration began as a paper sketch with I discussed with Gibson. After our meeting I created a fully functional prototype. The most important part of the prototype was that it gave Gibson, for the first time, access the full database of clips. Gibson used the prototype to reflect upon the emotional tones he had originally specified, and the usability of the interface itself. After which, the second iteration was developed with a simplified interface, some new emotional tones, the removal of some unwanted tones and the additions of extra, on-screen feedback. Also added was functionality that allowed direct navigation to any clip in the database (see Figure 8.2).

The final *ConvoTagger* has a simple graphical user-interface in which the user can navigate forward and backwards between clips, navigate directly to a particular clip, set the clip's type, set the clip's emotional tone and enter specific data in the special case that the clip is a question (see Figure 8.2). In Figure 8.2 a clip is being tagged that is a question. In this case all the options that relate to questions, that are otherwise grayed-out, are active. This is to generate the necessary information for the narrative engine to correctly handle all voice interaction between viusers and ghosts. For example, when Ryan asks "have you spoken to my mother?", the narrative engine must know that if the viuser says "no" at this point, Ryan's mother should be summoned.

This process of examination and revision enabled Gibson see the database of performances as a coherent whole. With this in mind he was able to group clips into consistent emotional moods, and discover which clips were unsuitable for the installation.

ConvoTagger is a native Apple OS X application, which uses FileMaker Pro as its underlying database. All video files are independently stored in the file system as Quicktime Movie files. A simple shell script was used to convert the data exported by from FileMaker Pro into XML that the narrative engine could read.
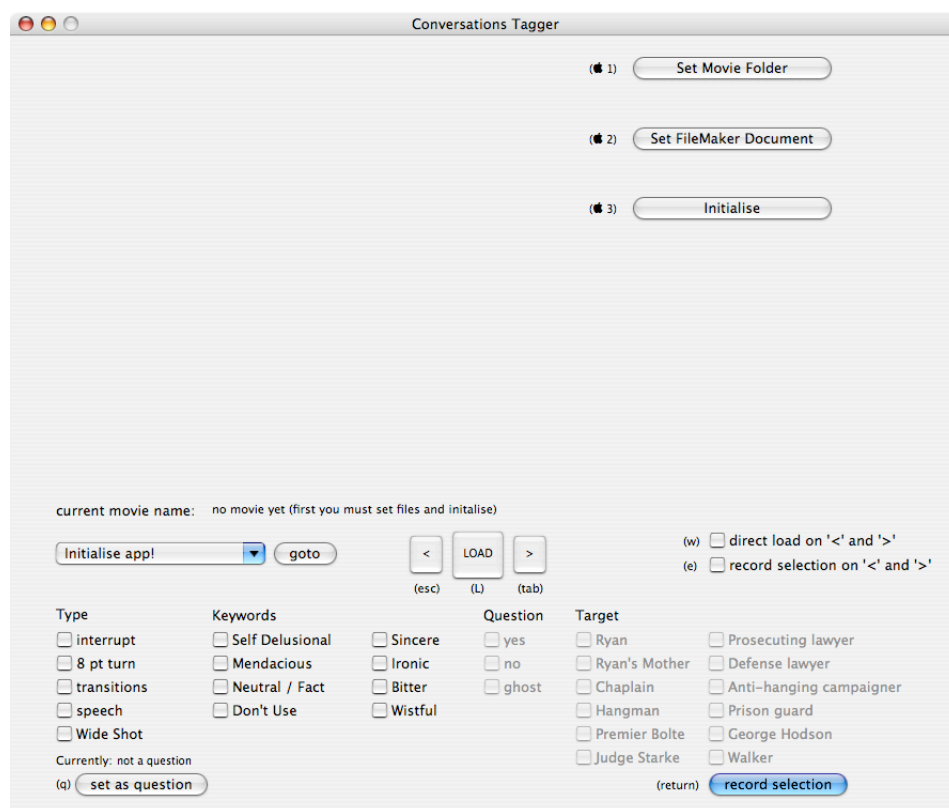
Figure 8.1 ConvoTagger screenshot before initialisation.
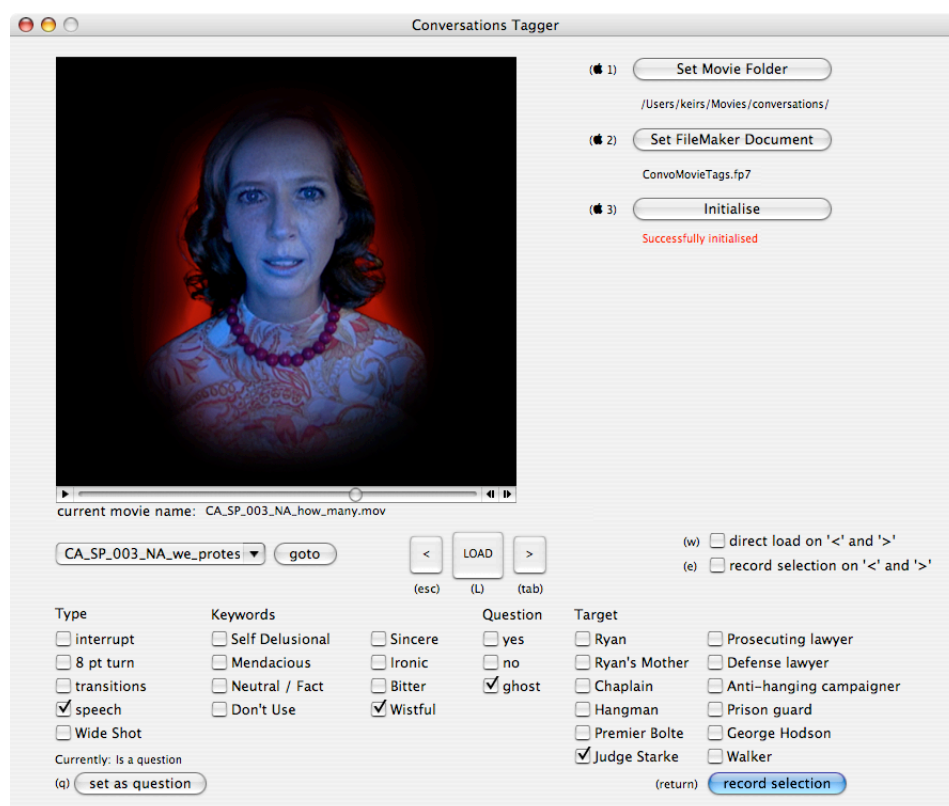
Figure 8.2 ConvoTagger in use. This clip has been tagged as a "wistful" question, where Judge Starke is the target.

B.3. The narrative engine

To generate clip sequences Joachim Tesch developed the *Conversations*' narrative engine. The narrative engine combined the output from *ConvoTagger*, with information about which clips can be used at the beginning or end of a series, which can be used in-between and how they can be combined. Each vignette, for each character, was given a code in a custom *Excel* spreadsheet which Gibson used to enter the required details.

The narrative engine uses this information, and the emotional tone information from the *ConvoTagger*, to generate the ghosts' soliloquies. The narrative engine incorporates an element of random chance — such that each soliloquy differs from the last — and ensures that each ghost never repeats the same vignette to the same viuser.

B.4. Conclusion

The development of *ConvoTagger* was privileged by close collaboration between the developer and the only user. This factor enabled me to create an application, over two iterations of programming, feedback and review, that reflected Ross Gibson's needs. Although it was successful in terms of the user experience and the accuracy of the data it produced, it is specific to the *Conversations* content and, as such, does not lend itself to wider application. Despite this, the development process brought to light some of the common challenges for high quantity media management and organisation, as well as serving as a reminder that, especially in aesthetically driven work, a big picture view is often needed before decisions can be made about the fine details.

Appendix C   Sound synchronisation

C.1.   Introduction

In order to provide a truly immersive experience in *Conversations*, it was very important that the auditory elements were accurately spatialised, and in perfect harmony with the visual elements of the experience. iCinema teamed up with the University of Sydney's Computing and Audio Research laboratory (CARlab) to make this possible. All audio elements of the *Conversations* experience are a result of this collaboration.

Beginning in the winter of 2004, iCinema's lead developer Matt McGinity and I began meeting with members of the CARlab team, under the directorship of Craig Jin and Andre van Shaik. McGinity and I outlined the whole project, how the audio elements would interact with the visual elements and our conceptual design of what would later become the 3D Audio Playback Engine (3DApe) and associated 3D Audio Sound Producer (3DASP).

The audio production pipeline, in particular the breakout score, followed a circuitous route. To generate the score sound designer Robert Hindley created a sound track, using Foley and synthesised sounds, for each source in the breakout film. Independently I generated 3D trajectories for these sounds, using *SoundPath*. Dennis Lin, Alan Can, Craig Jin and Andre van Shaik from the CARlab used the sounds and mappings to generate the breakout score using 3DASP. The score played back, according the viuser's head orientation, by 3DApe, which was built by CARlab's Teewoon Tan.

My role was to ensure that the audio software developed by the CARlab could be synchronised with the visual system developed by the iCinema team. This appendix

will briefly discuss 3DASP, 3DApe and their interface with visual display in *Conversations*[1].

C.2.   Engineering 3DASP

3DASP is designed to produce spatial-audio soundtracks with no restrictions on the number of sound sources that can be rendered simultaneously with real-time head-tracking in virtual auditory space. (Kan et al., 2005a)

Once the breakout scene was completely composited, the process of scoring began. Scoring a spherical film is vastly more complicated than scoring a traditional feature. Greg Ferris and I created a number of different visual representations of the sphere for Robert Hindley to use. To provide an overall picture, we rendered the whole scene, flattened, as a single rectangular film. This gave a general sense of the action, but was not appropriate for fine grained sonic elements such as individual footsteps. Greg Ferris created a number of films that followed the principle characters, such as Ryan, Hodson and Walker. To make sure no characters or vehicles were omitted I created 4 movies — each showing a quarter of the scene — which were cropped to only include regions of activity. With these three video streams Robert Hindley was able to generate — using traditional Foley, sounds from sound libraries and software synthesisers — a sound track for each of the twenty six elements of the scene. The sound tracks were created to appear as if the object was wearing a microphone; relative volume, and sound effects such as doppler and echo, were added by the CARlab system. The sounds were supplied as 16-bit mono PCM WAV files at a sampling rate of 44100 Hz.

The CARlab's 3D Audio Soundtrack Producer (3DASP) requires two inputs; the individual sound files described above and the trajectories of those sounds through 3D space, as described in the previous appendix. 3DASP is not a stand-alone application, rather it is a MATLAB toolbox which uses a brute force method, that utilises head related transfer functions (HRTF)[2]. HRTFs are mathematical functions

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[1]An in-depth analysis of the software developed by the CARlab for *Conversations* appears elswhere (Kan et al., 2005a; Jin et al., 2005). These technical papers include explanations of the underlying mathematics, software implementation and descriptions of data structures and storage.

[2]MATLAB is a self-described "high-level language and interactive environment" that enables users to "perform computationally intensive tasks faster than with traditional programming languages such as C, C++, and Fortran." http://www.mathworks.com/products/matlab/.

that can be used to calculate how a sound, at a particular point in space, would be affected by the physical body and ear of a listener. HRTFs are generated by measuring how sounds from different origins appear inside a listener's ear. This is a complicated procedure, however the CARlab has an anechoic chamber on-site, which they used to create the HRTF we used in *Conversations*. HRTFs can be thought of as mathematical mappings of how an individual ear hears[3]. HRTFs are used to work out how a mono sound source would sound if it originated at a particular virtual position and orientation, as is done in *Conversations*.

With current off-the-shelf PC technology it is difficult to render more than five or six different sources using HRTFs in real-time, but for the breakout scene in *Conversations* twenty six were needed. 3DASP works by pre-rendering all the available sources for 393 individual head orientations — an amount chosen as it gives enough coverage of all possible head orientations such that when viusers look between two orientation points, a smoothing algorithm gives a very accurate auditory experience — into a single file (in a custom file format called spatial sound sources (SSS)). CARlab found effective spatial audio experience was obtained by pre-rendering a high number of orientations and smoothing over an envelope of 50 samples, centred on the direction in which a person is looking, during playback.

This solution has the added benefit of not requiring custom hardware, the data is read from two Serial ATA hard disks in a RAID 0 configuration, and the sound is generated using generic sound cards. This allowed iCinema to avoid resorting to an experience hardware solution, such as Lake Technology's Huron DSP technology[4].

A simple score, with a lower resolution, was created for *Ghost World*. The score was made up of audible but not intelligible whispers from the ghosts and the rise and fall of wind. As with every sonic element in *Conversations*, this score is presented spatial by 3DApe.

C.3. Engineering 3DApe

3DApe is an auditory user interface (AUI) which can simultaneously play back pre-rendered, spatial-audio soundtracks created by 3DASP, spatially render up to four instantaneous and simultaneous sound

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[3]A thorough explanation of HRTFs can be found in Wightman and Kistler (1989).

[4]Details of the Lake Huron system: http://www.lake.com.au/Lake_Huron.htm.

sources on command, and provide 3D audio communications using voice over IP. (Kan et al., 2005a)

3DApe provides the aural environment for *Conversations*; the score, the sound of ghosts approaching, the ghost's words and the voice communication between viusers. At times these sounds are presented simultaneously, yet, as in a bar or restaurant, these sounds are spatialised which enables the human ear to hear them comfortably and independently.

The sound playback elements of 3DApe can be divided into three parts; the score, instantaneous sounds and voice over IP (VoIP)[5]. During playback of the score, 3DApe uses the SSS file created by 3DASP and the viuser's head orientation to generate the spatial soundtrack for the viuser, in real-time. 3DApe buffers all instantaneous sounds, such as speech from the ghosts, into memory (RAM). This gives 3DApe immediate access to the sound file which must be converted, using an HRTF, before being played to the viuser. Once a new viuser has entered *Ghost World* their microphone, should they use it, is spatially broadcast to other viusers already in *Ghost World*. This spatial VoIP rendering takes into account the head orientations and positions of all viusers.

3DApe was developed by Teewoon Tan over a number of iterations, in response to internal testing by both Tan and myself. The majority of enforced revisions were due to the complex challenges of synchronising the visual and sonic aspects of the experience, such that when a ghost spoke, the movement of their lips perfectly matches the sound of their voice.

C.4.   Sound synchronisation

Synchronising all the elements of the aural display with the visuals they represented, in real-time and in harmony with quickly changing head orientation, was a complex task. The *Conversations* installation at the Powerhouse Museum consisted of 3 stations. Each station utilised two interconnected computers, one for audio and one for video. This was needed due the high bandwidth of data being read from disk and processing required by each system. The video machine drove the user experience by providing the virtual environment, communicating with the other stations, making

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[5]The "IP" in "VoIP" stands for Internet Protocol. VoIP is voice communication via a network, such as the internet. An example of this technology in the commercial sphere is *Skype*.

the narrative decisions and triggering instantaneous elements of the sound environment.

I wrote additional software for *Virtools* that enabled communication with 3DApe, via simple messages sent over the local network. These messages were used to start and stop the soundtrack, triggered instantaneous sounds and to place other viusers in the virtual audio environment, such that when they spoke their voices would appear to originate from their avatar. This communication system was used to test all elements of 3DApe; the testing process led to a series of revisions and improvements.

C.5. Conclusion

During the development of the *Conversations* project numerous novel technologies were built. Many of these were developed as part of the successful collaboration between iCinema and the CARlab. *Conversations* is, in many ways, archetypal of the large-scale, technologically ambitious new media works that are becoming more frequent in the wider digital art world. As with other such works, *Conversations* could not have been built by an individual, or even a single research group. iCinema's collaborators are fundamentally important to the success, and the very existence, of the work. Such collaborations, I believe, are most successful when each party gains measurable benefit in their particular field of investigation. For CARlab this collaboration was productive, the team developed two new technologies and widely published the results of their research. The benefits for iCinema are clearly evident.

SoundPath, 3DApe and 3DASP were all developed in response to an aesthetic need. For a genuine immersive experience, *Conversations* requires surround, stereoscopic visuals and high-fidelity, spatial audio. Further, these elements must remain in perfect harmony, and react instantaneously to the head movements of the viuser.

Appendix D   Usher interview question text

Conversations usher interview questions and prompts, interview conducted by Keir Smith with: on:

What course are you doing?   and at what stage are you in the course?

Why did you want to be involved?

How would you describe *Conversations*?

What does it do?

What would have happened to people if you (the ushers) hadn't been there, what sort of experience would they have had?

What were the main problems for people using it, ie. What did you have to explain multiple times?

What were the main problems with the installation itself, what didn't work, or worked intermittently?

How much did people talk to each other (when they did vs. didn't know the other people using it)?

Did anyone get scared/did it make anyone feel sick?

Any thoughts, things that stayed with you from the experience?

Appendix E   Destinations and their descriptions

There are two hidden and fifty listed destinations in *Day of the Figurines*. The two hidden destinations are "the edge of town" and "a street corner". These are used, respectively, for the initial location when players enter the game and for the hub — such that if a player sends an **UPDATE** request when they are in the hub travelling from one destination to another they are told they are on "a street corner". The fifty destinations that players can specify are listed below, along with descriptions taken from the Berlin exhibition. These texts describe the town at five am during the closing, apocalyptic moments of the experience. They exemplify the manifestly dark and decrepit nature of the *Day of the Figurines* town.

Destination	Example description
the 24 Hour Garage	family cars are dumped on the forecourt, a grey truck is backed against the shop, its engine running.
the Allotments	it's very dark here, just the glare from the Cop Shop car park on the fluttering carrier bags.
Big Chef	the doors are closed. A pair of men sit in 2 identical Cortinas in a dark corner of the car park.
the Bins	some junkie has used a PhD thesis for her bodily functions. Fag butts and milk crates scattered in the rain.
the Blue Cross	a strip light in the window illuminates a handwritten notice of temporary closure.
the Boarded Up Shop	dark rooms, the smell of varnish and the floors scattered with greying papers.

Destination	Example description
the Bus Shelter	it's cold. Fag butts scattered by the seat. A screaming stick man drawn over the timetable in marker pen.
the Canal	a junkie lies asleep in the dark, a Happy Shopper bag over her feet, 1 hand dangling in the water.
the Car Showroom	the shutters are down, smoke drifts among the limp pennants. Cunningly placed rocks prevent driveaways.
Cash Creators	now closed for the day. Light spills from the window: exercise machines, hair tongs (3.99!) & game consoles.
the Cemetery	wind rustles carrier bags and trees in the gloom. Police tape cordons off one area of collapsing headstones.
Chefwok	locked tight. A light is on upstairs: it sounds like Pro Poker is on Channel 5.
the Conveniences	a deep blue light shines within but the rusty padlocks have been glued shut.
the Cop Shop	cell doors hang off hinges, evidence bags are scattered across the floor. Somewhere, a phone rings.
the Council Block	no-one answers the intercom. In all 18 storeys not a single window has a light on.
the Dance Hall	the doors are closed, the foyer deserted. A poster stands out front: Mega Jumble first Sunday of the month.
the Gasometer	light from the neighbouring Timber Yard casts flickering shadows on their towering frames.
the Hospital	A&E is in darkness; slumped silhouettes dot the plastic chairs. Outside, a big haired goth girl sits smoking.

Destination	Example description
the Internet Cafe	all the black-floppy-haired youths in flip flops have gone home.
Kath's Cafe	the door is locked & windows are steamed up. A powerful waft of boiling chicken rolls from under the door.
the Level Crossing	an owl, silhouetted in the dark above the electricity sub station, watches over the tracks.
Max Agra's Curry House	it's closed. 1 light on through the window: the waterfall effect picture glistens against the flock wallpaper.
the Multistorey Car Park	the heart of the dogging scene. Misted up saloons dot the top deck. Below, lights track around the streets.
the Nuclear Bunker	a locked metal door and no windows.
Pirate FM	duvet and odd pillows share the bed with record boxes. Smoke hangs above the desk by the window; decks turn.
the Product Barn	some scattered placards, steaming embers and drinks cartons. Parcel tape on the shattered windows.
the Rat Research Institute	the gates are high and locked. Floodlights blast the car park: razor wire, CCTV and BMWs.
Ron's Top Chip Shop	Ron's been here 27 years. His best selling range is chips.
the Royal British Legion	windows the colour of sherry, chipped steps and nobody home. Poster: Close the Locarno!
the Sauna	the door has 3 padlocks. Through the letterbox, the illuminated fish tank is visible. Open at 2pm.

Destination	Example description
the SK8 Park	crisp packets flutter in the dark puddled bowls of graffitied concrete: "Dawn takes it up the bum".
the Slaughterhouse	the shed is shut tight. Some overalls lie in the drive, in the glare of the floodlight.
Sparkies	corrugated iron gates laced with heavy chains, a dog barking deep inside.
the Street Sign Depot	through the fence there are dead ends, U turns and rights of way in the gloom.
TH Plating	huge galvanised troughs and an acrid stench rolling from under the shutters.
the Battle Of Trafalgar Sq	the net curtains give away no secrets. The painted sign outside shows a cop van on fire.
the Locarno	an unconscious metal girl lies among the flyers "Next: Saxonic Rock Plinth + Cock Doctor"
the Lock	patches of stubborn grass still grow. A pair of boxer shorts are draped over the lock gate.
the Pound Shop	the window is repaired with parcel tape where Jack the Biz chucked a stepladder.
the Rec	the damp smell of blackened plastic. A burning car throws shadows among the trees in the half light.
the Vic	through the patterned glass of the window you can see the fruit machine running its kaleidoscopic routines.
the Timber Yard	inside the padlocked fence: sheds, gazebos and hot tubs dot the landscape, tarpaulins flapping in the breeze.

Destination	Example description
the Tower Block	lift goes to the top floor. From canal to cemetery sodium glow onto piss streets.
the Traffic Island	the flowers taped to the railings are sodden: "Gary, we miss u" in bleeding felt tip is on a collapsing card.
Trap Solutions	at this time the car park is deserted except for a single Nissan.
the Underpass	a streetlight casts an amber light: "I am the bitch you hated" is sprayed down the length of one wall.
the Video Zone	the cardboard lovers in the window are giving way at the neck.
the XXX Cinema	you can never really tell if it is open or not, or what is showing. Open at 2pm.
the YMCA	the squatters took their toll on this place. Even now the outside is ragged.

Appendix F   Figurine health descriptions

When a player begins *Day of the Figurines* their figurine's health is set to fifty. Over the course of the game it can range from one hundred, "cock of the walk", to zero, "dead". If a player's health falls below twenty they become incapacitated. The game engine does not allow players to die easily, for example if a player is above twenty and something terrible happens to them, the player is incapacitated instead of being killed. However, as the below table shows, as a player gets closer to incapacitation or death the health descriptions become more frequent and urgent.

Health description sent to player	Health range
cock of the walk	from 100 to 98
banging	97 - 91
hot to trot	90 - 81
very fine indeed	80 - 71
averagely fine	70 - 61
feeling peaky	60 - 51
run down	50 - 41
poorly	40 - 31
pretty ill	30 - 27
very unwell	26 - 25
maximum sick	24 - 23
about to pass out	22 - 21
unable to move	20 - 11
fading fast	10 - 4
very fucked	3 - 1
dead	0

Appendix G   Day of the Figurines questionnaires

G.1.   Laban

Short boring questions or longer more interesting ones? The dilemma of any feedback questionnaire. In this one I have tried to give you a mixture of quick structured questions but also with some space for more expressive longer responses without requiring them. The more you feel you can give, the more the game can be improved for next time. This questionnaire is an evaluation process handled by the Mixed Reality Laboratory and Fraunhofer Institute as part of iPerG project.

My preferred way for you to complete this is to type into this Word doc and email it to me: Mauricio Capra: mxc@cs.nott.ac.uk

Or if you'd rather, print it out, write your responses and post it to me: Mauricio Capra, School of Computer Science & IT, The University of Nottingham, Jubilee Campus, Wollaton Road, Nottingham, NG8 1BB.

Thanks, in advance, for giving up the time to complete this.

Your figurine and the town

What was the name of your figurine?

How close do you feel to your figurine? Are they 'you' or are they someone else?

Would you want to revive your figurine in a future game?

What can you tell me about your figurine that I may not know?

Can you describe where your figurine has been in the town and what they did.

What kind of place did the town feel like to you?

Did you have access to a map? Printed/online? And how often did you refer to it?

Duration and timing of the game

On a scale of -5 to +5 please indicate below whether the game felt like it was too long, too short or about right.

```
too                    about                  too
short                  right                  long

| | | | | | | | | | |
```

How did your pattern of play (e.g., the amount of time you spent playing, and the places and times where you played) change over the course of the game?

Please mark below which days of the week you preferred playing on

```
| | | | | | |
Mon  Tue  Wed  Thur  Fri  Sat  Sun
```

Why did you most prefer playing on these days?

Please mark below which days of the week felt **worst** to play

```
| | | | | | |
Mon  Tue  Wed  Thur  Fri  Sat  Sun
```

Why did you least prefer playing on these days?

Please mark below which times of day it felt **best** to play?

```
midnight  1  2  3  4  5  6  7  8  9  10  11am
| | | | | | | | | | | |
```

midday   1   2   3   4   5   6   7   8   9   10   11pm

Why did you most prefer playing at these times of day?

Please mark below which times of day it felt worst to play?

midnight   1   2   3   4   5   6   7   8   9   10   11am

midday   1   2   3   4   5   6   7   8   9   10   11pm

Why did you least prefer playing at these times of day?

Do you feel like the time of day when you composed and sent a message had an impact on the content of the message?   [ ] yes   [ ] no

Comments:

Places where you played

Please indicate in which real physical places did you tend to play the game?

[ ]   Home   [ ]   Café/restaurant

[ ]   Work   [ ]   Shops

[ ]   Bus   [ ]   Other (please list these below)

[ ]   Car

[ ]   Train

Why did you choose to play the game in these places?Which places felt **best** to play the game and why?

Which places felt **worst** to play the game and why?

Do you feel like the place you were in when you composed and sent the message had an impact on the content of the message?   [ ] yes   [ ] no

Managing the flow of text messages

On a scale of -5 to +5 please indicate below whether you received too many, too few or about the right amount of text messages throughout the game:

Please tell us about any occasions when you received too many text messages from the game?

Please tell us about any occasions when you received too few messages from the game?

Were then any occasions when you temporarily stopped playing the game? When were these and why did you stop?

Do you feel that the game adapted to your level of engagement, by sending you more messages when you were active and less when you were not?

Do you think that you missed any important events in the game? If so, why?

Did you stop doing what you were doing to check the message?

Did the messages disrupt your activities?

[ ] mostly in a pleasant way   [ ] mostly in an annoying way

[ ] sometimes pleasant, sometimes annoying.

How long after receiving did you usually answer the message?

[ ] immediately   [ ] after I finished what I was doing

[ ] when I felt like it

Did your way to react to an incoming message change from the way of your reaction prior to playing DOTF?

[ ] yes   [ ] no

If yes, in which way did it change?

Do you feel like the mood you were in influenced the type of message you sent and the behaviour of your figurine?

[ ] yes   [ ] no

What did you do with the messages sent to you from the game?

[ ] deleted them:

    [ ] right after I received them

    [ ] when I didn't have enough space left

[ ] saved them

If you saved them, did you ever go back and read the old messages?

[ ] seldomly   [ ] occasionally

[ ] frequently

Was the cost of sending text messages an issue for you?

Personalisation

On a scale of -5 to +5 below please indicate the amount of messages that you received that you think were automatically generated compared to those that you think were created by a human:

```
all                          all
messages        about        messages
automatically    50/50       human
generated                    generated

|   |   |   |   |   |   |   |   |   |   |
-5              0              +5
```
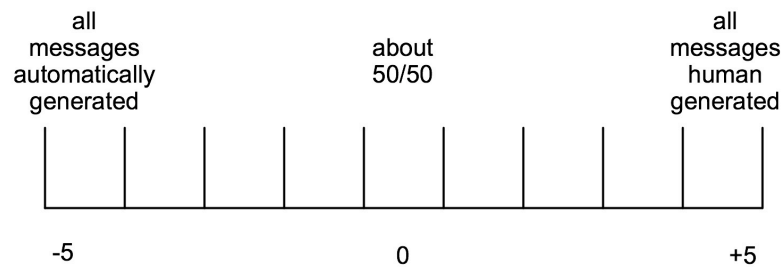
Why do you think this?

Could you distinguish text messages from the game from others that you received? Why?

On a scale of -5 to +5 below please estimate the amount of messages that you received that seemed inappropriate or incomprehensible?

```
no                              all
messages received    about    messages received
seemed inappropriate  50/50   seemed inappropriate
or incomprehensible          or incomprehensible

|   |   |   |   |   |   |   |   |   |   |
-5              0              +5
```
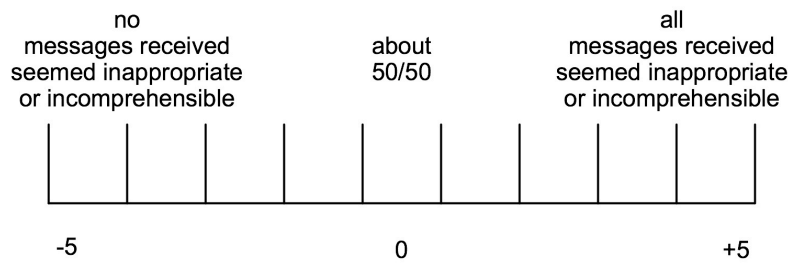
Please give us examples of any messages that seemed inappropriate or incomprehensible.

Did you deliberately structure the text messages that you sent in a particular way?

General feedback

On a scale of -5 to +5 below rate how much you enjoyed Day of the Figurines:

```
                  I fell neutral
I didn't enjoy        about       I really enjoyed
Day of The Figurines  Day of The  Day of The
at all                Figurines   Figurines

|   |   |   |   |   |   |   |   |   |   |
-5              0              +5
```
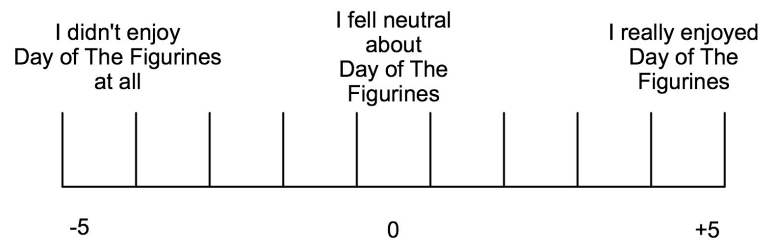
What did you like about Day of the Figurines?

What didn't you like about Day of the Figurines? Where did it break or feel like it let you down?

How could we improve the game next time we play it?

Would you like to take part in future games of Day of the Figurines?

Would you be willing to take part in a follow up telephone interview to discuss your opinions?

G.2. Sónar & Berlin

1. Please add the name of your figurine and your e-mail address:

2. The game was played for 3 days between 12:00pm until 10:00pm. On a scale of 1 to 5 below:

	I strongly disagree		I'm neutral		I strongly agree	
	1	2	3	4	5

Was this the best time to play the game?

Did the game fit your day time schedule?

Did you feel the game adapted itself for your everyday routine?

3. The dynamic of the game meant players who did not respond to text messages in time could miss key moments of the narrative.

I had time enough to answer all text messages and felt I missed nothing   [ ]

It was difficult to keep in track of all of the text messages, but I quite often managed it   [ ]

I definitely felt that the game should give more time to answer a text message. It was impossible to keep messaging so often and probably I missed a lot of the game   [ ]

4. Did you feel at any point during the game that the narrative broke down?

    Yes   [ ]

    No   [ ]

5. At what time and day DO YOU PREFER to interact with your phone (gaming, messaging, calling,

etc.)? At what time and day YOU DO NOT PREFER to interact with your phone?

6. What made you feel engaged in the game? What were the moments that you really liked? Can you please describe these moments? What moments did you not like and why?

7. The game stimulated the possibility of interaction with other figurines. On a scale of 1 to 5 below:

	I strongly disagree		I'm neutral		I strongly agree	
	1	2	3	4	5
I exchanged a good number of messages chatting with other figurines					
The chat messages kept me engaged in the game for longer					

8. On a scale of 1 to 5 below:

	too few messages		right number		too many massages	
	1	2	3	4	5
The number or messages that you received.					

9. Some of the messages from the game arrived with more than one piece of information: On a scale of 1 to 5 below

	useless content and difficult to understand		neutral		very good content and really easy to understand	
	1	2	3	4	5
The contents of the messages were useful					
The messages were easy to understand					

10. The game tried to work out which players were active and which were inactive in the game and send messages which were appropriate to this. On a scale from 1 to 5 below:

	I strongly		I'm		I strongly	
	1	2	3	4	5

	disagree		neutral		agree
	1	2	3	4	5

I never disengaged from the game

The messages arrived at the right time to reengage me, reminding me that I was playing a game

The messages made me feel like playing the game again and told me how much I missed

11. For all the messages that you received from the game what percentage of messages do you think that were automated?

10%	[ ]
20%	[ ]
30%	[ ]
40%	[ ]
50%	[ ]
60%	[ ]
70%	[ ]
80%	[ ]
90%	[ ]
100%	[ ]

12. Did you feel that the game reflected/respected your cultural background (language/content/etc.)?

Was it a issue? Can you please give us some examples of what and when it did?

13. The operator was your first contact with the game. He/She was there to introduce the game and give you some extra information. On a scale of 1 to 5 below:

	I strongly disagree		I'm neutral		I strongly agree
	1	2	3	4	5
There were the right number of operators					
They had time to explain the game					
They made me feel like playing the game even before I started					

14. Day of the Figurines offered different ways to perceive the game. On a scale of 1 to 5 below:

	I strongly disagree		I'm neutral		I strongly agree
	1	2	3	4	5
The board was useful to understand the game and situate myself					
The map printed on the paper helped me to GUIDE myself through the game					
The commands printed on the paper helped me to PLAY the game					
The web interface helped me to understand my situation in the game					

15. On a scale of 1 to 5 below please rate how much did you enjoyed Day of the Figurines

I did not enjoy it at all!   [ ]

I fell neutral about the game!   [ ]

I really enjoyed Day of the Figurines!   [ ]

G.3.   Singapore and Brighton

I am...

[ ] female   [ ] male

My age is...

What is your educational level?

[ ] primary school   [ ] middle school

[ ] high school   [ ] vocational college

[ ] bachelors degree   [ ] masters degree

[ ] PhD or other doctorate

What is your occupation?

What is your favourite hobby?

Do you often go to art galleries or theatres?

[ ] Yes (What do you like to see and how often do you go?)

[ ] No

Do you consider yourself a gamming person (for any kind of game electronic or not)?

[ ] Yes (Which games do you like to play and how often?)

[ ] No

How often do you send text messages in your mobile phone?

[ ] 0 to 5 every day   [ ] 5 to 10 every day

[ ] 10 to 15 every day   [ ] more than 15 every day

Which of the two systems do you prefer when sending a message to another person?

[ ] Mobile phone - SMS messaging   [ ] E-mail

Was the messaging price an issue when playing Day of the Figurines?

[ ] Yes   [ ] No

Which sort of contract do you have with your mobile company (pay as you go/pre-paid)?

What other factors influenced in the number of messages that you sent to the game?

How many times did you visit the physical game board?

[ ] 1   [ ] 2

[ ] 3   [ ] 4

[ ] 5 or more

How did the physical game board contribute to your experience of Day of the Figurines?

How long did you stay (in average) each time you visited the game board?

[ ] 1-10 minutes   [ ] 20-30 minutes

[ ] 30-40 minutes   [ ] 40-50 minutes

[ ] more than 50 minutes

Is there something you would like to add to the game board? Please describe what it might be.

How would you feel about playing a version of Day of the Figurines without the physical game board?

What is your figurine name?

Please rate how important the following features were to your experience of the Day of the Figurines. to chose my own figurine to be able to develop the character of my figurine to communicate with other players to cooperate with other players to be able to follow the evolvement of the storyline to be able to influence the evolvement of the storyline to understand and use the game rules to be able to be anonymous to be able to return to the game board to feel I was part of a virtual community

Was there enough to do in the game?

How much activities did you encounter in the game?

What was the most exciting part of the game?

What was the least exciting part of the game?

Please rate the following characteristics of the messages that you received from Day of the Figurines.

[ ] ...informative?   [ ] ...well composed?

[ ] ...easy to understand?

Did you chat with many other players and did this enhance your game?

   [ ] Yes (How?)   [ ] No

How did your health change during the game and what did you do about this?

Please rate on a scale of 1 to 10 how you perceived the amount of messages you received from the game.

Please tell us about any occasions when you received too many or too few messages from the game.

Did the game respond quickly enough when you sent messages?

Did you save messages from the game on your phone?

   [ ] Yes   [ ] No I saved some of them

   Please comment on your decision

When receiving a message from a real friend and a friend from Day of the Figurines at the same time which one do you answer first? Why?

   [ ] Real friend   [ ] Day of the Figurines friend

How would you describe your pattern of play?

   [ ] Frequently   [ ] Occasionally

   [ ] Seldomly

   Comment on your decision

In which places in the physical world did you like playing the game and in which did you not?

   [ ] Home   [ ] Work

   [ ] Bus   [ ] Car

   [ ] Train   [ ] Cafe/Restaurant

   [ ] Shop   [ ] Other

   Please comment on your decision

Did you share the game with others who were with you when you sent/received messages and how did this affect the game?

At what times did you like playing the game and at what times did you not?

Did playing the game change or interfere with your daily activities in any way?

   [ ] Mostly in a pleasant way   [ ] Mostly in an annoying way

[ ] Sometimes pleasant

Why?

Overall how much did you enjoy Day of the Figurines?

What was it you liked about the game?

What was it you didn't like about the game?

What do you think would have made your gaming experience even better?

Would you play this game again?

[ ] Yes   [ ] No