Presence-Generating Arts Systems

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Certificate of Authorship / Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of student

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Abstract

In order to advance understanding about presence-generating art systems, artists, researchers and designers, working in the field of immersive environments, create experiences for people. These experiences involve the participant not only through the systems functionality (interaction), but in a psychological way, employing the use of the senses. Designed sensorial experiences account for both the participant's experience and the system's functionality. A presence-generating art system facilitates engaging experiences for participants, as both system form and system content compliment each other. These three components; the participant, system form, and system content are reliant upon each other if the outcome is to produce presence-based engagements. Creating meaningful, engaging experiences is one method for generating the experience of presence. This work looks at the process of creating presence engagement by applying in design; previous research into presence, two models for creative engagement and designing low stress environments. It briefly explores participants' experiences of navigating a projected interface, using a stand alone eye-tracking device. This practice-based research project examines an interactive art system and how it use's levels of interactivity to engage participants through models for creative engagement, designed for gaining and sustaining attention. The work advances understanding about interaction and experience design, by evaluating participants experiences of the seven features designed to enhance the sense of presence. These features are: designing for creative engagement, the sensation of spatial presence, the experience of ecological validity, the use of narratives, the use of colour and motion, audio and the system response time.

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Chapter One

1 INTRODUCTION

This research project is concerned with how to engage people in interactive experiences with computer driven systems, namely interactive art systems (Cornock and Edmonds, 1973). Such systems often provide for the participant a unique human-computer interaction, experienced physically and psychologically. By interacting with a system that responds to the participant's input, such as the use of sensor apparatus, sound and tracking devices, a two way process takes place. A forward backward motion of information incorporates the participant's response which, in turn, sustains the creative engagement for each participant. When engaging with an interactive art system, the participant is taking part in the artist's vision, the artist's ability to conceptualise and produce an engaging interactive experience.

Art systems are designed to draw the participant in and some are designed to invite playful participation requiring thoughtful engagement. *PEGASYS:* a Presence-Generating Art System is a system that participants interact with using their eyes only. There are three stages of interaction designed to enhance creativity by providing a variety of possible narratives. Participants choose their own pathway by panning either left or right (and holding their gaze on an invisible icon) while the video-on-demand system allows for instant access to the chosen content. The media content is of an audio-visual natural environment shot in 360 degrees, played back in real-time through the video-on-demand system, in high definition video, with stereo-surround sound.

The illusion of presence is created through our sensory inputs. Thus, the work presented here aimed to transport the participant in some way into an experience of their own generated through memories, associations, experiences of 'reality' and previous knowledge. The aim of the systems design was to transport participants away from the context of their everyday lives through techniques and methods designed for creative engagement. By facilitating for the participant a sense of another place, a relaxing yet interesting and engaging environment, the system was designed to elicit the sensations referred to as the experience of presence, a human state, a phenomenon that emerges when the form and content of the system produce a 'being there' quality for participants.

There is a debate current amongst researchers in the area of presence that the form of the system being used to test participants' experience of presence is of paramount importance to the experience of presence; the content of the system is, on the other hand, thought be a secondary matter (Slater et al., 1994). The art system produced and the accompanying thesis take into account that communication and presence literature distinguishes between media form (the physical objective properties of the display environment or system) and the media content (the theme, narratives or story unfolding within the display environment). For this reason, artists are exploring how to design the different parts of an interactive experience to induce relevant emotions and improve levels of involvement. This research investigates the role of media content and system form for inducing relevant emotions in participants, assisting them to experience a presence-based engagement. The research undertaken for this thesis sought to establish if, in the circumstance of participants experiencing a presence-generating art system, the form of an art system is more important than the content. In the case of *PEGASYS*, the participant experience study results indicate that it was the content that drew them in, held their attention and engaged them, whereas the form (eye-tracking technology) was seen to be merely a method by which to deliver the content in an engaging way.

The aim of this research was to identify specific technological issues associated with the design of an art system created to elicit presence-based experiences for participants. Previous research into presence was explored in order to understand how the results and methods used could influence the design of an interactive art system. The conceptual development and application of the art system was studied with a view to advancing understanding about designing interactive art systems that facilitate presence engagement. The research included an investigation into participant experiences of the art system with particular respect to seven features that were designed to enhance the experience of presence through creative engagment.

1.1 Aims

The main aim of this research project was to design an immersive interactive experience for participants, and test it to see if it contained the ideal features for the generation and experience of presence. The research aimed to discover the attributes that make a presence-based engagement and replicate those attributes through an art systems design and functionality. Interaction, assists the experience of presence through creative engagement. This research project aims to produce knowledge about designing experiences for participants of presence-generating art systems. The research aims to

evaluate participants' experiences of an art system, in respect to the systems design features, and the factors influencing an individual's ability to experience presence-generating art systems.

1.2 Objectives

There were two research objectives, both objectives were met through the analysis and evaluation of data gathered through a particular methodological process, namely practice-based research. Participants' experiences of an art system were evaluated to determine if, and by what method, a presence-based engagement had occurred.

The research objectives were:

1. To advance understanding about interactive art systems that facilitate a presence-based engagement.
2. To contribute knowledge about human-computer interactions through the measurement and analysis of participants presence-based engagement.

1.3 Research Questions

The research questions were as follows:

1. How can previous research in presence inform the design of an art system?
2. In what way did the art system design features contribute towards the participant experience? In particular, what influence does eye-tracking technology have on the experience of presence-generating art systems?
3. What are the factors influencing an individual's ability to experience presence-generating art systems?

1.4 Outcomes

The outcomes of this research include the design, production and evaluation of a presence-generating art system. The research outcomes provide value in its application in supporting the design process of producing entertaining and engaging experiences for participants. The system features combine to create a contemporary art system with the potential for multi-purpose application. As well as considering aspects of media content creation for delivery within the system, it also provides an example of an innovative type of human-computer interaction, namely an interactive story telling device. The system encourages time for relaxation and self-reflection by placing the participant in the centre of the place they are visiting; it also enables them to move the view of the place as if in real life, but from a static point. This research project produced a new experience for participants with respect to the creation of a networked system that provides a panoramic, cinematic engagement within an interactive art system framework. The outcomes of this

research project produce knowledge about design requirements for creating presence engagement within a video construct environment. The practice-based methodology facilitates a process of identifying and cataloging various levels of participant engagement within the art system. The research outlines how involved the audience as participants became in the interaction and what enhances or reduces this engagement.

These outcomes are anticipated to be of benefit to researchers of presence, digital media artists and interaction designers who are engaged in the process of creating mindful experiences for participants. The research also benefits those researchers who are working with eye-tracking technologies assisting in the development of video as a tool for time-based media for experiences. The research outcomes include findings about how human beings respond to eye-tracking technology, implemented as a hands-free component to enhance the sensations of presence. The results of a two-part study illustrate a link that is made between interactivity and non-interactivity evaluating participants' presence-based engagement with the computer-based system they are experiencing.

1.5 Significance

This work has significance in the areas of research that are focused on understanding digital interactive experiences and designing those experiences. The research produces knowledge about attributes of presence factors that need to be considered in the design of a presence-generating art system, created in order to engage participants thorough eye-tracking technology. Artists, research scientists and presence researchers will find information about designing and then analysing presence-based experiences for participants. By acknowledging the information contained within this document and previous papers by this author about this subject, the system produced in this research project is reproduceable. However, the code enabling the video-on-demand to network with the eye-tracker is not open source so a communication between artists and or technologists would be required to take place.

This work is significant in as much as it facilitates a dialouge about accessing video-on-demand through eye-tracking technology. It did not investigate the use of other forms of interactivity (namely, joysticks, mouse and keyboard operation etc) but acknowledges that future research into video-on-demand systems may benefit from investigating these forms of interactivity.

1.6 Chapter Synopsis

Chapter One introduces the research project aims, objectives, research questions, outcomes and significance of the work. It then goes on to summarise the remaining chapters.

Chapter Two: State of the Art

This chapter examines four main areas of previous research relevant to this research project. These areas are: presence, models for creative engagment, interactive art systems and gaze-based devices.

The first section 2.1 *Presence* describes the notion of 'presence' within this research context. As there are many variables that influence the feeling of presence, presence is examined here in relation to the following factors as decreed by the International Society for Presence Research *(ISPR,2000)*: namely, engagement, spatial presence, sensory presence, and social realism. Presence as absence or inverse presence is also briefly touched upon. Negative effects as previously associated with experiences of presence and the impact of place on the experience of presence is then mentioned. The relationship between participant experiences of immersion and time factors are discussed next. Inner Presence and Media Presence contain characteristics that embody the form of the technology, the media content and the participants' experience of the systems features. A summary table outlines various researchers previous work in presence.

Section 2.2 *Models for Creative Engagement* examines two models illustrating how to design creative engagements.

The next section of this chapter (2.3) looks at the history of *Interactive Art Systems* and illustrates work with examples from artists such as Franke, Edmonds and Cohen. Next computer-controlled systems are compared to user-controlled systems. A brief history of the use of video in art systems and art systems that comprise of a biotechnological input is discussed, where the art systems of Australian artists Khut and Armstrong are examined in respect of developing concepts for designing engaging experiences. This section on interactive art systems closes with examples of art systems designed to enhance presence-based engagement.

Section 2.4 *Eye-tracking Technology* considers eye-tracking devices as technological tools for enhancing the experience of a screen-based engagement. It describes eye-trackers and how they are being incorporated into systems that facilitate biotechnological

feedback. 2.4.1 *The Eye-tracking Device* examines exactly how an eye-tracker works using two current examples. Art and science collaborations that produce systems so as to engage participants with interfaces for creative expression are discussed next. Finally, eye-gaze technology as a form of interaction for presence generation is reviewed.

Chapter Three: Methodology

Chapter Three explores the methodological approach applied to this research project. First it introduces *a Practice-Based Research Methodology* that can be applied to support and evaluate creative work. Practice-based research projects like this one considers reflective practice with time for critical reflection. The research methods are then discussed in respect to the role of the artifact in generating evidence.

Section 3.2 *Investigating Presence* focuses on the studies and the nature of presence, examining the factors that influence participant experience. In 3.3 *Data Gathering Methods,* various data gathering techniques are discussed such as the use of questionnaires, observation and interviews as well as how the participant profile information can provide valid data for analysis. Section 3.3.5 examines the process undertaken to evaluate participants' attention. Section 3.4 *Research Context and Environment* discusses how the studio environment is contextualized to support the exhibition environment. 3.5 *The Presence Components of the Design Methodology* are then discussed in respect to the degree of immersion facilitated by the participants' experiences of the content and how this will be measured. The degree of immersion experienced by participants is then discussed in respect of the form of the system. Measuring participants' experiences in general are then discussed.

The next section, 3.6 *Designing A Two-Part Study* presents a methodology for designing the evaluation studies. It does this by looking at the venue and methodology of each study including *Study One: Without Interaction* and *Study Two: with Interaction.* 3.7 *Data Gathering for the Two-Part Study* looks at the techniques applied, such as: the process of observation, administering the questionnaire, the use of the participant profile information, interview as an analysis technique and finally, the application of video and photography documentation. 3.8 summarises the methodology chapter.

Chapter Four: Foundation

This chapter explores the evolution of the researcher's creative practice, identifying the influences on creative and professional practice. The chapter outlines the exploratory nature of my creativity and the processes that influenced research undertaken in the area

of presence-based engagement. The chapter highlights the natural progression of skills accumulated and knowledge put into practice through creative expression within the following industries: graphic design (4.1), theatre production (4.2), filmmaking (4.3), interactive multi-media (4.4) and interactive experiences (4.5).

Chapter Five: New Work

Chapter Five New Work begins with a retrospective account of the process of the evolution of the concept in which it details the four conceptual versions of the proposed system. The pilot study results are then examined in respect to the contribution they made to the formal system and likewise the results of study one. A description of the art system called *PEGASYS*: a presence-generating art system is followed by a section about the creative team involved in the production of the system. In 5.3 the art system's design features are identified. There are seven features that distinguish the system, these features are: designing for engagement, the experience of spatial presence, ecological validity, the use of narratives, the use of colour and motion, sound and finally, the form of the system. Section 5.4 on content production outlines the creation of the three stages of interaction. The location-based film shoot is discussed in respect to a camera shelf designed specifically for the location-based shoot, the video cameras used, sound and the video-on-demand database design. 5.5 examines the form of the system, identifying issues with eye-gaze control, and applying eye-tracking into the system design. The section 5.5.3 *Exhibiting Eye-Gaze Tracking* within an art system examines installing the device, the interface design, the invisible icons, changing from stage of interaction into another, calibration of the device, confirming an action, and experimenting with the interface. Finally, hazards associated with the technology are outlined briefly. 5.5.5 provides a summary of the chapter outlining how the concept impacted upon the finished product.

Chapter Six: Evaluation of the Study

This chapter examines the results of the data gathered from studies one and two. As study one results and impact were discussed in 5.1.6 *Study One Results* and 5.1.6.1 *Conclusions Drawn from the Previous Study*, the data from study two is examined here in more detail. The chapter starts by revisiting the research questions (6.1) and moves into discussing the two-part study (6.2) in respect to the process of evaluating the outcomes through observation (6.2.1.1), questionnaire results (6.2.1.2), the interview process (6.2.1.3), and the participant profile information (6.2.1.4). 6.2.1.4 extends to include information derived from each of the participants' sessions including session durations (6.2.1.4.1), age and sex (6.2.1.4.2), participants' occupation (6.2.1.4.3), and the time of the day of each

session (6.2.1.4.4). Section 6.2.1.5 summerizes the use of video and stills documentation for data gathering that took place during the course of study two.

Section 6.3 *Evaluating the System Design* identifies how the system features were devised by applying two models for creative engagement. *The Model of Engagement* (2.2) and *The Creative Engagement Model* (2.2). It addresses how the engagement models were implemented into the five step system design for *PEGASYS* (6.3.3). Particular attention was paid to the process involved in designing to enhance experience through interactive modes and phases. The application of attractors, sustainers and relaters is also demonstrated.

6.3.3 *Evaluating the Designed Experience* is broken down into five parts in order that the audio-visual media components can be addressed individually and yet contextualized. *Step One* includes the use of atmospheric sounds (6.3.3.1), *Step Two* sustainers in action includes a look at how the compositional music score was perceived (6.3.3.2), and *Step Three* includes a section on how the dynamically generated sounds were received by participants (6.3.3.3). Relaters in action are described in sections 6.3.3.4 *Steps Four* and *Five* (6.3.3.5).

Evaluation of the *Systems Features* in respect to participants' experiences of them is addressed in the next two sections. Section 6.4 focuses on the digital media content in respect to participants' experiences of it, namely; participant engagement (6.4.1 *Evaluating Engagement as a Design Feature*), the visual media content (6.4.2.*Evaluating Spatial Presence)*, 6.4.3 *Evaluating Ecological Validity (Sensory Presence*), 6.4.4 *Evaluating Narratives and Emotional Content* and 6.4.5 *Evaluating the use of motion and colour*. The section addressing sound design follows (6.4.6 *Evaluating the Audio Components*, 6.4.6.1 *Audio Systems*, 6.4.6.2 *The Surround-Sound Environment*, 6.4.6.3 *The Use of Headphones).*

Next, section 6.5 considers the *Systems Features* in respect to the form of the technology. The systems form is considered in respect to participant's experiences of it, namely; the system response time: 6.5.1 addresses evaluating the system response time, and 6.5.2 as a sensory output. 6.5.2.1 examines the ideal viewing distance and 6.5.2.2 looks at how obtrusiveness the technology is. Evaluating participants' experiences of eye-gaze tracking is addressed in section 6.5.3. This concludes this investigation into eye-tracking and art systems with a summary of eye-gaze and its impact on participants'.

Section 6.6 *Evaluation of Personality Types and Moods* is divided into five sections. Its main aim is to alert the reader to the intricate nature of the experience of presence, to remind the reader that experiencing presence is not due soley to the system design features but requires that the participant enagages with and is absorbed by the interaction. Participants' personality type and mood affect the outcomes of these experiences and this section identifies some of the signifiers that exist to evaluate how these other factors influence the enagament. *Moods* (6.6.1) are addressed first followed by 6.6.2 *Attention as an Attribute of Engagement*. In this section participants level of attention is evaluated, discussed and proven to be a reliable data gathering indicator (3.3.5 *Gaining Participants Attention*). The five sections evaluate attention as; focussed, sustained, selective, alternating and divided.

Presence and Time Factors (6.6.3) include elements such as the participants levels of involvement (6.6.3.1) and their ability to concentrate (6.6.3.2). 6.6.4 *The Meaning the User gives to the Stimuli* also addresses participants issues with control (6.6.5).

By comparing and contrasting differences and commonalities of an individual participant's personal factors we can see how the experiences of an art system differ and scrutinize the percieved factors impacting on participants responses. This section addresses the distraction factors associated with experiencing the system (6.7), it addresses the impact of the negative effects (6.7.1) associated with the system restrictions (6.7.2). 6.7.3 outlines difficulties related to the environmental distraction factors including the exhibition lighting conditions (6.7.3.1), and the physical and psychological barriers (6.7.3.2). It closes with a summary of Chapter Six (6.8).

Chapter Seven: Conclusions

The first research objective (1) is to advance understanding about interactive art systems that facilitate presence engagement. This was explored through the creation of the form and content attributes and the systems features for enhancing presence engagement within an art system and is examinined in respect to participants' reponses to the art system's features in 7.1. The section 7.2 *Did PEGASYS Generate Presence* concludes that yes, PEGASY immersed participants to the extent that many attributes associated with the experience of presence were engaged for them. The second research objective (2) sought to contribute new knowledge about human-computer interactions through the measurement and analysis of participants' presence-based engagement. This was achieved through evaluation of participants' experiences of the system and observations

made of those experiences. 7.3 *Summary of Research Outcomes* examines the information gathered during the process of the two-part study, pertaining specifically to what extent eye-tracking technology played in the role of the participants experience of presence.

This research process also facilitated the objectives by developing a concept for measuring participants experiences of presence in low stress environments. Using the information retrieved from the studies it is possible to advance understanding about participants' experience of presence when using *PEGASYS*, a system designed to induce a low stress experience (7.3.1). 7.3.2 looks at whether designed interactivity assisted in sustaining participant's experiences of presence engagement through the use of interactive narratives. Results determined that Stage Two of the interactive experience was more engaging than the others. Why? 7.3.3. Explains the outcomes of evaluating participants' inner presence experiences and 7.3.4 discusses how adding interactivity to the experience of PEGASYS enabled participants' to experience more presence-based elements. Section 7.5 *Future Work* considers the outcomes and proposes what could/should/would happen next in respect to future work undertaken to enhance the experience of *PEGASYS* for participants and share it with the rest of the world.

1.7 Addendum

1.7.1 References for the *PEGASYS* External Drive

The external hard drive accompanying this thesis contains a number of items that assist the reader in their understanding of the artist, the art system and the participants' experiences of the art system. It is highly recommended that the reader start the process of evaluating the thesis by examining the content of *PEGASYS*: the Presence-Generating Art System. There are two ways in which to do this. Folder 6_*PEGASYS* Application contains all the media files required to preview the system in an interactive format however there is no sound, and Folder 7_*PEGASYS* / Examples of the New Work contains three full-length video files that demonstrate the quality and visual depth of each of the twelve original media files developed for use in *PEGASYS*.

The folders progress from 1 – 7 in much the same way the thesis does; namely progressing from foundation to experiments to new work through to evaluation. There are nine appendices, an application through which to view and interact with the media, and three examples of the twelve finished high definition video clips created for *PEGASYS*. The media files contained on the *PEGASYS* Drive are formatted for use in a Macintosh

operating system, OX10 is recommended. QuickTime movie files can be opened by simply dragging them onto the QuickTime icon on the desktop. Still images can be opened in Preview or an alternative picture viewer. Other media items that require an application to open are discussed in the addendum in full and are also located on the external hard drive accompanying this work.

Folder 1_SM_Foundation contains a number of items that introduce the artist with examples of previous work.

Folder 2_SM_Experiments contains four items that illustrate the preliminary creative work undertaken to support the research process.

Folder 3_ New Work holds a variety of media platforms illustrating various aspects of the new work.

Folder 4_ Evaluation includes a folder called *Chapter Six_Evaluation*. Within this folder are four audio-visual demonstrations of participants using *PEGASYS* during evaluation sessions.

Folder 5 _APPENDICES contains nine appendices which are all Pdf's.

Folder 6_ Application contains all the media files required to preview the system in an interactive format.

Folder 7_ Examples of the New Work contains three full-length video files that demonstrate the quality and visual depth of each of the twelve original media files developed for use in *PEGASYS*.

Chapter Two

"Illusion is the first of all pleasures"
Voltaire (1694-1778)

2 STATE OF THE ART REVIEW

In English, there are two essential families of words that we use to express the faculty and the act of seeing: 1) 'sight', 'see', and 2)'vision' to 'view'. These words originally came from words that meant, respectively, "to follow something with the eyes" and "to have learned". This suggests that, for our ancestors, an image was something to shape with the eyes (follow with the eye), a form of information taken from the real world (learning through visual perception). The abiliity to use our eyes to see is a process far from banal, and far from being passive. When we look at a panorama, its colours take around thirty milliseconds to arrive at the 'visual cortex' within the posterior lobes of our brain. The shapes of the scene and the sensation of the distances, which involve depth and motion, are perceived shortly after, at approximately seventy milliseconds. During these tiny slices of time, the brain filters, analyses, and interprets the various pieces of the puzzle, trying to assemble them into a coherent image (Sarcone et al, 2009). In other words, it is crafting the best and most useful scene possible from the raw image data that our eyes present to us. This research project is interested in the ability of human beings to transfer information from the eyes to the brain in order to interpret and evaluate a form of human-computer interaction. It is through looking and seeing and acting that a participant learns how to operate and control the system using eye-tracking technology that facilitates an extension of our ability to learn through visual perception.

Presence is an illusion, the very essence of it being the experience of that which is not real (Riva and Waterworth, 2003). The sense of transportation, immersion, perception and engagement combine to create a physical experience for the participant who is experiencing a system designed to enhance these qualities. The participant's experience of the combination of light for seeing colour, the use of eyes for following images, and the ability of the brain functionality to decifer the outcomes of the illusion created, all interplay in the experience of presence as it is defined and was experienced within this practice-based research project. This chapter assists the reader in understanding the research topic by defining the four elements that came together to inform the design of *PEGASYS*: a Presence-Generating Art System. These areas are: presence (2.1), models

for creative engagement (2.2), interactive art systems (2.3) and gaze-based technologies (2.4).

2.1 *Presence* establishes the context of presence-based terms and addresses the various components as they were considered for the development of an interactive art system. The first section introduces the concept of presence as it was originally conceived and discusses how researchers have changed the established title to include a variation for research into the experience of presence. The next section defines presence within this research context (2.1.2). As there are many variables that influence the feeling of presence it is examined here in relation to the following factors as defined by the International Society for Presence Research (2.1.3) (*ISPR2000)* and others: engagement (2.1.4.1)*(Riva et al., 2004a)*, spatial presence (2.1.4.2) (*Lessiter, Freeman et al. 2001)*, sensory presence (2.1.4.3*)* (Waterworth and Waterworth, 2006b), and social realism (2.1.4.4)(Heeter, 1992). Presence as absence or inverse presence is also touched on briefly (2.1.4.5)(Timmins and Lombard, 2005). Negative effects as previously associated with experiences of presence (2.1.4.6)*(ISPR, 2000)* and the impact of place on the experience of presence are discussed next (2.1.4.7). The relationship between participants' experiences of immersion (2.1.4.8)(Slater, 2010), and time factors are then discussed (2.1.4.9). The psychological aspects of Inner Presence (2.1.5.1) and the rationalist view of Media Presence (2.1.5.2)(Coelho et al., 2006) contain characteristics that embody the form of the technology (2.1.6.1), media content (2.1.6.2), and the participant's experience of the combination of system features, for any given system under evaluation (2.1.6.3). A summary table outlines various researchers previous work in presence (2.1.8).

Section 2.2 *Models for Creative Engagement* examines *The Model of Engagement* (2.2.1) (Bilda et al., 2008) and *The Creative Engagement Model* (2.2.2*)* (Edmonds et al., 2006) both of which informed the features of the art system designed to evaluate participants' experiences of presence.

2.3 *Interactive Art Systems* are described in detail in order that an understanding of this topic and its constraints and boundaries is developed. Computer-based art systems are discribed in terms of computer-controlled systems (2.3.1.1) and user-controlled systems (2.3.1.2). Levels of interactivity and engagement are discussed in respect to classifying art systems namely: static, dynamic-passive, dynamic-interactive and dynamic-interactive varying systems. The chapter then discusses the use of presence as an experience tool

where artists have constructed works that explore concepts about presence in video constructs (2.3.1.3). Identifying the philosophical constructs and the current digital technologies that assist in generating a presence-based art system is a dominant aspect of this thesis. These systems are primarily computer-based video systems, specifically systems that generate presence using a biofeedback system networked into an immersive environment (2.3.1.4). Reflecting on the current status quo in terms of interactive art systems (Cornock and Edmonds, 1973) that facilitate a presence engagement, this section provides a context for presence artworks each of which utilise a networked system (2.3.1.5). The intention of this section is to deliver an account of presence focussed digital video works that reflect a science art and technology collaboration, thereby falling into the categorisation of computer-based interactive art systems. The emphasis is on presence–generating interactive art systems that realize powerful artistic concepts and deliver a presence experience using multimedia content, system driven technologies and human-computer interaction (HCI).

Section 2.4 *Gaze-Based Technologies* considers eye-tracking devices as technological tools for enhancing the experience of a screen-based engagement. It addresses exactly what an eye-tracker is and how they are being implanted into systems that facilitate biotechnological feedback (2.4.1). 2.4.1.1 *The Eye-tracking Device* examines exactly how an eye-tracker works using two current examples. Art and science collaborations that produce systems that engage participants with interfaces for creative expression, are discussed in 2.4.1.2. Finally, eye-gaze technology as a form of interaction for presence generation is reviewed (2.4.1.3).

Chapter 2 State-of-the-Art broadly covers: presence in terms of its functions and boundaries for application within a digitally constructed computer-based system; interactive art systems in terms of their history and exhibition; and gaze-based technology providing hands-free interaction for participants wishing to experience a method of digital communication that explores one method of human-computer interaction.

2.1 Presence

2.1 *Presence* establishes a context for presence-based terms assisting in defining presence within this research context. As there are many variables that influence the feeling of presence it is examined here in relation to the following factors as decreed by the International Society for Presence Research (ISPR, 2000) and others; engagement (2.1.4.1), spatial presence (2.1.4.2), sensory presence (2.1.4.3), and social realism (2.1.4.4). Presence as absence or inverse presence is also mentioned briefly (2.1.4.5). Negative effects as previously associated with experiences of presence (2.1.4.6) and the impact of place on the experience of presence is then discussed. The relationship between participant experiences of immersion (2.1.4.8) and time factors are then discussed (2.1.4.7). The experience of Inner Presence (2.1.5.1) and Media Presence (2.1.5.2) contain characteristics that embody the form of the technology (2.1.6.1), the media content (2.1.6.2), and the participants' experience of the system's design features (2.1.6.3). A summary table outlining various researchers' previous work in presence concludes this section.

2.1.1 Presence: An Introduction

In 1980, Marvin Minsky coined the term *Telepresence* (Minsky, June 1980). It refers to the phenomenon experienced by a human operator when using a computer system interface that facilitates a sense of being physically present in a remote location. The users' actions and the subsequent response produce a sense that they are physically able to interact with and behave in a consistent manner with the remote environment, much like real life scenarios (Coelho et al., 2006). *TelePresence* is the term used to describe the phenomenon that occurs when experiences of the 'other place' are on par with experiences of the physical environment. The participant experiences the 'other' place more lucidly than he/she experiences the 'real' world that surrounds them as they engage within the displayed environment. The participant becomes embedded, immersed within the environment generated by the technology rather than their actual physical location (Steuer, 1992). For Minsky's purposes, the term was used to describe the sensation as expressed above in relation to operating technological equipment in the 'real world' environment that is having an effect in another environment, say in space, or underground.

> "The biggest challenge to developing *telepresence* is achieving that sense of *'being there.'* Can *telePresence* be a true substitute for the real thing? Will we be

> able to couple our artificial devices naturally and comfortably to work together with the sensory mechanisms of human organisms?" (Minsky, June 1980) p.48).

In 1992, Sheridan and Furness introduced the shortened term of presence to the scientific community in the title of a new journal dedicated to the research of virtual reality systems and teleoperations: *Presence, Teleoperators and Virtual Environments*. In this way, the term *Telepresence* remained associated with teleoperations, whereas the term presence became associated with virtual environments (VE) (Sheridan, 1992). However, one of the main factors that contributed towards interest in presence is that it can be generated both by the real world and by media (Riva, 2004). As such, presence research is not only relevant to virtual reality communities but also a variety of other industries. These include but are not limited to: TV broadcasters, display developers (Burkett, 2004, Fisher 1982), creators of human-computer interfaces and environmental psychology (de Kort et al., 2003). Because the concept of presence is so multi-dimensional it is also of interest to designers and evaluators of interactive systems as well as new applications in areas such as training, education (Fontaine, 1992), telecommunications, new media, medicine (Biocca, 2001, Guger, 2004), cybertherapy (Riva, 2004, Sponselee 2004), remote industrialised operations and entertainment devices (Aley, 2005, Armstrong 2006).

There are currently many international institutions and researchers specialising in the study of presence. *Toward a Core Bibliography of Presence* by Ijsselsteijn et al (2001) presents the core literature associated with the many dimensions of presence. For a further exploration of the topic, the following resources provide detailed descriptions: Presence-Research.Org and Resources for the Study of Presence. Presence has also been explored in association with: virtual reality systems (Alcaniz, 2004, Azuma, 1997); its measurement (Freeman, 1999, Insko, 2003, Ijsselsteijn 1997, Usoh 2000, Witmer 1998 Lofland, 1985, Floridi, 2005); audio systems (Freeman, 2001); display environments (Ijsselsteijn, 2001); dreaming (Moller and Barbera, 2006); working memory (Nunez, 2004); philosophy (Sheridan, 1992, Slater 2009) and place (Turner, 2006, Slater 2009). Some of the journals relating specifically to the interests of presence are the aforementioned *Presence: Teleoperators &Virtual Environments*; *Journal of Computer Mediated Communication* and *CyberPsychology & Behaviour*.

2.1.2 Presence: As Defined within this Research Project

Presence is defined within the context of this research as a psychological state induced through system design (form and content) referred to as Media Presence, and the subjective perception of the participant's experience of that system, categorized as Inner Presence. In this context, presence is considered to be a part of the experience one has in becoming immersed within a non-reality screen based environment. Presence can be generated within such systems when the form and the technology of the system facilitates an experience for the participant that embodies a psychological interaction through physical interaction without drawing attention to it (i.e. the technology). It is through experience of the technology and content of that system that the generation of sensory qualities experienced by the participant are likened to experiences that take place in 'reality', in the real world. Such computer driven systems make possible engagements that replicate the sensations of being somewhere else, being with someone else called co-presence, or experiencing the other place as if it were here and now. Presence within this research is refered to as the phenomenon relating to the engagement that takes place between humans and computers when the system is designed to enable participants to use their sight, sound and other senses within a virtual environment.

2.1.3 Presence: Explication Statement

In July 1999, an electronic forum "Presence-L Listserv" was established by the *Information Systems Division* of the *International Communication Association* who instigated a discussion on the definition of presence in 2000 (Coelho et al., 2006). During this time, a comprehensive clarification of the concept of presence was devised and written as an explication statement (Lombard, 2000). The statement can be found on The International Society of Presence Research (ISPR) website[1]. *The Concept of Presence: Explication Statement* is updated but currently reads at nearly 3000 words. The following section outlines in brief (in their own words) some of the key concepts associated with presence. For a more detailed analysis please visit: http://ispr.infp/

1) "Presence (a shortened version of the term *"telpresence")* is a psychological state or subjective perception in which, even though part or all of an individual's current experience is generated by and/ or filtered through human-made technology, part or all of the individual's perception fails to accurately acknowledge the role of the technology in the experience. Except in the most extreme cases, the individual can indicate correctly

[1] http://ispr.infp/

that s/he is using the technology, but at some level and to some degree, her/his perceptions overlook that knowledge and objects, events, entities, and environments are perceived as if the technology was not involved in the experience (ISPR, 2000)".

2) "First order" mediated experience generally provides perceptions that correspond to the true nature of the physical world, it can also provide perceptions that do not correspond to the true nature of the physical world. Presence refers to the subset of human experience in which this misperception involves, at least in part, the actual role of technology in the experience: Presence occurs when part or all of an individual's experience is mediated not only by the human senses and perceptual processes but also by human-made technology".

3) "Technology is defined as a machine, device, or other application of human industrial arts. It includes traditional and emerging electronic media such as television, radio, film, the telephone, computers, virtual reality, and simulation rides; traditional print media such as newspapers, books, and magazines; and traditional arts such as painting and sculpture".

4) "Presence is a property of an individual and varies across people and time; it is not a property of a technology or one of the technologies commonly referred to as a medium".

5) "A person's sense of presence can vary in degrees".

6) "Presence occurs during an encounter with technology and not before or after this encounter".

7) "Presence is a multi-dimensional concept; i.e., there are different types of presence".

8) "There is currently disagreement regarding whether presence that occurs in the context of non-interactive ("passive" or "audio-visual") technologies (e.g., television and film) is comparable with presence that occurs in the context of interactive ("active" or "motor") technologies (e.g., computers and virtual reality)".

9) "A number of types of 'misperceptions' of the physical world seem to be examples of presence as defined here: the hearing of voices by schizophrenics; perceptions during dreams and daydreams, and less clearly, perceptions during role-playing games and perceptions that result from the use of various drugs".

10) "The exact nature and location of the processing that results in presence is not known. It is likely that our initial and immediate responses to external stimuli (i.e., sensations) are identical when the external stimuli are created by or filtered through technology and when the external stimuli are not created by or filtered through technology (i.e., the role of technology is not acknowledged in the former situation).

11) "A large number of possible causes of some or all of the different types of presence have been proposed; the causes may function individually or in various interactions to evoke presence".

12) "A large number of possible consequences of some or all of the different types of presence have been proposed and serve as motivations for further study of presence. The consequences may occur individually or in various combinations and depend on a large number of complex interacting factors (see 11 above). These consequences include but are not limited to: increases or decreases in physiological arousal; feelings of self-motion (vection), motion sickness, enjoyment, empathy, learning, improved task performance and skill training, psychological desensitization, connectedness (involvement, mutuality, engagement) with other people (e.g., media personalities), parasocial relationships, a number of different emotional responses, persuasion, and distorted memory and social judgments".

Due to the scope of the nature and industry of presence, this research project focuses on two particular aspects of presence research namely, Inner Presence and Media Presence. Both Inner Presence (psychological component) and Media Presence (technological component) (Riva et al, 2006) are factors that assist in the production of measureable presence attributes. See Chapter Three for more specific details on measuring presence. Inner Presence and Media Presence (**2.1.5**) are addressed in more detail soon but first let us examine the dimensions of presence individually in order to establish existing variants.

2.1.4 Presence: Variables that Influence the Feeling of

In respect to *The Concept of Presence: Explication Statement* point 7 in 2.1.3 discusses the major proposed dimensions of presence which include the following nine factors; (7a) spatial presence, (7b) sensory presence, (7c) social realism, (7d) engagement, (7e) social presence, which includes co-presence/transportation shared space and medium as a social actor. All these factors are consistently recognised by researchers in their investigation of presence and assisted in informing the design of *PEGASYS*: a presence-generating art system.

2.1.4.1 Presence Engagement

Presence engagement is a key factor in presence generation and includes the participant's ability to get involved, facilitating a psychological immersion (Riva, 2004). Engagement can be a two-way communication with another person or with an artificial entity for example a computer "agent" or avatar (Welch et al, 1996. Heeter, 1992, Steuer, 1992). Part of a virtual reality system's appeal is its ability to stimulate sensations within the brain and body, where for example, immersive environments create a sense of *'being there'* for the participant. Dominant issues in conversation around virtual reality try to explicate presence, define and thus control whatever it is that creates these experiences. Defined as presence engagement (the sense of being physically present somewhere other than where ones body is located) researchers, designers and artists are now collaborating with other industries (education, health, transportation, training etc) in order to develop a taxonomy of presence encounters and measure them against other presence-based engagements, and also real world encounters, engagements and experiences. Sheridan discuses how the degree to which subjects respond to the virtual cues rather than the real ones indicate presence perceptions. He proposes a related measure,

> "...when a virtual object is suddenly seen (and/or heard binaurally) to be on a collision course with one's head, does the subject blink, or duck?" (Sheridan, 1992) p.21.

Examples of this type of engagement occuring are apparent when, for example, a player is interacting with hardware and software such as Wii Fit where virtual experiences take on 'real' physicality leaving the player ducking and weaving whatever is virtually getting in his way. Interactive art transforms the spectator into a participant (Moss, 2006) who physically engages with and becomes a part of the computer-based art system (Cornock and Edmonds, 1973). In this way, participants facilitate the creation of their own experience by interacting with the computer-based components to orchestrate their own engagement. In order to generate a presence engagement (Lee, 2004, Spagnolli and Gamberini, 2004, Floridi, 2005) a key concept requirement is that the participants engross themselves in the system, devote themselves to the experience and acknowledge that the system is designed to take them on a *'being there'* experience if they are willing (Spagnolli and Gamberini, 2004). The psychological challenge for each participant is to allow the art system to operate as it is designed by the artist, thereby facilitating an experience that has the potential to become presence-based and engaging for them.

2.1.4.2 Spatial Presence

Spatial presence is commonly referred to as physical presence and/or perceptual immersion. Spatial presence transmits a sense of physical space, transporting the participant into the landscape producing a *'sense of being there'*. I.e.; virtual reality systems (Schubert et al., 1999). Lessiter et al conducted research analysing a questionnaire examining individuals responses to a 3D computer game.

> "Schubert et al.'s first-order principal components analysis revealed three components related to presence: 'Spatial Presence', 'Involvement' and 'Realness'". (Lessiter et al., 2001).

Lessiter et al go on to say that spatial presence is also referred to as 'physical space' which is proposed to closely connect engagement and naturalness as key binding elements. Together these factors work with the individual's personal evaluation based on appeal and believability of both the displayed environment and its content.

In their paper *The Sense of Being 'There': a Model for the Space of Presence,* Spagnolli et al refer to spatial presence as introducing a model for the *Space of Presence* (Spagnolli and Gamberini, 2004). They suggest that a central determining factor for creating a sense of presence lies within the place itself, i.e. the virtual environment or other location. They investigate the proposal that these places are different from physical and even mental spaces as the space of presence is viewed not *"...as a component but as a defining dimension of presence itself"* (p48). Spatial presence refers to the physical bodily orientation in the world and requires appropriate updating of displays through tracking devices.

2.1.4.3 Sensory Presence

Sensory presence is gained through the system's ability to produce a sense of natural order, ecological validity (a sensory cue that enables ones perception to experience 'things' as they most likely are) and tactile engagement. For example: a 3D IMAX experience. Sensory presence is produced by the vividness of the display environment in conjunction with the media content. To work best it requires high quality images and stereographics (if using a virtual environment) (Smyth et al., 2006). Other sensory sensations are also included here such as the sense of smell, temperature and tactile response. The attention to sound as a sensory trigger has been noted to play a key role in the generation of presence engagement for participants (Darken et al., 1999). A study conducted by Held & Durlach in 1992 divided participants into groups with different

audio conditions: high fidelity sound, low fidelity sound and no sound. Within the VE each location was allocated a unique sound. Study results indicated that participants experienced higher levels of presence in those environments with sound regardless of its quality. Auditory cues are associated with an increase in presence engagement as is pictorial realism. Visual depth has proven to be an important factor in the ability of a displayed environment to create a sense of depth and presence (Witmer & Singer, 1998).

2.1.4.4 Social Realism and Presence

Social realism and presence refers to the content's ability to construct a realistic impression, this does not restrict content to 'reality' scenarios as cleverly constructed fantasy worlds may also produce social realism. For example a well written well acted filmed version of events that have occurred in the physical world "It seemed so realistic" (Riva, 2004). Social presence enhances the relationship between the participant and the content thus facilitating deeper presence engagement for participants. Researchers have discovered that when 'other people' exist within the displayed environment then the likelihood that the 'other place' exists increases. Social presence is reflective of a theory that considers,

> "...that presence can increase with the existence of other individuals in the virtual environment and with the number of interactions between the participant and the virtual actor" (Riva, 2004, p.36).

Issues pertaining to the separation and experience of the self are enhanced if 'other people' or avatars are involved in the virtual experience (Heeter, 1992). Mutual understanding and awareness, intimacy and immediacy, behavioural engagement, sensory awareness of the embodied other, sense of access to intelligence and salience of the interpersonal relationship are all factors influencing the experience of 'being together with another' (Biocca et al, 2001.pp 462-465).

2.1.4.5 Absence or Inverse Presence

In discussing presence we must also consider that absence of presence and how failure or interruption of presence engagement influences the results of our experience.

> "...by introducing the concept of 'absence', presence can be distinguished from other concepts with which it is sometimes confused, including engagement, attention, or even consciousness itself" (Timmins and Lombard, 2005).

The observation that people were confusing reality with mediated scenarios gave rise to concern. For example, a naturally beautiful landscape confuses a viewer into believing that the view is merely an image, not real, as if the picture postcard aspect has overwhelmed the viewer drawing them into a place that has been constructed for their enjoyment, rather than existing for its own sake. Timmins and Lombard from Temple University in the USA noted through experiments that a disturbing trend was starting to appear. They propose three categories of this '*illusion of mediation*':

1) Positive (when people perceive natural beauty as mediated)
2) Negative (when people perceive a disaster, crime or other tragedy as mediated)
3) Unusual (when close connections between peoples 'real life' activities and mediated experiences lead them to confuse the former with the latter) (Timmins and Lombard, 2005).

A number of misperceptions of the physical world exist,

> "...which include the hearing of voices by schizophrenics, perceptions during dreams and daydreams, perceptions during role-playing games, perceptions that result from the use of various mind altering drugs and negative hallucinations" (ISPR, 2000).

Presence and absence are both viewed as states of absorption, the former in relation to the state of 'flow' as described by Csikszentmihalyi (1996), and the latter in respect to imagined situations and events. Kim and Biocca developed a scale of definitions of presence and used this with individuals who were presented with video stimuli on a variety of screen sizes, namely; 9, 20, or 32 inch. After testing ninety six participants, two common factors became evident, these are the sense of 'arrival' (being there), and 'departure' (a sense of not being there) or absence (Kim and Biocca, 1997).

2.1.4.6 Negative Effects on Presence Engagement

Previous research in presence indicates that there are a variety of possible consequences of different types of presence. These consequences include: increases or decreases in physiological arousal, feelings of self-motion (vection), motion sickness, enjoyment, empathy, learning, improved task performance and skill training, psychological de-sensitisation, connectedness (involvement, mutuality, engagement) with other people, para-social relationships, a number of different emotional responses, persuasion and distorted memory and social judgments (ISPR, 2000).

2.1.4.7 Presence and Place

> "Rushing from place to place, we rarely linger long enough in one particular place to savor its unique qualities and its local history. We pay a heavy price for capitalising on our basic animal mobility. The price is the loss of places that can serve as lasting scenes of experience and reflection and memory " (Casey, 1993)

Cecily Maller discusses this approach in her research *'Healthy Parks Healthy People. The Health Benefits of Contact with Nature in a Park Context':*

> "...benefits are grouped around eight marketing messages, which are: recreation and active living are essential to personal health; recreation is a key to balanced human development; recreation and parks are essential to quality of life; recreation reduces self-destructive and anti-social behavior; recreation and parks build strong families, and healthy communities; recreation reduces health care, social service, and police/justice costs; recreation and parks are significant economic generators in the community; and parks, open spaces, and natural areas are essential to ecological survival" (Maller et al., 2002).

Maller presents a review of current literature providing 186 references for the case for positive re-enforcement of relationship development between natural landscapes and humanity. Natural environments provide recreational access to places for rest and relaxation. The health potential of individuals within settings of everyday life it seems, becomes problematic when nature is precluded. Unfortunately social capital and physical disability often places restraints upon individuals' ability to engage with nature within these natural landscapes (Maller et al., 2002).

A paper by this author was discussed at OZCHI2008, 'Habitat and Habitus'. To read the paper see: *PEGASYS* Drive/ Folder 5, *The Reflective Practitioner: In creation of PEGASYS*

2.1.4.8 Presence and Immersion

Slater's research examines presence in the context of immersive virtual environments (Slater, 2010). His paper, *Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments* introduces the concept of splitting the term 'presence' into two different terms both of which, together, represent presence. These terms are: 'Place Illusion' (PI) and 'Plausibility Illusion' (Psi).

> "We have called PI the ''being there' qualia that was referred to as 'presence' in the original literature: it is the feeling of being in the place depicted by the virtual environment (even though you know you are not there" (Slater, 2010).

> "We call the Psi the illusion that what is happening is real (even though you know it is not)" (Slater, 2010).

> "Plausibility Illusion (Psi) is tabled under Inner Presence as it is determined by the extent to which the system can produce events that directly relate to the participant; concerned with the 'reality' of the situation depicted; maintained through correlations between events that can be perceived that are directed at the participant; relies on the process of inference from evidence (perceptions) to issues concerning the 'reality' of the situation" (Slater, 2010).

As Slater recommends, these elements are contained within the category of Inner Presence as they relate to variables that influence the psychological feeling of presence, namely social realism, engagement, sensory presence and involvement. For more on immersion and presence see 2.1.7 *Three Layers of Presence*.

2.1.4.9 Presence and Time

Time is a construct through which we deal with the variations of ongoing experience in the physical world. Presence is linked to time in as much as any activity undertaken can seem to pass slowly or fast depending upon our level of engagement and the information we are dealing with. Taking into consideration previous research into working memory (also referred to as "conscious processing load' or CPL) and presence, it appears that researchers differ in opinion (Ijsselsteijn et al., 2001, Waterworth and Waterworth, 2006).

Here, the former researchers prescribe that,

> "If the degree of experienced presence of an interval were high, then the subjective duration would tend to be short"

where as the latter researchers found evidence that,

> "When there is a correlation it is positive, with long duration estimates corresponding to high presence judgements" (Ijsselsteijn, Bierhoff et al. 2001).

Experienced subjective duration of time is difficult to measure as post experience questionnaires can result in inaccurate observations from the participant who may have become bored in the last few minutes or who may be distracted by outside world events.

Waterworth et al devised a table that outlines what they consider to be the relationship between presence and time perception.

Working Load	External world focus	Internal world focus
Low working	Watching the sun set	Daydreaming
Memory load	High Presence /slow time	Low Presence/slow time
High working	Climbing a difficult rock face	Solving a logical puzzle
Memory load	High Presence/ fast time	Low Presence/ fast time

Table 1. Being-in-the-world: Presence and Time Perception
(Waterworth and Waterworth, 2006)

Waterworth et al also executed a test to determine if different media streams (with the same content) carried different perceived durations.

The four media streams tested were:

1. "A real /concrete stream (filmed events with natural soundtrack – the camera stream)".
2. "A real/abstract stream (text, sketches and spoken word describing events – the words stream)".
3. "A virtual/ concrete stream (a detailed animated 3D graphics version, with synthesised sound effects - the 3D stream)".
4. "And the virtual/abstract stream (a wireframe 3D with text labels and stylised synthetic sound effects – the 3D wired stream)".

The results of which were tabulated into a graph clearly indicating that the camera stream produced the most presence in as much as,

> "...when the abstraction level of an experience increased, the feeling of presence decreased, and vice versa, and that when the subjective experience of presence increased, estimated duration also increased, but only under certain circumstances" (Waterworth and Waterworth, 2006b) p.87.

Furthermore,

> "When experienced presence is high, and working memory is heavily loaded (so that time seems to fly) this may correspond to what has been called the *flow experience*. A literally ecstatic state (out from the internal, into the external), in contrast, may refer to a combination of external focus and low memory load, when presence is high and time seems to stand still. When low presence and high working memory are combined, a state of absent-mindedness with automatized

> actions prevails; attention is directed almost exclusively to the internal and time passes quickly. And when low presence is combined with low working memory load, the individual may be experiencing a trance like state, with an internal focus, but processing only the simplest of conceptions perhaps, for example, mentally repeating a mantra" (Waterworth and Waterworth, 2006).

2.1.5 Inner Presence and Media Presence: A Synopsis

Researchers of presence aim to support the development of a comprehensive definition of presence with tangible measures that assist in determining ample levels of presence for the achievement of goals. Media Presence and Inner Presence are two components of presence that are constantly under evaluation by researchers as they search for a standardization of its evaluation as a reliable and valid measure (Coelho et al., 2006). Systems designed to evoke presence comprise of two main parts: a technological component (Media Presence) and a psychological experience (Inner Presence). Media Presence is generated through technologies that adhere to the characteristics of media/technology, namely form, content and participant. Researchers who agree that presence can be generated and experienced through technology also acknowledge that the sense of presence becomes a function of our experience of the technological form. This facilitates the ISPR definition of presence allowing it to be defined as the *"perceptual illusion of non-mediation"* produced by means of the disappearance of the medium from the conscious attention of the subject. An alternative view is that the psychological or ecological perspective called Inner Presence is,

> "...seen as an experience common among different types of human experiences independent of any technology. Specifically, these researchers consider presence as a neuropsychological phenomenon, evolved from the interplay of our biological and cultural inheritance, whose goal is the control of the human activity" (Coelho et al, 2006 p.28).

Research into Media Presence and Inner Presence inform discussions about designing presence engagement for participants using art systems. We will now examine how.

2.1.5.1 Inner Presence

Inner Presence is a crucial aspect of the experience of presence. It is the psychological component that along with the quality of the sensorial input (form) and the interactivity of the participant facilitates the experience of 'being there'. It is possible to experience the sensation of Inner Presence whilst writing, reading and experiencing media content

regardless of technology (Steuer, 1992). Inner Presence is associated with immersion and when immersion is associated with digital technologies, then the media content of the 'other world' becomes as if real rather than mediated. Presence is considered an asset of immersion (Witmer & Singer 1998). Researchers, Coelho, Tichon, Hine, Wallis and Riva present a theory of Media Presence and Inner Presence. They outline extensively the concept of Inner Presence with reference to the work in phenomenology by Loomis, J.J.Gibson and Heidegger (Coelho et al., 2006). In brief, Loomis argues that 'normal' life is mediated through our senses and nervous system.

> "The physical world, including our nervous system, is not given to us directly through experience but is inferred through observation and critical reasoning. Given the separation between these two domains, it is useful to recognize the 'normal' division between 'self' or internal phenomenon and 'non-self', or external phenomenon" (Loomis, 1993).

Thus, our experience of a representational world can be construed as 'real' if all our senses and experience are telling us it is real: that is, our thought processes assist in facilitating the experience of Inner Presence. J.J. Gibson indicated that he believed in the theory that the environment can be understood, without the need for intervention through our cognitive processes. Perception and action become integral in respect to the relationship that develops between the participant and the system; as such the actions must be afforded by the environment (Gibson 1979). Heidegger proposed a theory of the form of existence. He argued that our very being is thrown together in ways that insist that we continuously act and interpret each situation as it arises (Coelho et al., 2006). In VR or interactive art systems, the challenge is to produce meaningful experiences for participants. By designing systems that afford participant action within the system, then associations with the environment ensure that the participant is aware of what is possible and what is not. The fact that the participant is using the same perceptive processes to interact with the displayed environment as in real life means that real life perceptions and human behavioural traits are acted out whilst experiencing these environments (Waterworth &Waterworth, 2003). Riva and Coelho define presence as:

> "...an evolved neuropsychological process whose goal is the control of the activity of the subject. This is achieved by filtering and organising the streams of sensory data: the more this process differentiates the self from the external world, the more is the level of presence experienced by the subject. Within this vision,

> they suggest that the ability to feel 'present' in a virtual reality system – an artefact- basically does not differ from the ability to feel 'present' in the real world" (Coelho et al, 2006).

By creating virtual landscapes that are often intangible spaces, researchers have been able to focus on determining what presence is, by measuring participants' experiences of presence engagement. These technology-generated environments usually consist of computer-generated images and are built for researching virtual reality Waterworth and Waterworth, 2006,Waterworth and Waterworth, 2006). Technology-generated environments can also be created through photo-realistic real-time video systems. Some of those systems that also implement interactivity, maybe considered art systems. Those systems that facilitate an experience of another environment provide opportunities for gauging presence engagement.

Inner Presence, then, is experienced when our senses relate to us the experience of the 'other' as if it were 'real' in a psychological way. This is discussed in more detail in respect to the three layers of presence: Proto Presence (2.1.7.1), Core Presence (2.1.7.2) and Extended Presence (2.1.7.3).

2.1.5.2 Media Presence

Media Presence is, as stated above, generated through the systems technology (form) that the participant is using. The system generally comprises of a collection of diverse technologies (head-mounted displays, gloves, touch screens) that normally involve a method by which to communicate (Riva, 2004). Immersive interactive systems that integrate multimedia as in, computer graphics, video, audio, text and image and contain an interactive component tend to be VR environments. However, interactive art systems may also be included. According to Pimentel and Teixeira it is,

> "...through visualizing stereoscopic images, hearing binaural sound and manipulating three dimensional objects in real time in a computer generated world, the subject can overcome the barrier represented by the computer screen and experience new realities" (Pimentel, 1993).

Therefore, an ideal technological system for experiencing Media Presence allows for all sensory experiences: smell, touch and temperature, tracking various body parts to provide precise and instantaneous feedback to the user (Slater and Usoh, 1993). Some researchers argue that the degree to which immersion is presented within the system will, in itself,

generate the sensation of presence. For example, if the participant is able to traverse the environment in 360 degrees, having a sensorial experience of that environment, then Media Presence is achieved. These researchers see immersion through technology as a sensorial experience that they define as presence (Usoh, 1996, Kalawsky, 1999).

> "This way, immersion depends on technology and the world is presented from the user's point of view such that each time the user moves his head new images are generated according to new viewing geometry. Immersion increases with isolation from the physical environment, inclusion in the virtual situation, the possibility of a natural interaction with the environment and control over it, as well as the existence of stimuli that support the perception of self-motion" (Coelho et al, 2006. p.29).

Because this research is interested in how the layers of presence (as mentioned below) and the characteristics of the media and technology can inform the design of an art system, we shall examine them in the context of Media Presence. As Proto Presence is associated with the media form or technology and Core Presence is associated with media form through content, both relate directly to the concept of Media Presence. Media Presence is generated when the form and the content of the system work in unison to produce an immersive simulated environment. The sensorial stimulation and the ability to interact with elements within the displayed environment facilitate participant experiences of presence engagement (Coelho et al, 2006).

2.1.6 Characteristics of Media/Technology

The Concept of Presence: Explication Statement point number eleven makes reference to three characteristics of media/technology each of which is a possible cause for the different types of presence that have been proposed. These are form, content and user or participant as they are referred to in this study. These categories are now discussed in relation to Inner Presence and Media Presence.

2.1.6.1 Form: as a Component of Media Presence

In designing an interactive system that generates presence, the characteristics of the media/technology "form" are to be considered. The ISPR provide a summary of sub factors that assist in presence-generation. The design or the 'form' of the technology should consider:

1) "The characteristics of media/technology *form* such as the number and consistency of sensory outputs, image size and quality, viewing distance, use of motion and color, audio volume and fidelity and the visual and aural dimensionality. Subjective camera techniques such as direct address, obtrusiveness of the technology, technology size and shape, and a number of other variables relating to interactivity" (ISPR, 2000).

System response time is the time taken between the participant's action and the perceived effects of those actions upon the displayed environment (Freeman et al., 2002). Latency of visual feedback has been seen to detract from presence engagement when significant intervals of time pass between the action and the re-action. Durlach & Mavor suggest that in order to preserve the illusion of instantaneous control, the intervals should not exceed 0.1s. Accordingly, the system should ideally update the visual data using 8 to 10 images per second in order to maintain an illusion of movement. Response velocity of the system will increase participants' feelings of control (Durlach & Mavor, 1995).

2.1.6.2 Content: as a Component of Media Presence

According to ISPR, in respect of designing experiences that enhance attributes of Media Presence, the following factors should be considered:

2) "The characteristics of media/technology *content* such as social realism (i.e., believability), quality of writing, quality of acting, physical appearance of actors/personalities, fame or notoriety of actors/personalities, use of media conventions, and the nature of the task or activity" (ISPR, 2000).

In studying immersion and emotion, researchers conducted a study comparing three immersive systems (a rear projected video wall, a head mounted display and a PC monitor)(Banos et al, 2004). They concluded that emotional content enhanced the experience of presence within VR environments regardless of high-end or low-end interface. It has been stated that only by 'making sense' of the media content by being aware of its meaning, can the participant experience the sense of 'being there' (Riva, 2003). According to this view, researchers have to analyze the participant's interaction with and within the media experience in order to create the full potential for presence engagement. This includes,

> ...all the different aspects that converge on it: the relevance of the content, the social relationships established, the physical and symbolic resources exploited and the cultural competence used (Riva, 2004.p.36).

2.1.6.3 Participant: as a Component of Inner Presence

When a participant mentally signifies the possibility of acting upon the virtual world, then presence can be significantly increased. If the participant has the capacity to change the environment he/she is in then and/or perceives their own movement inside the system, they are likely to experience more presence engagement (Witmer and Singer, 1998).

> 3) "The characteristics of the media/technology *user* such as her/his willingness to suspend disbelief, knowledge of and prior experience with the technology, age, and gender" (ISPR, 2000).

An experiment conducted in 1999 by Walker, Song, Kobayashi and Hodges reported that interactivity significantly increased feelings of presence in those participants who had control of their own actions, rather than those who were passive observers (Dinh et al., 1999). In respect to mood and personality factors researchers have identified common traits that appear to signify that a participant's personal characteristics affect the degree to which they experience presence (Hand, 1994, Barfield and Weghorst, 1993, Banos et al., 2004, Waterworth and Waterworth, 2006b).

> "Since presence is, for us, a reflection of the extent to which an individual is engaged with (and feels able to act in) an external world rather than with an internally modelled world, we would expect personality factors that are known to affect this relation to also affect experienced presence. For example, we might expect that extrovert personalities in general experience higher presence than introvert personalities. Similarly, elderly people might be expected to experience less presence in common situations than the young" (Waterworth and Waterworth, 2006)

As a characterisation of an extroverted person is one who predominantly engages with the external world rather than the internal world of imagination and mental processes, then this enforces the knowledge about presence and external display environments. Experiencing presence requires a state of absorption or observation from the participant that involves,

> "...an openness to experience emotional and cognitive alterations across a variety of situations, which also seems to be important in predicting the tendency to experience presence" (Waterworth and Waterworth, 2006)

Low Presence	High Presence
Old	Young
Awareness of themes	Awareness of perceptual details
Sensory deprivation	Rich sensory stimulation
Introversion	Extroversion
Depression	Mania
Sedatives, alcohol	Stimulants, psychedelics
High error on vigilance task	Low error on vigilance task
Infrequent stimulus sampling	Frequent stimulus sampling
Long reaction times	Short reaction times
Ideological bias	Experiential bias

Table 2. Presence in Relation to Personal Characteristics and States (tentative) (Waterworth and Waterworth, 2006)

In 2006 Waterworth et al. proposed a set of individual characteristics and traits that could be associated with degrees of high presence and those that signify an outcome of low presence. It is important to recognise however, that different individuals will present different characteristics and that variation from the perceived norm is to be anticipated.

2.1.7 Three Layers of Presence

Riva et al describe three layers of presence in their paper, The Layers of Presence: A Bio-cultural Approach to Understanding Presence in Natural and Mediated Environments.

These three layers are:

Self versus non-self (Proto Presence)

Self versus present external world (Core Presence)

Self relative to present external world (Extended Presence)

2.1.7.1 Proto Presence: as a Component of Media Presence

In brief, Proto Presence is:

> "... an embodied presence related to the level of perception action coupling (self Vs non-self). The more the organism is able to couple correctly perceptions and movements, the more it differentiates itself from the external world, thus increasing its probability of surviving" (Riva, 2004 p.410).

The experience of Proto Presence is the result of technology that couples the perceptions and movements of the participant in such a manner as to exclude the external world. The digital environment thus contains the same characteristics required by humans for them to navigate the system using their natural bodily insticncts. Proto Presence is likened to the experience of spatial presence in as much as the display environment and the form of the

technological tracking device are paramount to the participant's experience (Riva, 2004. p.414).

2.1.7.2 Core Presence: as a Component of Media Presence

Core Presence, the second layer, responds to the contents of consciousness and is not dependent upon reality. It is based largely on the vividness of the displayed environment and is equivalent to Sensory Presence as discussed above. It requires good quality graphics and appropriate audio signifiers. It is defined as;

> "The activity of selective attention made by the self on perceptions (self vs present external world): the more the organism is able to focus on its sensorial experience by leaving in the background the remaining neural processes, the more it is able to identify the present moment and its current tasks, increasing its probability of surviving" (Riva, 2004 p.411).

2.1.7.3 Extended Presence: as a Component of Inner Presence

Extended Presence requires intellectually stimulating and/or emotionally provocative and significant, content. The role of Extended Presence is,

> "To verify the significance to the self of experienced events in the external world (self relative to the present external world). The more the self is present in significant experiences, the more it will be able to reach its goals, increasing the possibility of surviving" (Riva, 2004 p.411).

In 1993, Slater & Usoh discussed how the participant's body representation in the virtual environment affects the sense of presence engagement. However, this is not relevant to the work being discussed within this research project because participants' bodies are not body represented within the media experience. The three proposed definitions of presence assist in developing an art system's functional characteristics as they discuss a categorisation of presence that include the physical, psycholological and emotional responses associated with experiencing presence (Slater & Usoh, 1993). Riva et al suggest that systems designed to include all three layers of presence are likely to produce a mediated presence engagement for participants.

> "The biological purpose of presence means that it is dominated by the current state of the body, and perceptions of the current state and position of the body, in relation to the world in which the body is located. Any mediated presence is in competition with presence in the real world" (Riva, 2004, p.413).

Building on our framework of presence within the context of interactive art systems Riva et al suggest that the aforementioned Proto Presence is determined by the form of the system, Core Presence by both the form and the content and Extended Presence through the content only. However,

> "Optimal presence in a mediated experience arises from an optimal combination of form and content. The form must provide the means for a convincing perceptual illusion, but the content should be integrated with (and so attract attention to) the form for the illusion to happen convincingly" (Riva, 2004, p.416).

2.1.8 Previous Presence Research: A Summary

As previously discussed presence-based experiences can rely on two major factors, these are Inner Presence (2.1.5.1) and Media Presence (2.1.5.2). The table below illustrates how research into the field of presence as a phenomenological and physiological experience can be categorised within these facets. Column one describes the presence theory or category previously identified by researchers in presence. Column two relates the attributing factors in respect to Inner Presence and Media Presence and defines exactly who has studied what.

Technology (Form)	MEDIA PRESENCE
	Latency of Response: (Ellis et al., 1997)
	Audio System: (Darken et al., 1999, Davis et al., 1999, Freeman and Lessiter, 2001)
	Stereoscopic Presentation: (Dillon et al., 2001, IJsselsteijn et al., 1998)
	Visual Field: (Hatada et al., 1980, Hendrix and Barfield, 1996)
	Control Process: (Welch et al., 1996)
	System Response Time: (Freeman et al., 2002, Harvey and Sanchez-Vives, 2005)
	Number and Consistency of Sensory Outputs: ISPR, 2000
	Image Size and Quality: (Slater and Usoh, 1993, Hendrix and Barfield, 1996)
	How the Use of Motion and Colour Affect the Participant: ISPR, 2000
	Subjective Camera Techniques: ISPR, 2000
	Obtrusiveness of the Technology: ISPR, 2000
	Number of Variables Relating to Interactivity: (Sheridan, 1992, ISPR, 2000)
Media (Content)	**MEDIA PRESENCE**
	Pictorial Realism: (Witmer and Singer, 1998)
	Body Representation: (Slater and Usoh, 1993)
	Presence of Others: (Heeter, 1992, Steuer, 1992, Welch et al., 1996)
User (Participant)	**INNER PRESENCE**
	Emotional Content: (Banos et al., 2004)
	'Making Sense' of the Media Content (Riva et al., 2003, IJsselsteijn, 2002)
	Presence of Others: (Heeter, 1992, Steuer, 1992, Welch et al., 1996)
	Focus of Attention: (Witmer and Singer, 1998)
	Presence and Time Factors: (Waterworth and Waterworth, 2006b)
	Selective Attention: (Darken et al., 1999)
	Previous Experience with Tasks: (Riva et al., 2004a)
	Expectations Regarding the Experience: (Riva et al., 2004a)
	Willingness to Suspend Disbelief: C. Hand, 1994

	Meaning the User gives to the Stimuli: Barfield, 1993
	Level of Intent: Witmer, 1998
	Distraction: Witmer, 1998
	Interplay of Senses and Nervous System: (Loomis, 1993)
	Cognitive Processes; (Lee, 2004a) Perception and Action: (Gibson, 1999)
	Personality Factors: (Waterworth and Waterworth, 2006b)
	Body Representation: (Slater and Usoh, 1993)
	THREE LAYERS of Presence Riva, 2004
	MEDIA PRESENCE
Proto Presence	System response time: Ellis, 1997
Core Presence	Audio signifiers: (Darken et al., 1999, Begault, 1994)
	Pictorial Realism: Witmer & Singer, 1998(Feiner, 2002)
Extended Presence	**INNER PRESENCE**
	Attention: Witmer, 1998
	Self : (Riva et al., 2003) Verification of the Existence of Self: (Riva et al., 2004b)
	Consciousness (Waterworth and Waterworth, 2003, Riva et al., 2004a, Moller and Barbera, 2006)
	Control: (Riva et al., 2004b)
	Body representation: Slater & Usoh, 1993
	Bodily instincts: (Riva et al., 2004b)
	Variables that influence the Feeling of Presence
	MEDIA PRESENCE
Spatial Presence	System Response Time: Ellis, 1997
	INNER PRESENCE
	Immersion (Waterworth and Waterworth, 2006b)
	MEDIA PRESENCE
Sensory Presence	Audio (Darken, 1999, Begault, 1994
	Pictorial Realism: (Burkert et al., 2004)
	INNER PRESENCE
	Ecological Validity: (Waterworth and Waterworth, 2006b)
Social Realism	Presence of Others: Heeter, 1992
	Construction of a Realistic Impression: Riva, 2004
Engagement	Control (Walker et al, 1999)
	Immersion: (Banos et al., 2004)
	Involvement: (Sheridan, 1992)
	Presence and Time: Waterworth et al, 2006, ijsselsteijn, Bierhoff et al. 2001(Timmins and Lombard, 2005)
Negative Effects	Consequences: ISPR, 2000
	Measurement of Presence
	Social Presence:(Biocca et al., 2001)
	Virtual Environments: (Darken et al., 1999, Durlach and Mavor, 1995, Freeman et al., 1999a, Riva et al., 2003, Riva et al., 2004b, Schloerb, 1995, Schubert et al., 1999)

Table 3 Researching Presence Attributes

This table does not attempt to list all the research being undertaken in presence but is intended to illustrate the extent to which presence is being researched worldwide. Many other resources exist that discuss the impact of research into presence, see for example, Benyon and Smyth et al *Presence for Everyone* (Benyon et al., 2009).

2.2 Models For Creative Engagement

Knowledgebased systems for designing creative engagements assist designers to produce considered, intuitive systems that encourge participant engagement and foster a positive human-computer interaction (Edmonds, 1993). This section examines 2.2 *Models for Creative Engagement* which includes *The Model of Engagement* (2.2.1) and *The Creative Engagement Model* (2.2.2) both of which informed the design of the art system produced to evaluate participants' experiences of presence.

2.2.1 The Model of Engagement

A Model of Engagement was proposed by researchers of art systems namely Bilda, Edmonds and Candy (Bilda et al., 2006, Bilda et al., 2008). These researchers prescribe a *Model of Engagement* that situates the artist's requirements with the system deliverables keeping in mind the users needs:

> "Experiencing art is driven by perception, where perception is an active and constructive process. Experiencing interactive artworks involves the same condition in addition to the active engagement with the work, which involves being in the space of the work, interacting with it and constructing a meaning through this interaction. Therefore, within an interactive art system, the audience as well as the artist, is engaged in a creative pursuit" (Bilda et al., 2008) p.1.

By utilising Beta_Space as a laboratory (see 3.4 *Research Context and Environment*) Bilda et al accessed results of studies undertaken with ten art systems and user experiences. As a consequence they proposed a *Model of Engagement* that addresses engagement from an audience perspective, thus providing guidelines for artists who wish to create interactive systems with the most engaging possible outcomes. The concepts and modalities explored in the model were designed in order to provide open communication between,

> "...artists, interaction designers, researchers and system developers, and thereby improve collaboration through examining, understanding and agreeing on the sets of concepts and modalities on interactive experience" (Bilda et al., 2008) p.2.

> "While interaction modes define dialogues between the participant and the art system, interaction phases define participant's longer-term cognitive processes" (Bilda, 2009 p.7.)

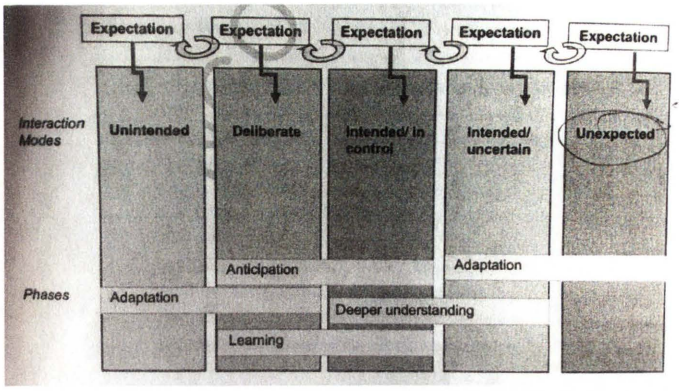

Table 4. The Model of Engagement Interaction Modes and Phases

In their paper, *Designing for Creative Engagement*. Bilda et al describe the Interaction Modes as follows:

Unintended Mode: the participant expectations are not yet set.

Deliberate Mode: the participant has a limited idea of what the system is doing, and expects features and functions to work as he/she expects.

Intended / In control Mode: the participant is capable of setting a purpose for his/her actions and expectations about the outcome.

Intended / Uncertain Mode: the participant starts expanding his/her intentions for actions and expectations about the outcome.

Unexpected: refers to the stage where the participant questions his/her intentions, expectations about outcomes and what the system can deliver (Bilda et al, 2008. pp.9-11)

The Interaction Phases are described thus:

Adaptation: the participant adapts themselves to the changes in the environment.

Learning: the participant starts developing an internal /mental model of what the system does, this also means that they change their expectations, emotions, and behaviours, access memories and beliefs.

Anticipation: the participant knows what the system will do in relation to their initiation.

Deeper Understanding – the participant reaches a more complete understanding of the system and what their relationship is to the system (Bilda et al, 2008. p.11)

> *"The Model of Engagement* is 'sequential and temporal' which means that it identifies certain modes of the interactive experience on a timeline and how those modes unfold along the timeline of an experience. The most significant aspect of the model is that it suggests *sequential and temporal* definitions of experience. This means that the sequence and duration of each interaction mode could be different for each individual experience" (Bilda et al, 2006. p.12).

2.2.2 Designing for Creative Engagement

Edmonds proposes a method for developing interactive art systems in terms of three classifications. These are:

- Attracters which draw the participant into the engagement
- Sustainers that maintain the interest and hold the participant's attention
- Relaters which work to captivate and engage the long-term interest of the participant (Edmonds et al., 2006).

In order to create an art system that is engaging and provides meaningful experiences, the participant's attention must first be attained. Attractors are attributes that entice the participant, encourage them to explore the system, intrigue them into engaging with the system. Sustainers are then added to maintain that engagement and enhance interaction. Relaters guarantee extended interest. These classifications of activators are embedded within a larger description of art systems that identifies and assembles them into four categories: Static, Dynamic-Passive, Dynamic-Interactive and Dynamic-Interactive–Varying (Candy and Edmonds, 2002).

The creative engagement experience differs not only from category to category but also from participant to participant. This is because engagement with an art system involves not only the act of looking, but necessarily involves the participant in taking an active role and engaging with the system physically. Creative engagement invites the spectator to become a participant within the system facilitating a unique engagement involving human and computer. Subjective personal human qualities, such as motivation, emotions, and the ability to suspend belief become intermingled with concepts of beauty, fun and pleasure. Therefore aesthetic appreciation plays a key role as does the cognitive state of the participant.

2.3 Interactive Art Systems

This section focuses on interactive art systems (Candy and Edmonds, 2002). It places these systems within an artistic framework, one that situates it historically as well as socially and politically. As we have just defined interactivity in terms of computer-based systems and different levels of interactivity, these are now discussed with respect to participant engagement. This section examines art and science collaborations that engage spectators as participants in new expressions generated by the employment of computer-based interactive art systems.

Interactive Art differs from other forms of artistic endeavour because it facilitates a dialogue between the artwork otherwise known as system, and the observer who naturally progresses into becoming a participant; for to engage with it is to participate in it. Interactive art systems generally create an experience that differs from user to user as varying levels of interactivity produce a variety of outcomes. In this way, interactive art facilitates an inter-action between the system (computer-based) and the human user. Various technologies are employed in order to create these works. Some rely on the transmission of human sensor data whilst others provide immersive environments that transport users into virtual or augmented realities such as CAVE's (for examples see Figures 10 and 20). Although interactive art systems generally consist of an external interface, they are only fully functional when in operation, and therefore, user participation becomes a core ingredient in the creative mixture that utilises the art system to its full functionality. Human-computer interaction is involved throughout every stage of the creative process, from the artists and technicians inception to the users' level of participation.

This section places interactive art systems within an artistic context. It defines computer-based art systems in terms of computer-controlled systems (2.3.1.1) and user-controlled systems (2.3.1.2). The chapter then discusses the use of presence as an experience tool where artists have constructed works that explore concepts about presence in a video construct (2.3.1.3). These systems are primarily computer-based systems that generate presence using a biofeedback system networked into an immersive environment (2.3.1.4). The emphasis is on interactive systems that realize powerful artistic concepts and deliver a presence experience using multimedia content, system driven technologies and human-computer interaction (2.3.1.5).

2.3.1 Art Systems

In 2010, the term interactivity has come to have many uses. It can happily be applied to aspects of communication as common to the World Wide Web as to the operation of household appliances. It also includes the retrieval of information through touch screen kiosk apparatus and art systems.

Levels of interactivity differ from project to project. In the late 1960s, Cornock and Edmonds devised core categories for interactivity that Candy explores further (Candy and Edmonds, 2002). This system for defining interaction recognises four levels of interaction: static, dynamic-passive, dynamic-interactive and dynamic-interactive-varying

(also referred to as generative). Defining interaction is based on the relationships that develop between the art system and the audience as participant. Structured by the artist and their collaborators (technologists etc), levels of interactivity differ and can be defined by the participant's level of engagement with the art system. In relation to applying the term interactivity to art systems, interactivity within these systems can be divided into two categories, namely: computer-controlled systems and user-controlled systems (Candy and Edmonds, 2002, p.31). Computer-controlled systems have been utilised to create art works through the employment of art systems since the mid 1950s.

2.3.1.1 Computer-Controlled Systems

A computer-controlled system is one in which the spectator remains exactly that. A computer program drives the artwork development producing a randomised outcome that conforms to the artist's vision. Computer-controlled systems in art were first exhibited by German scientist and artist Herbert Franke who launched his art experiments with computers in 1956 with his work titled *Oszillogramme* (See Figure 1). Born in 1927, Franke lectured in computer graphics and computer art from 1973-1997 at University of Munich where he created 'electronic abstractions' and wrote the first text on the subject namely *Computer Graphics - Computer Art* (Franke, 1971). Franke's work utilises the algorithmic as a basis for computer art. During the course of his profession he implemented the use of many smaller electronic components within the composition and construction of his works. These tools include:

> "...the oscilloscope, plotters, milling machines, the first inkjet printers ever available in Europe, and the capabilities of smaller home computers and PCs as they emerged" *(http://www.dam.org/franke/practice.htm)*.

Franke's exhibited works demonstrate his use of the computer as a creative tool, implementing computer-controlled systems throughout his portfolio. In 1975 he said,

> "The first technical instrument which allows us to realize the idea of graphic music is the computer with an annexed graphic delivery gear. Elementary units, for example may be line-elements or tokens arranged in a screen. The first computer-graphic installations offered only very restricted possibilities. They used the same methods as in film making with the only difference being that the production of the phase-pictures was controlled according to a program. The transition allows one to view graphic motion pictures in real time on the fluorescent screen. Interactive systems allow direct exertion of influence on the

produced pictures. Thus it becomes possible to go beyond the projected linear course—as it relates to film and to become a sort of 'Graphic improvisation.' Corresponding to what is usual in music, the field of computer-art was founded, breaking new ground and filling a particular void in the scheme of possible Art-forms" (Franke, 1975).

Figure 1. *Oszillogramme* (1956) by Herbert W Franke
at *Mutamorphosis* in Prague 2007

Franke's collaboration with Horst Helbig (1979–1992) saw the creation of artworks that were produced by programmed computer systems, systems that increased in complexity as new technologies developed. With pieces like *Technical Forms*, *Wave Functions* and *Spiral Nebula,* it was only a matter of time before Franke moved into more exploratory art systems–*Cold Logic* in 1978 used stills cut from documented video which were interactively programmed to the music of J.S. Bach. *Cold Logic* is a picture sequence based on logical operations. Strictly speaking, Franke's video works contain no interactive elements however they were produced by means of a *computer-controlled system* that facilitated their construction (Franke, 1971). By the mid 1960s, European artists became busy creating computer assisted works and publishing their results in journals such as; *Computers and Automation* founded in 1963 and *Leonardo* which was first printed in 1967. These journals assisted artists and technologists to collaborate with scientists and others through the Association of Computing Machinery (ACM) that led amongst other things to developments in Human Computer Interaction (Leonardo, 2009).

British born artist Ernest Edmonds created *Nineteen* in 1968/69. *Nineteen* was the product of Edmonds first use of computers in art practice as its components were arranged in order according to a computer program. Edmonds, as we shall see later in the chapter, has continued to utilise his experience of computer controlled art systems, extending them as Franke did, to incorporate video but going one step further by introducing interactive elements that added user control. These two artworks *Oszillogramme* and *Nineteen* (below) demonstrate the flexibility of the aforementioned, computer controlled system.

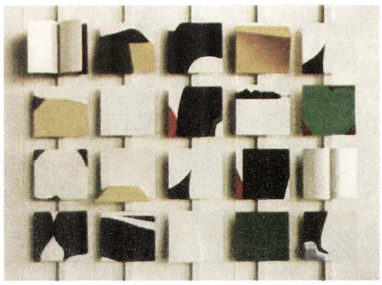

Figure 2. *Nineteen* Ernest Edmonds 1968/9

Another example of an artist whose primary concern was to facilitate a computer controlled system that makes art, is Harold Cohen. Cohen exhibited his pioneering work with AARON at the Tate Gallery, London, in June - July 1983. Cohen's work relies on a *computer-controlled system* that creates drawings and paintings unaided, that is to say that the computer is programmed to behave in controlled ways rather than being assisted by personalized software. Cohen's work evolved slowly, building and developing the system through a process that involved both his own knowledge about painting and drawing and accumulative knowledge through trial and error of his developing system. Cohen's work was facilitated by new technologies such as low-level robotics (Cohen, 1985).

2.3.1.2 User-Controlled Systems

User controlled systems differ from computer-controlled systems in that they are created in order that the spectator who becomes the participant can enjoy full interactivity whilst engaging with the art. Here the participant makes choices that affect the outcome of the work. Writing software for computers specifically in order to facilitate the artists' vision is a time consuming and demanding process requiring creative collaborations between artists and technologists. Most of the examples used throughout this thesis are user-controlled systems and we will therefore be looking at this type of system in more detail later. Using *Absolute_5* (Edmonds, 2005) as an example (see Figure 9) we can identify a system that employs both a computer controlled system (generative video art) with a user-controlled component (interactivity).

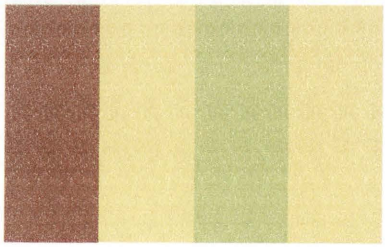

Figure 3. *Absolute_5* Ernest Edmonds and Mark Fell 2005

Absolute_5 by Ernest Edmonds and Mark Fell was exhibited in 2005 as part of the exhibition, *White Noise* at The Australian Centre for Moving Image (ACMI) in Melbourne, Australia. *White Noise* is described thus: *White Noise: sound where the intensity is the same across the different frequencies*. Stubbs in, *A Leap into the Light*, describes White Noise in the catalogue (p.49),

> "White Noise is an exhibition in real-time. With varying degrees of luminosity, tempo and volume the artworks invite the audience into a space that is both physical and reflective: not to view pictorial representations of something, or document another time or place, but to invite us in to the here and now" (Edmonds and Stubbs, 2005).

Absolute_5 was devised by Edmonds and Fell in a collaboration that brought together Edmonds knowledge and experience of computer-based systems and Fell's musical expertise. It is an installation with interactive audio / visual projection that utilises live cameras and 4-channel mono sound. *Absolute_5* combines elements of a computer-controlled system and user-controlled system as,

> "The work generates its own behaviour (with or without an audience) by following rules but the system's behaviour also changes in response to human activity within the space: speed, density, patterns of movement and so on" (Edmonds, 2005).

In this way *Absolute_5* provides participants with a personalised experience that facilitates questions about action and non-action. Interactivity is provided in order that users may deepen their engagement with the system or alternatively they may stand aside and watch the computer-controlled system operate its self. Due to the fact that this art system is a real-time artwork that uses digital video as a component of its hardware, it could be said that it is therefore video art, however, the video cameras are used in conjunction with floor pads containing sensor devices that capture the audience in the space and inturn relay data to the software, the cameras do not themselves project an image that integrates with the visuals as many other interactive art systems currently do. Considering that the interest here is in user controlled systems we now examine systems constructed to create interactive experiences for participants.

2.3.1.3 Video in Art Systems

The use of video via satellite technologies was first utilised in 1977 in *A Space With No Geographical Boundaries* by the American group Satellite Arts Project (see Figure 10). In 1975, artists Kit Galloway and Sherrie Rabinowitz, devised a series of productions under the banner of "Aesthetic Research in Telecommunications". *A Space With No Geographical Boundaries* provided a virtual performance space where telecollaborative arts were combined to produce a global art system.

A Space With No Geographical Boundaries utilised geographically dispersed electronic images to contextualise a live immersive place,

> "... a place where artists, and others, could convene and co-create together on a scale that could be as culturally inclusive as desired."

As a mixed media project it was one of the first to be exhibited and set a precedent for other artistic networks whose primary concern lie with telecommunications such as the British group Blast Theory (http://www.blasttheory.co.uk/) and Australia's Transmute Collective (http://www.transmutecollective.com) (Armstrong, 2006).

Figure 4. *A Space With No Geographical Boundaries*, Satellite Arts Project, 1977

This section examines a number of art systems developed in the 21st century that are dependent upon video as a core technological tool. However, it is worth noting that as an early interdisciplinary collaborative project the *Satellite Arts Project* was very successful in its use of established technologies. It demonstrated for the first time that artists could connect via technology to create works that explored interactivity and participation in new ways. The interactivity involved the participants viewing their collaborators' efforts that were delivered through the medium of satellite: 'separated by oceans and geography' these artists experimented with computer technology to produce images that were a physical improbability. This form of interactivity in art facilitated a dialogue between international artists and technicians, now however, the audience were elevated to the role of active observer.

'Static' is a category of art systems which describes the more traditional form of viewing art (Candy and Edmonds, 2002). In brief, the audience as observer plays no role in the development of the work. The work is complete, it stands alone without any input from the audience. Visual art and sculpture are dominant forms here where the audience are invited to view the work, discuss the work and bring to their understanding of the work all the knowledge and emotional attachments that the work evokes from them. "The artwork itself does not respond to its context", in fact the artwork once exhibited does not itself change in any way its shape or form.

Examples of static networked art systems that happen to facilitate deep presence engagement through interactivity, can be found in the video work of Nam June Paik (ref). In 1979 Nam June Paik experimented with TV monitors on mass when he produced *Moon is the Oldest TV* (1965-1992).

Figure 5. *Moon is the Oldest TV*, Nam June Paik, 1979 -1992

Figure 6. *Video Fish*, Nam June Paik, 1979 -1992

Continuing with his use of monitors, with *Video Fish* he inadvertently produced a new art form; the Monitor Form.

> "The "monitor form" developed according to the double aesthetic of sculpture and installation, orientated more on the work of art as "object" rather than as "installation", demanding active participation on the part of the spectator" (Van Assche, 2006) p. 233.

Thus the "monitor form' contains interactivity within its system built in terms of the demand that is placed upon the participant to become actively involved. This static system feeds back into itself, the use of multiple images screened simultaneously allows the participant to choose between images and create their own meaning as much as interpret the artists way. The Monitor Form continues to be explored in artists work as they separate images, text and sound in-order to create new constructs of meaning. Intention may often be found wherever one looks but some times the participant must

struggle harder at sense making. Gary Hill's *Disturbance Among the Jars* (1988) is such an example.

Figure 7. *A Loving Man* Jananne-Al-Ani, 1996

A Loving Man (1996) by Jananne-Al-Ani positions the monitors on shelves separated in the space so as to create a 360 degree experience, thus the spectator must engage by moving their physical body in order to witness all the action. They become physically embedded within the work. This level of engagement facilitates a presence experience in as much as the participant must remain focused on the subject matter, engaging both their mind and their body in the act of making sense. This type of work falls under the categorization of *Static* as the finished object (s) or system does not respond to its audience or its environment. However, the process of construction relies heavily on advancements made in technology and science. The art systems given here are examples of *Static* art systems that are both interactive and potentially generate a presence-based experience through a science / art / technology collaboration.

Current technologies allow us now to engage with video in interactive experiences, where the media form and content affect the participant both physically and psychologically. IMAX Cinemas are a good example as they produce location-based films that affect audiences' physically. This physical reaction to a scene playing out within your environment can be linked closely to a number of categories in the presence debate. The reaction from audiences' when they are fully engaged and focused indicates that they are immersed to some degree in the experience of being elsewhere. Artists and technologists are now designing digital panoramas that project us into the past, present and future. The art of panorama production having recently had a resurgence, it is as if the digital age provides perhaps the most appropriate media form for panoramic expression. The panorama is unique in the sense that the viewer gains peripheral vision from the outer corners of the eye, seeing as one can see in real-life. This gives the viewer the sense that there are no boundaries other than the restrictions of the eye itself. Along with a multitude of other adaptations the panorama became the blueprint for the Cinerama, which is now more commonly known as the IMAX format (IMAX incorporating height as well as width).

More recently computer-based systems like *iCinema* and *iDome* at the College of Fine Arts (COFA), Faculty of Engineering and the Faculty of Arts and Social Sciences (FASS) at the University of New South Wales, demonstrate technological advancements in our ability to expand upon the concept of large-scale interactive panoramas with works like "Eavesdrop".

In the past decade, presence-based engagement, generated through video technologies, have been created by scientists and artist collaborations who are working with universities and major government funded institutions throughout the world. Peter Campus*'s Interface* (1972), is a system that invites playful participants into multiple interactions. Other artists to develop early video works using surveillance technologies include: Bruce Naumans', *Going Around The Corner Piece* (1970) and Dan Graham's, *Present Continuous Past (s)* (1974). These systems facilitate a discussion about presence as absence. The linking characteristics provide a platform for discussion as video surveillance technologies are constructed in new ways to facilitate new interactions. The observer becomes embedded within the visual landscape and becomes a key player in the activity of the technology. No longer static, the recording device captures the observer placing themselves as central characters within the work, facilitating new engagements for observer / spectator / participant. The participant then controls the action by navigating themselves within the constructs provided by the artist and they manage the ebb and flow of interactivity as they choose. Inter-action can also include a deliberate non-action, for the act of standing back and observing will, nevertheless, draw the player into an audiovisual landscape containing their image. To move or not to move? Observers become participants against their will...once you enter the curatorial display the artist's imagination forces you to enter a new world where you gain a new perspective of yourself.

The following section addresses levels of interactivity that include the audience as participants of the art experience.

2.3.1.4 Biotechnological Art Systems

Data extrapolated from sensor apparatus and input/output technologies can be used to create, operate and facilitate the production of biotechnological art systems. Collaborations between artists and technicians are changing the face of spectator participation. Here we examine art science collaborations that produce works that engage participant's biological input in the process of creating new expressions generated by computer-based interactive art systems. Art systems that use the human body in order to

function are referred to as Biotechnological Art Systems which derives from the conjunction of art and science and explores the contradictions and underlying complexities that technology offers humanity. This section provides a broad overview of some projects which involve digitally manipulating the participants' biological fluctuations towards an artistic expression. The nature of art conceived from the co-joining of science-based technological experiments and computer-based interactivity in the context of presence is also examined here.

Biological systems rely on biological input from a participant in order to operate fully. *Cardiomorphologies* by George Khut is an interactive art system that was exhibited at Beta_Space at the Powerhouse Museum in 2005 (Khut and Muller, 2005). In an interview conducted by this author Khut said of his work,

> "This is an ambiguous project, a lot of people don't know whether it's a science demonstration or a medical demonstration or an art work - for me it's about a cultural space for discussing bodily experience and experiencing ourselves in a different way, and that for me is one of the important contributions art can make, it's that sense of place where we can have unusual experiences and reflect on them and see how they might shift our experience of the world" (George Khut, 2005).

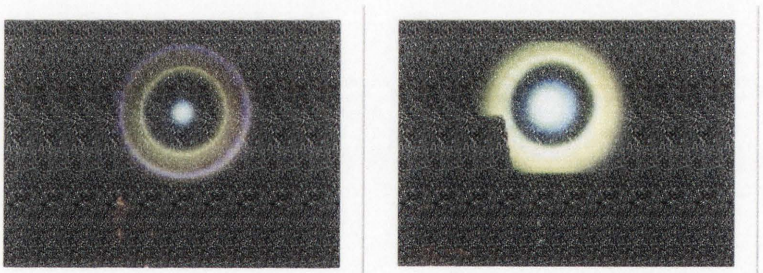

Figure 8. *Cardiomorphologies* by George Khut, (Khut, Turner and Muller, 2005).

Cardiomorphologies is a submersive experience for the participant whereby the participant becomes consciously engaged with the artwork and activates its development. Participants experience a range of breathing and heart rate physicology during the 15 minute sessions. Khut states,

> "The interrelationships between thinking and emotional processes and physiology responses is reflected in our breathing and heart rate patterns" (George Khut, 2005).

These patterns are then digitally transferred into a data system that observes the response signals of the participant's own body through attached sensors and projects the images onto a screen directly in front them. *Cardiomorphologies* was created using the MAX/MSP software environment with additional coding in C language. For further information see Khut's paper; *Evolving Creative Practise*: A Reflection on Working with Audience Experience in Cardiomorphologies.

Another new Australian biotechnological art system includes Transmute Collective's *Intimate Transactions*.

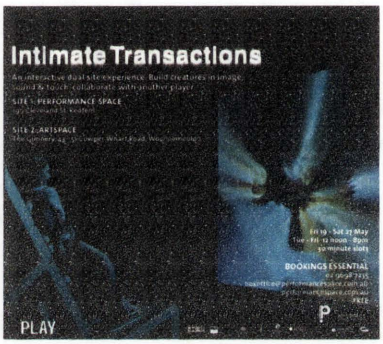

Figure 9. *Intimate Transactions* Transmute Collective, 2006

Intimate Transactions provided the participant with an exploration of physical interconnectivity through the application of a 'bodyshelf'.

> "This unique hybrid of furniture and interface, underpinned by electronic and computational systems, demanded a particularly active physical engagement - requiring participants to make full body contact with its footrests and backboard, and to be in continual motion" (Armstrong, 2006).

Armstrong and other members of Transmute Collective were interested in producing *'an embodied experience of interaction'*. This work relies on a two-part installation process where identical apparatus are installed in different locations. Connectivity is produced by participants engaging with the system at either end through a server within a distributed network. The biofeedback system integrates the participants' movements and thus, their intentions become visualised creating and feeding back into each other's environments and therefore, engagements.

> "While each participant operates within separate worlds, and their individual actions trigger local image and sound experiences, the two worlds are conjoined and interdependent. So while each participant is not able to observe what is

> happening to the parallel user's environment, the shadow of the other person's avatar suggests their presence and, moreover, the effect of their actions upon the depletion of their creatures slows down both worlds. Here we are evoking ideas of 'overshoot' that are caused by ecological foot printing and 'entanglement'. This flow of local actions through the system was achieved through the unusual design approach of creating two separate, parallel universes that are joined through the computational layering. Because of networked and cross-affective processes, participants' worlds are indirectly exposed to the ramifications of the other participant's activities" (Armstrong, 2006).

In the work *Intimate Transactions,* Transmute Collective were not only concerned with ecological factors and implementing biotechnological input from participants in order to create 'an embodied experience of interaction' but they also expressed a concern for creating an engagement that orientated itself around the concept of the self and others. The regeneration of space and place manifested itself throughout the engagement as the system responded to the actions of the participants.

2.3.1.5 Presence-Based Art Systems

Presence-based art systems that facilitate engaging experiences for participants are characteristically concerned with embodiment and immersion. Systems that monitor bodily movement do so to ensure consciously monitored control over the environment. As we shall see, such systems can also implement direct, automatised inputs from the participant (Riva, 2004).

Figure 10. *The Sensorama* by Morton Heilig 1962

Heilig's *Sensorama* is known to be one of the first examples of an immersive environment, incorporating mulit-sensory technology. Consisting of stereoscopic 3D images presented in a wide angle view, with body tilting and surround-sound the system it also incorporated aromas and the sensation of wind (Heilig, 1960).

In the mid 1990s, Char Davies pioneered the use of breath and balance to control navigation in the work, *Osmose*. In her work *Ephemere,* visually dwelling on an 'organic' form causes it to age before the eyes (Wilson, 2002). Many of the five thousand participants who engaged with *Osmose* reported,

> "Experiences such as "being in another place', 'losing track of time', 'unable to speak rationally afterwards', and euphoria" (Wilson, 2002).

Such reports indicate that participants experienced a loss of self-consciousness, facilitated by 'digital participation and mediated flow' (Riva, 2004, p.417). These characteristics of form combined with content enabled strong presence engagement for participants.

Figure 11. *Iamascope* by Sidney Fels

Iamascope by Sidney Fels is an interactive system that utilises participants' bodies to both create and sustain the work. Participants physically engage through use of a camera capture device providing a live feed into a computer system so that the participant's responses are almost at real time speed. A rear projection allows for easy access to image for interaction and image visibility; again the participant is active and engaging with the system form to create the systems content.

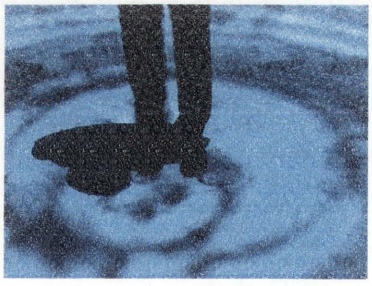

Figure 12. *The Famous Grouse Experience* / ART+COM / Berlin/ 2002

The Famous Grouse Experience was an experiment in engagement. In 2002 ART+COM created an interactive environment with the use of projected real time film images, an interactive sound system, sophisticated lighting with the addition of an olfactory fan

system for whiskey aroma diffusion. This experience was capable of sustaining up to twenty players at the one time providing a number of engagements that included stomping in order to break the ice projected onto the floor, flying over Glasgow and running across the surface of water (without getting wet). Deep sensorial engagement created real experiences for participants, projecting them from one place into another, engaging them physically and psychologically.

Figure 13. *Telematic Dreaming* Paul Sermon 1997

In much the same way that *Intimate Transactions* facilitates communication between two players through a networked system, so too, does Paul Sermon's *Telematic Dreaming*. This presence-generating art system creates a sense of self and other within the intimate prop of a bed, locating two interspersed individuals through personal memory of a transaction and visually stimulating data.

> "*Telematic Dreaming* deliberately plays with the ambiguous connotations of a bed as a telepresent projection surface. The psychological complexity of the object dissolves the geographical distance and technology involved in the complete ISDN installation. The ability to exist outside of the user's own space and time is created by an alarmingly real sense of touch that is enhanced by the context of the bed and caused by an acute shift of senses in the telematic space. The user's consciousness within the telepresent body is controlled by a voyeurism of itself. The cause and effect interactions of the body determine its own space and time; by extending this through the ISDN network, the body can travel at the speed of light and locate itself wherever it is interacting. In *Telematic Dreaming* the user exchanges their tactile senses and touch by replacing their hands with their eyes" (Sermon, 1992).

As *Telematic Dreaming* illustrates, to engage in a presence-based experience is, for the spectator as participant, a psychological journey as much as a physical sense of engagement, i.e., that of 'being there' (Harvey and Sanchez-Vives, 2005).

Another example of the use of video in art systems is Philippe Parreno' s *El sueno de una cosa* (2001) which translates into English as *The Dream of a Thing*. This video lasts for one minute and shows a picturesque scene of a fjord in Svalbard, in the north of Norway.

> "The camera's brief jaunt from the sea to the fertile mountainsides terminates in the sudden blooming of flowers that have burst forth from the ground, and the whole scene is carried along on the steady rythum of music arising from a melancholic and almost enigmatic extract of Edgar Varese's Desert" (Pompidou Centre, 2006) p. 238.

Figure 14. *El sueno de una cosa* Philippe Parreno, 2001/2002

This video system is likened to its similarity to the system produced within this practice-based research project, as it too offers the viewer a place for contemplation: a dream world appears and the participant becomes immersed within it.

> "It has the ability to trigger a narrative process as in the way of so many dreams; a quiet delirium breeding desire and surprise which give rise to a need to push forever onwards" (Pompidou Centre, 2006) p. 238.

Video is currently being used in virtual reality systems designed to facilitate within participants, sensorial sensations that trigger the ease felt when immersed in a naturalistic setting. Healing media environments and experiences are being designed inorder to assist people to manage more ably in the world at large.

Figure 15. Virtual meditative 'walk in park', 2010

Through the research of Dr. Diane Gromala who leads a pain-management team, chronic pain sufferers are able to experience a virtual meditative 'walk in the park'. Designed as part of the Transforming Pain Research Group's initiate "walking meditation" the system was developed to enable suffers to manage chronic pain,

> "...sometimes with better results than traditional means such as morphine" (Sinoski, October 12, 2009).

The technique is one of several programs, including virtual reality video games and meditation chambers, used around the world to aid sufferers of chronic back pain and migraines. The "walking meditation is a 3-D stroll in the forest which participants experience wearing virtual-reality glasses and earphones. This enables them to feel as if they are walking into an interactive computer screen. The walking meditation technique enables patients attached to a machine to take a walk through the forest where they can see the rocks and trees. With respect to the audio, a meditative voice suggests what to focus on while music plays in the background. They can also hear the sounds of birds and animals. The visuals and sounds reflect the participant's movements.

> "The virtual reality technique is similar to using movies or video games to distract chronic pain sufferers from their pain. But it takes it a step further: Users hook up to a "biofeedback" device by putting Velcro rings around their fingers" (Sinoski, October 12, 2009).

Utilising a bio-feed back system of this kind means that when participants are approaching a meditative state, the sunsets and the world becomes quieter. Created through a combination of a mix of abstract and real world images these systems draw participants into other places, enabling them to disengage from 'real life' scenarios.

2.3.1.6 Virtual Reality Systems

In the past decade presence-based engagements' that implement video technologies have been created by scientist and artist collaborations who are working with universities and major government funded institutions through-out the world. Many of these collaborations have occurred in the context of producing healing-media experiences for participants. Healing-media art systems generated from presence-based concepts and the digital media combination of systems form and content, facilitate positive experiences for users. Recognition of these experiences assisted in the development of rehabilitation tools in the field of Cybertherapy. This has led to the creation of healing media art systems that

are redefined for Clinical Psychology and Neuroscience application (Sponselee, et al, 2004, de Kort et al. 2004; de Kort et al. 2006; Riva, Botella et al. 2004; Riva, Morganti et al. 2004).
Freemans et al's Relaxation Island is such an example. This virtual reality system was a screen-based engagement developed to explore how creating engaging media content could assist people with phobias (Freeman et al. 2004).

The EMMA Project (Engaging Media for mental Health Applications, 2004) is another example where researchers studied the relationship between presence and emotions. Using music, images and words they aimed to assist generally unhappy people to feel better about themselves. A study was undertaken investigating three alternative display environments, namely; a PC monitor, a head mounted display and a big screen with retro projection. They also analysed three interaction devices; a mouse, a joystick and a wireless pad.

More recently a system was produced by researchers at a University in Birmingham that consisted of using "...large screen TV's, video projectors and head mounted displays to create virtual versions of soothing rural and coastal scenes " (Lombard, 2011).
Artists have long been experimenting with panoramic photographic images creating wide-angled vistas for spectators to experience locations that they have never seen before (Oetterman, 1997). By creating a panoramic view of a location, artists simulate an experience that extends beyond the spectator's field of view and produce an image that provides content replicating that which the spectator would see if they were to move their head from side to side. Unlike traditional photography which generally presents one aspect of a scene, panoramic photography presents an image that captures all the details of the world that surrounds us (Andrews, 2003). In the 21st Century, documenting our habitat is now so immediate and accessible that millions of people do it each day. Cameras are embedded within mobile phones, computers, touch screen applications, security and surveillance systems, and art systems. Delivering locative-based images to audiences no longer requires large-scale complex cinema centres screening strips of film. More often, imagery is transferred using digital interfaces, facilitating the development of yet newer entertainment devices creating immersive interactive experiences.

Researchers into presence associated with the BENOGO project completed a series of studies of real places and then created photo-realistic environments. These 360 degree panoramas were also experienced through a head-mounted display and,

> "...critically shaped both the approach to the measurement of sense of presence in both real and virtual environments, but also the subsequent debate as to what constituted presence and its relationship with place" (Smyth et al., 2006).

More recently computer-based systems like *iCinema* and *iDome* at the College of Fine Arts (COFA), Faculty of Engineering and the Faculty of Arts and Social Sciences (FASS) at the University of New South Wales, demonstrate technological advancements in our ability to expand upon the concept of large-scale interactive panoramas.

Figure 16.*The T_Visionarium* at *iCinema*. University of New South Wales

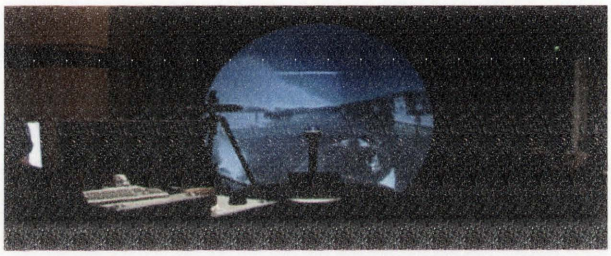

Figure 17. *iDome at the* University of New South Wales

Conceived and developed by Jeffery Shaw in 1993, the T_*Visionarium* presents the viewer with a multitude of windows or screens, each window a projection of a recorded TV program. Within this space the viewer determines their own narrative as they choose to enage with the "continual play of elements in this 'spatial montage" (Bennett, 2008). Shaw also created in collaboration with David Pledger an interactive system called 'Eavesdrop'. Presented at iCinema in a 360 degree purpose built cinematic environment, 'Eavesdrop' presented the participant with multiple viewpoints of ten peoples dramatised relationships. Participants navigated through screen and narrative space to investigate their stories of choice.

As we have seen, art systems are as diverse in functionality as they are in system content. In common, however, is the artist's goal to create art systems that engage participants in

sensory experiences, experiences that heighten the intersections between art, science and technology and facilitate creative explorations of digital media experiences.

2.4 Gaze-Based Technologies

Section 2.4 *Gaze-Based Technologies* considers eye-tracking devices as technological tools for enhancing the experience of a screen-based engagement. It describes eye-trackers and how they are being implanted into systems that facilitate biotechnological feedback (2.4.1). 2.4.1.1 *The Eye-tracking Device* examines exactly how an eye-tracker works using two current examples. Art and science collaborations that produce systems so as to engage participants with interfaces for creative expression, are discussed in 2.4.1.2. Finally, eye-gaze technology as a form of interaction for presence generation is reviewed (2.4.1.3).

2.4.1 Eye-tracking Technology

Gaze-based or eye-tracking technologies are non-invasive control systems that facilitate communication through a hands-free interface. A hardware device containing several sensors and infrared illuminators are positioned behind a black window around a screen. Eye-tracking systems bounce infrared light from LEDs at the bottom of a computer monitor and track a person's eye movements using stereo infrared cameras. This setup can calculate whereabouts on a screen the participant is looking with an accuracy of about 5mm. The components behind this screen all need a free line of sight to the participant's face and eyes. The software requires specific information about the environment and the participant and the device requires calibration; a system adjustment acknowledging the position of the participant's eyes in relation to the screen. From then on (as long as the sensors can read the pupils which are not hidden from view) the eye-scan software detects the participant's pupil movement and responds accordingly .

Eye-trackers are effective in assisting game designers (Agustin et al., 2007), web designers and commercial advertisers (Ware and Mikaelian, 1987) to create engaging, fun and exciting experiences for participants. By introducing an eye-tracker into the evaluation process, it is possible to establish exactly where the user is looking on the screen and what they are looking at. Using an eye-tracker can assist designers in providing information about the experience so that they can gauge how to improve it. They also help to reveal usability problems that would otherwise remain undiscovered. Many eye-trackers require the user to wear head mounts or special glasses but standalone devices also exist. Producers of standalone eye-trackers claim that these systems are

accurate, affordable, portable, and small and do not require any physical restraints. There are currently many eye-trackers available for interactive applications for use with commercial eye-tracking systems that are used for controlling a computer by people (with disabilities).

Open source gaze tracking, freeware and low cost eye-tracking systems are being introduced into research prototypes. The list below provides information in respect to building an eye-tracker. Some of them are targeted at people with disabilities (eye-control systems), some for more general eye-tracking and research.

- EyeWriter is low-cost eye-tracking apparatus and custom open-source software that allows graffiti writers and artists with paralysis to draw using only their eyes.
- ITU Gaze Tracker works with a webcam or video camera with night vision and infrared illumination.
- openEyes is open-source open-hardware toolkit for low-cost real-time eye-tracking
- Opengazer is open-source gaze tracker for ordinary webcams.
- TrackEye: Real-Time Tracking Of Human Eyes Using a Webcam. Implemented in C++ using the OpenCV library.
- myEye, eye-tracking software to allow people with severe motor disabilities to use gaze as an input device for interacting with a computer. Beta version of the prototype software available for download.
- Eye Gaze Communication Board, low-tech eye pointing, cheap (self-made) gaze communication board, "first aid" solution for acute communication needs.

2.4.1.1 The Eye-tracking Device

Figure 18. Illustration of a Mirametrix S1 Eye-Tracker

Eye-trackers are capable of determining in real time where on a computer screen a participant is looking. Advanced computer algorithms track both eyes, offering a point-of-gaze measurement that is accurate to within one degree. Eye-trackers such as Mirametrix S1 Eye-Tracker and Tobii X120 Eye-Tracker provide lightweight solutions that can be used with existing technological equipment meaning that the system does not

require a custom monitor or embedded computer, they run entirely on existing hardware. These standalone eye-trackers sit unobtrusively below the screen, facing the user. They use advanced computer vision algorithms to track the eyes and produce point of gaze data at a rate of 60 times per second.

Using the Tobii X120 eye-tracker as an example of standalone eye-tracking units, we can see that they are designed to be used in relation to computer screens, television sets and projected images. Flexible eye-trackers are recommended for studies that require particular setups, and are ideal for visual testing brochures, magazines, products and shopping shelves. Scientific uses include psychological studies where stimuli needs to be presented on a projection screen, and infant studies that involve real world objects.
They are also used for studying user experiences and usability of handheld devices.

> "High accuracy and excellent head movement compensation provides you with high quality data throughout your entire population. The Tobii X60 & X120 eye-trackers track basically everyone, regardless of ethnic origin, age, glasses or contact lenses. Drift compensation guarantees high tolerance to varying light conditions" (www.tobii.com).

> "Eye-tracking technology keeps track of the user's gaze as well as the location of objects on the screen and estimates what actions the user intends to initiate based on eye movements" (User Manual: MyTobii Version 2.4 p. 4).

2.4.1.2 Eye-tracking Interfaces for Creative Expression

Eye-tracking has in recent years become more embedded in our technology applications through computer games, online virtual communities and 3D environments. Researchers are investigating aspects of eye-tracking such as eye typing, 3D point of gaze estimation, integrated speech and gaze control and head-mounted sensor-based eye-tracking devices (Bates et al., 2007). Using eye-tracking technology users with disabilities are discovering that new ways of communicating are possible, expanding the human-computer experience which in turn produces the actualisation of a life enhanced through system design and technology. By using an eye-tracking system and third party software the technology provides a hands-free interaction, thereby eliminating the use of the body. Eye-controlled software contains a range of applications including; text editing, writing, e-mail, internet browsing, chat, media player and games. These systems have also been developed to extend user's communication abilities and creativity through the use of interfaces that enable participants to engage in creating music and participating in

choreographed dance routines. Since the 1990s, eye-tracking interfaces have assisted people with conditions such as motor neurone disease (MND), cerebral palsy and other "locked-in syndromes" to control 2D desktop environments and write using visual keyboards. Designing eye-tracking interfaces to assist disabled participants in creative endeavours is relatively new and to date has relied heavily on the research of Donegan at COGAIN. His work with The InterFACES project at SMARTlab Digital Media Institute involves people who have severe physical disabilities and provides opportunities for creative engagement through the use of specifically designed eye-tracking interfaces. Eye-tracking software assists participants to navigate and activate icons embedded within the interface of a computer screen that is generally attached to the wheel chair arm brace (Donegan et al., 2005).

Figure 19. InterFACES: The Human Face of Assistive Technologies

Research at SMARTlab has seen the development of interfaces that enable participants to,

> "...create a 'soundboard' or 'eye harp' with communication grids and musical interface developed in collaboration with SpecialEffect, UEL PhD students with disabilities and professional musicians. The SMARTlab team demonstrated the new musical application of the Mytobii technology, in a Live/Online Jam with Colm O'Snodaigh of KILA and special guests including Fay Patton (jazz musician), Clilly Castiglia (SMARTlab), Michela Ledgidge (Modfilms/SMARTlab) and very special guest Sapna Ramnani, who joined the jam using her eyes as her instrument and interface" www.smartlab.uel.ac.uk

2.4.2.3 Eye-tracking and Presence Research

Presence in the context of this research and as discussed above relates to situations where engagements are enhanced through the use of technology. As we have seen issues associated with focus and attention are key factors in experiencing presence. Eye-tracking interfaces facilitate human-computer interactions that require the participants to pay

attention to both the content and the form of the technology. Therefore in all probability eye-tracking devices are able to assist in producing the environment required for presence-generation.

This research investigates the properties of eye-tracking technology embedded within an art system to gauge how successful eye-tracking can be as design feature in a presence-generating art system. The benefits of utilising eye-tracking technology in developing art systems is that participants with disabilities will be able to experience designed engagements that able bodied participants enjoy. For many, the world thus becomes a more 'inclusive' and effective place to be. Implementing creative interfaces with video into systems that engage participants in the use of eye-tracking technology broadens the context for modes of communication and human-computer interaction. Systems that give people with disabilities an opportunity to communicate also give them the opportunity to control their environment.

2.5 Chapter Two Summary

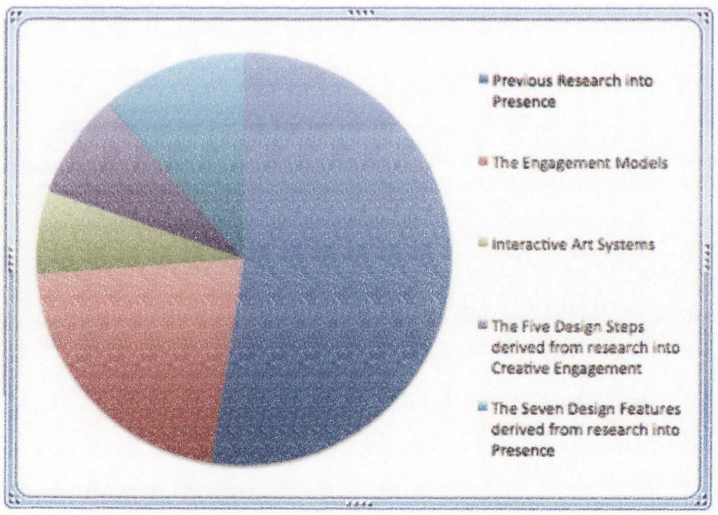

Figure 20. Contributing Factors for the design of PEGASYS

This figure illustrates how previous research into presence informed the design of seven features which led to the development of a five step development process. This process took into account two engagement models that offer interaction modes and phases and attractors, sustainers and relators, all of which assisted in the design of the five steps. Reflection on interactive art systems, what they do and how they operate was also taken into account in the produced outcome which is PEGASYS.

Chapter Three

"One cannot, I say, attain supreme knowledge all at once; only by a gradual training, a gradual action, a gradual unfolding, does one pertain knowledge. In what manner? A man comes, moved by confidence; having come, he joins; having joined, he listens; listening, he receives the doctrine; having received the doctrine, he remembers it; he examines the sense of the things remembered; from examining the sense, the things are approved of; having approved, desire is born; he ponders; pondering, he eagerly trains himself; and eagerly training himself, he mentally realises the highest truth itself and, penetrating it by means of wisdom, he sees." Majjhima Nikaya, LXX

3 METHODOLOGY

Chapter Three explores the methodological approach adopted for this research project. First it introduces a practice-based research (PBR) methodology that can be applied to support and evaluate creative work (3.1). PBR projects like this one includes reflective practice (3.1.1). As an example, this chapter begins with Schumacher citing the Buddhist text from Majjhima Nikaya, LXX (Schumacher, 1977), it is by gathering data that knowledge can be examined and wisdom retained. The research methods used in this research project are discussed with respect to the role of the artefact (in this case, an art system) in generating evidence (3.1.2). Section 3.2 *Investigating Presence* focuses on the methods used to study the nature of presence. Section 3.2.1 examines the nature of what is being evaluated, specifically how the experience of an art systems features can influence participants' experiences of presence. In 3.3 *Data Gathering Methods,* various data gathering techniques are discussed such as the use of questionnaires (3.3.1), the act of observation (3.3.2), interviews (3.3.3) and how the participant profile information (3.3.4) can provide valid data for analysis. Section 3.3.5 examines a process undertaken to evaluate participants' attention. Section 3.4 *Research Context and Environment* discusses how the studio environment is contextualized to support the exhibition environment for the two-part study undertaken in this research project. 3.5 *The Presence Components of the Design Methodology* are then discussed in respect of the measurement of the degree of immersion experienced by the participants' experience of the content (3.5.1) It goes on to discuss the degree of immersion experienced by participants in respect of the form of the system (3.5.2), and how it will be measured, followed by 3.5.3 that discusses how to measure the degree of immersion experienced by participants. Measuring participants' experiences in general is then discussed (3.5.4). Having considered some of the methods used for evaluating studies, the next section, 3.6 *Designing A Two-Part Study,* presents a methodology for conducting the two-part study included within this research process. 3.6.1 describes *Study One: Without Interaction* and

3.6.2 *Study Two: With Interaction.* 3.7 *Data Gathering for the Two-Part Study* looks at the techniques applied, such as observation (3.7.1), administering a questionnaire (3.7.2), the use of the participant profile information (3.7.3), interview as an analysis technique (3.7.4). Finally, the application of video and photography documentation (3.7.5). 3.8 gives a precis of the main methodological features of this research and how this has informed the methods used for the evaluation studies.

3.1 Practice-Based Research

Practice-based research (PBR) is a methodology that offers the creative practitioner a means to explore and generate new understandings about the nature of practice and the role of the artwork in that practice. This form of research enables the generation of new knowledge about practitioner theories and processes that may apply generally in a given cultural context. Thus, PBR enables the process of creation to unfold in its unique way and, at the same time, facilitates systematic studies undertaken by practitioners to take place (Scrivener and Chapman, 2004, Candy, 2006, Hockey, 2003, Scrivener, 2002).

The Arts and Humanities Research Council (AHRC) (formerly AHRB) is the UK organisation that funds art and design research. AHRC's published definition of research includes key terms that arise from their definition of PBR including:

1. "PBR must define a series of research questions (1.3) that will be addressed or problems that will be explored in the course of the research. It must also define its objectives in terms of answering those questions or reporting on the results of the research project (1.2)".

2. "It must specify a research context for the questions adopted. It must specify why it is important that these particular questions should be answered or problems explored (1.5); what other research is being or has been conducted in this area (*Chapter Two*); and what particular contribution this particular project will make to the advancement of knowledge, understanding and insights in this area (1.4)".

3. "It must specify a methodology for addressing and answering the research questions (*Chapter Three*). It must state how to set about answering the questions that have been set, or exploring the matters to be explored (3.7)".

The numbers in bold (at the end of each of the three criteria's addressed) refer to where this document deals with the AHRB/AHRC criteria. Section 1.3 defines the research

questions and 1.2 the objectives of the research. The research context is discussed in section 1.5 Significance and the contribution that this particular research makes 'to the advancement of knowledge, understanding and insights in this area'. The methodology for 'addressing and answering the research questions' is discussed in detail within this chapter summarizing in section 3.7 the data-gathering methods for the two-part study conducted in order to evaluate participants' experiences.

At the centre of PBR is a reflective process that provides documented evidence of the way concepts, tools and materials are combined to generate theories, forms and art systems that contribute to understandings derived from practice. The role of reflective practice is fundamental to this process.

3.1.1 Reflective Practice

Reflective practice can be traced back to the work of Socrates who prescribed a form of learning through questioning and feedback. The work of Donald Schön gave rise to the concept of reflective practice for improving action and professional practice through the principles of reflecting on experience. This approach promotes autonomous learning which aims to deepen students understanding and critical thinking skills; it encourages the use of intuition, forcing the student to question what they know and examine the basis on which they believe something to be true (Schon, 1983).

Schön's *The Reflective Practitioner* investigates in detail the processes involved in participating in action research, a methodology that heavily involves the act of reflection (Schon, 1983). Definitions of reflection include reflection-in-action and reflection-on-action (Boud and Walker, 2002). The term reflection is defined here as the process of thinking for an extended period about the links between recent experiences and earlier experiences in order to produce a more complex and interrelated mental schema. In promoting an organisational or conceptual pattern in the mind, the researcher looks for links that join the research elements, thereby producing a more dynamic illustration of the concept.

According to Gustafon and Bennet reflective behaviour can be categorised into eleven variables; these are then grouped into three characteristics: Learner, Environmental and Reflection Tasks (Gustafon and Bennett, 1999). In brief, the *Learner* characteristics remind us, that reflecting is a learned behaviour cultivated by an individual over a period of time, that the ability to reflect upon a subject is directly proportional to the amount that one knows, and that motivation and mental preparation are equally important parts of the

whole. The environmental factors are also to be considered, as the learner's ability to establish an appropriate attitude for reflecting can be associated with the physical environment in which reflective practice is taking place. Environmental factors that might inhibit the process include such things as competing stimuli (e.g. televisions, personal conversations, ambient noise), poor ventilation, high or low temperature or uncomfortable furniture. Social interaction with peers can also enhance motivation, extending engagement with the task of reflection as information and ideas are shared resulting in deeper thinking about the subject (see 3.4 *Research Context and Environment*).

This PBR project applied the approach of reacting and contemplating as features of the reflection process. The process facilitates and encourages an expansion of the artistic outcomes through analysis of the learning process, reflection of personal goals and contemplation of the outcomes. By utilising the tool of 'reflection' higher order thinking may direct the PBR process.

> "Using intuition to inform learning is referred to in education as developing 'meta-cognitive' skills. That is, a more developed or higher order version of the 'cognitive' (knowledge, reasoning) skills that we employ in learning" (www.ukcle.ac.uk, Accessed June 2010).

Hatton and Smith identify four essential issues concerning reflection: that we should learn to frame and reframe complex or ambiguous problems, test out various interpretations, modify our actions accordingly and extend our thoughts systematically by looking back upon our actions some time after they have taken place. Certain activities labelled as reflective, such as the use of journals or group discussions following practical experiences, are often not directed towards the solution of specific problems. We should consciously account for the wider historic, cultural and political values or beliefs in framing practical problems to arrive at a solution (Hatton and Smith, 1995). This is often identified as 'Critical Reflection'. Critical Reflection facilitates investigation and experimentation to facilitate learning through analysis of experience. Reflective practice facilitates critical reflection encouraging discussions that evolve around the negative aspects of the work, where hesitation, doubt and uncertainties are considered important aspects of the process.

According to Brookfield there are four activities that are central to critical reflection:

> Assumption Analysis "reminds us to challenge our beliefs, values, cultural practices etc in order to assess their impact on our daily life and work".
>
> Contextual Awareness "asks us to consider that our assumptions are created in a specific historical and cultural context".
>
> Imaginative Speculation "permits us to challenge our ways of thinking about phenomena in order to create new opportunities for expanding our awareness of knowing and acting".
>
> Reflective Scepticism "questions of universal truth claims, or unexamined patterns of interaction through the prior three activities – assumption analysis, contextual awareness, and imaginative speculation. It is the ability to think about a subject so that the available evidence from that subject's field is suspended or temporarily rejected in order to establish the truth or viability of a proposition or action" (Brookfield, 1988).

Problems and solutions associated with reflective practice are outlined in Boud and Walker's paper (Boud and Walker, 2002). They identify a number of issues that need to be considered for good practice. For example, the belief that reflection can be easily contained is questioned; instead they propose that,

> "...the very nature of reflective activities is such that they may lead to serious questioning and critical thinking, involving the learners in challenging the assumptions of teachers or the learning context in which they are operating" (Boud and Walker, 2002).

They argue that if the learning environment is not supportive of the exploration then,

> "...intolerable tensions between staff and students can result, and some students may be left in situations detrimental to them" (Boud and Walker 2002).

Biggs however, reminds us of the fact that,

> "A reflection in a mirror is an exact replica of what is in front of it. Reflection in professional practice, however, gives back not what it is, but what might be, an improvement on the original" (Biggs, 1999).

The process of reflection requires practitioners to become thoughtful and contemplative about the work at hand, but it also requires evidence of these processes undertaken.

Evidence generation is required to systematically support the reflective practice and can be generated through the employment of a process that enables research methods to be conducted around it. In this way, new evidence arises from the data set taken from participants' experiences of the system, data that can support the practitioner's approach.

Steve Scrivener's position with respect to art and knowledge is summarised as follows:

- Art is not a form of knowledge communication
- Art is not a servant of knowledge acquisition
- Art making creates apprehensions
- Art research creates novel apprehensions (Scrivener, 2002).

With respect to this PBR project, the process of creating a 'novel apprehension' is guided by the research questions but this does not determine the outcome. As we have seen, artistic endeavours require that certain thought processes and environmental factors facilitate ongoing avenues for creative exploration. The process of creating original systems (that can be evaluated within a rigorous methodological approach) facilitates a dialogue that extends beyond the system enabling the discovery of new understanding about that system and the role it plays in the world at large. Analysis of the system provides a tool by which to evaluate its own positioning within the world, the argument here is that the role of the system becomes extremely important to the process of gaining knowledge about the practitioner's practice and or *justification of actions in relation to process and product* (Biggs, 2000). Therefore, any system created can be evaluated through investigation of the process and in this case, participant's experiences of the system. The system itself is not under investigation, rather how it is placed within a world context. It is the process of the artist's imagination, creative skills and justification that facilitate the production of the system thus enabling new knowledge through evaluation of experiences of the system. Because it does not *embody a form of knowledge* in itself, the iterative process that occurs during the production of a system is important to the knowledge gained about the impact of the particular system. Practice-based research,

> "...accounts for the iterative process that carries on until the artist decrees that the artwork is complete and available for critique, 'appreciation', interpretation, description and evaluation" (Candy, 2006).

Hence, it is through observation of the process of creation and evaluation of the participant's experiences of the system that new understandings can be reached. The

system is not left open to interpretation but is evaluated through considered efforts that aim to establish reliable facts about the significance of the system.

3.1.2 Research Methods

Research methods traditionally used in PBR include the role of the creative artefact in the creative process. The methods for collecting and collating data gathered enable analysis of data and facilitate a relationship between the practice outcomes and the argument of the thesis.

In the National Science Foundation (NSF) Workshop Report for Creativity and Support Tools (Hewett et al., 2005), Mayer provides examples of methods used to study creativity which include psychometric, experimental, biographical, computational and contextual methods. The strength of contextual methodologies lies in the way they place the study of creativity in a personal, social, societal, cultural and even evolutionary context. Research based in actual practice often supports many alternative explanations of what happens and how it happens (Mayer, 2005). Reflective action research, where the creation and evaluation of an artefact (in this case an art system) through audience studies, is at the centre of new understandings about creativity. For this reason it was the methodological approach adopted in this PBR project. The methodology embraces both arts practice and human-computer interaction for system development (Hammersley and Atkinson, 1983).

> "...thus various measurement techniques must, wherever possible, be combined with other metrics or measurement techniques in ways that the different measure converge upon an answer to the question(s) being asked in evaluation. The additional complexity raised by consideration of the need for multiple evaluation methods and multiple evaluation measures was that no single method or measure will be appropriate for all situations or all aspects of the complex phenomenon of creativity" (Mayer, 2005).

Mayer notes examples of sample measures to be used in practice-based research evaluation clearly indicating a procedure for retrieving and managing new knowledge. She suggests that practice is situated around questions addressing the number of unique alternatives attempted, the value of solutions attempted (to whom), the side effects (serendipitous solutions) and the quality of these solutions including the time taken to come up with these solutions. She also proposes that collaborative ventures require the acknowledgment and management of the organizational ability for scheduling production elements within a timeframe, consideration of constraining budgets and the

interdisciplinary trade offs anticipated to promote new concepts in time management and product growth (Mayer, 2005). Furthermore the cultural appropriateness of the art system must be evaluated to ensure the system delivers new knowledge throughout the process of conceptualization, production and exhibition. As we shall see in Chapter Five these attributes of extended practice are embedded within the process of generating the system as well as measuring the systems viability. Methodologies such as planned experiments, case studies, and field studies are tools for empirical validation and testing. These practical applications for seeking new knowledge can help in improving the system as well as developing a theory for understanding the creative process.

Generating evidence through audience studies is the main method used in this PBR project. The two-part study undertaken within the context of this research examines the research questions through a process of empirical validation and testing. In this way, it is possible to examine the impact that the system has on the participant that, in this case, refers directly to evaluating the experience of presence within a presence-generating art system.

3.2 Investigating Presence

This section discusses various research methods used in order to evaluate the outcomes of the practice undertaken. The main focus of the studies is how to identify the nature of presence (2.1) and how the art system design influences participant experience. As we saw in section 2.1.3 presence is an experience "that occurs during an encounter with technology and not before or after this encounter" (ISPR, 2000). It is therefore important to consider implementing research methods that allow for the full participant experience to be evaluated. As we saw in Chapter Two, there are many variables that influence the feeling of presence as described in section 2.1.4. Presence can be studied with respect to participants' experiences by adopting objective and subjective approaches to data gathering. The systematic observation of participants using video recording and collecting data by questionnaires and interviews yields information that can be analysed using both quantitative and qualitative techniques.

While investigating presence, both subjective and objective approaches can be undertaken. Since presence is primarily a subjective experience for the individual participant, one approach is to rely on individual reports by interview. This approach to data gathering is intended to identify conscious, introspective judgments by participants regarding their experience of the art system under consideration. Other structured forms

of data collection techniques include questionnaires. Completed questionnaires facilitate a process of analysing the results of each questionnaire in comparison to each of the other questionnaires. This is intended to assist in producing consistent, reliable outcomes. Although questionnaires provide a subjective measurement of an individual's experience they can influence the degree to which success and failure may be gauged. For example Slater and Wilbur discuss notions of the influence of immersion on presence. They argue that,

> "...presence is associated with the extent to which an individual is provided with an inclusive, extensive, surrounding and vivid display" (Slater and Wilbur, 1997).

Questionnaires assist to illustrate the value of elements that assist in the generation of presence attributes. Post experience questionnaires produce a subjective measure of presence as participants' are required to reflect on their personnel experience with the system and respond accordingly. Questionnaires are easy to administer, grade and interpret; they are inexpensive and they do not interfere with the participant as they engage with the media or displayed environment. They rely on the participant's ability to self-report their experience of the engagement, thereby facilitating a dialogue that assists in identifying elements of presence.

Over the years there have been several questionnaires developed for measuring presence engagement including the context of media content, environments and personality types. These include: the Witmer and Singer Presence Questionnaire (PQ) (1998), the Slater-Usoh-Steed questionnaire (SUS) (2000), and the Independent Television Commission Sense of Presence Inventory (ITC-SOPI) (2000). Other methods used to determine presence are cross-modality matching, "where participants can represent their sense of presence by relating it to a sensory modality such as the volume of a radio" (Insko, 2003 p.111) and situations where participants judge their own immersive presence engagement by comparing various different virtual environments to each other (Witmer and Singer, 1998). As this research aims to achieve new understandings into the nature of presence, questionnaires can provide readily analysable results. However, in order to understand the range of individual variation in audience experience of presence, participant reports acquired by post interaction discussions and structured interviews are invaluable. In respect of providing a form of data collection that assists in determining what participants actually thought about their experience of the system, questionnaires can be used to

compare and contrast participant experiences, in order to establish whether or not presence attributes were experienced.

By contrast, it has been suggested that a better approach to measuring presence is to tailor objective measurements in conjunction with the subjective methods

> "...to the specific medium under study..." (IJsselsteijn et al., 1997).

The point here being that tailoring subjective methods in conjunction with the objective measurements allows for a deeper analysis of the participants' experience to be evaluated. In this PBR project "the specific medium under study" is the participants' experience of the art system created, hence methods for measuring the outcomes must make allowances for the type of experience the participant is likely to have.

Objective measures of presence can be recorded through observation of documented video as a study of participants' physiological and/or behavioural responses that logically correlate with their relevant psychological responses. Objective measures also include collating data generated from the physical body of the participant. Such measures are gained through skin conductance, blood pressure, heart rate, muscle tension, respiration, ocular responses and posture. These objective measures of presence use sensor driven systems to closely monitor the body's physical reaction to the content, which enables researchers to reflect on qualitative data. These systems often detect physiological and emotional states of the participant by monitoring heart rate, perspiration and even cognitive status. No measures of this kind were undertaken in this PBR project.

3.3 Data Gathering Methods

This section discusses data gathering techniques employed from which to extract information about participant's experiences of presence. 3.3.1 examines how results of questionnaires can inform researchers about the activity of presence-based engagement, focussing on how useful questionnaires are in the process of data gathering. The power of observation as a technique is discussed in section 3.3.2 that is followed by 3.3.3 *Interviews*. Here, the process of planning, conducting and evaluating interviews is discussed in detail, outlining the procedures adopted for conducting analysis of standardized interview data. 3.3.4 examines the validity of gathering participant profile information. The section 3.3.5 *Gaining Participants' Attention* investigates a model of attention discussing how this model is implemented in the PBR project.

> "Empirical evidence is needed for research that bases its findings on direct or indirect observation as its test of reality. Evidence is acquired through acquisition of data gathered in the course of: observational studies, situated studies, people and technology interaction in context, practitioner accounts, personal reflections on activities and events and observer viewpoints. Overall observation gains the researcher insights into an independent perspective on participant actions" (Candy, 2006).

As suggested above by Candy, gathering empirical evidence can be conducted through the process of observation which, in this case, is extended through the application of documented media (video and stills). This media supports any observations made during the evaluation sessions taking place. There are a number of examples on the attached hard drive that illustrate the validity of this data-gathering method, see *Drive* /Folder 3.

3.3.1 Data Gathering: Presence Questionnaires

Previous tests have been devised to measure presence using three simple post-test rating scales questionnaires. Rating scales encourage the participant to tick a single labelled box rating the question one to three in terms of its relevance. Using a virtual environment, Witmer and Singers (1998) developed a 32-Item Presence Questionnaire (PQ) involving cluster analysis. This identified three clusters for possible further examination, these were: 'Involved / Control', 'Natural ' and 'Interface Quality'. By 1999, stability of this method was questioned by Freeman et al (Freeman et al., 1999) who prescribed a more rigorous approach. These researchers devised *"...more detailed, carefully piloted and psychometrically-sound questionnaires (which) offer a solution to potential instabilities in simple post-test ratings"*. They were also interested in plotting the differences between presence engagement using different types of media; to date, research into presence had been conducted using only one type of media at any one time. By 2000, the *Development of a New Cross –Media Presence Questionnaire: The Interactive Television Commission-Sense of Presence Inventory* (Lessiter et al., 2001) was implemented. The ITC-Sense of Presence Inventory (Lessiter et al., 2001) is available upon request for researchers to adapt and incorporate into their own body of work. The ITC-SOPI was constructed using a multi-media platform. In this way, content (which remained the same in both studies) was not judged so much as the tools by which the content was delivered.

By contrast, the New-Cross Media Questionnaire aimed to analysis the different levels of physical immersion within different media. The sample was divided into five sub-

samples, each of which provided an experience of a different level of physical immersion (e.g., 3D versus 2D, ability to control aspects of the environment versus no control, large screen versus small screen, surround sound versus stereo) and different content. Individuals were selected based on their experience of one of the following: an IMAX cinema, a cinema complex, a students' union film night (VHS), and two experimental settings which were a short video on a TV and a racing game on a games console. From 604 participants and 63 items, the factoring analysis suggested that the four factors which provided the most information were: 1) physical space 2) engagement 3) naturalness and 4) negative effects. The 3D IMAX scored the highest response to maintaining presence factors, this was followed by 2D IMAX and the interactive computer game.

Witmer and Singers' Presence Questionnaire (PQ) identifies the same four components each of which contribute towards generating a sense of presence for the participant.

3.3.2 Data Gathering: Observation

Observation as a data gathering method can be used to assess an individual's behaviour, interactions of events and experiences of an interactive artefact. As part of the preparation process, it is necessary to determine:

- Whom or what to observe
- When
- And for how long and by what method of recording

> "The primary advantage of observation is its validity. When done well, observation is considered a strong data collection method because it generates first-hand, unbiased information by individuals who have been trained on what to look for and how to record it. Observation does require time—for development of the observation tool, training of the observers and the data collection—making it a more costly data collection method than some of the others" (Candy, 2006. p.17).

The process of observing participants engage with a novel system enables the artist to determine if the system is being used in the manner for which it was designed. As Candy says, this data-collection method "generates first-hand, unbiased information" that has the potential to reveal outcomes (methods of interaction) that were not previously considered by the artist. Data gathering tools used in the process of observation include the use of notebooks to record any events and video or stills documentation (3.7.5).

Another way of using observation as a data-gathering method includes *Audience Experience Evaluation* (Bilda et al, 2006). Bilda et al suggest that implementing key questions into the evaluation process facilitates a method for using observations of participant behaviour. This approach of implementing key questions and methods employed for data collection through the use of observation (Bilda et al., 2006), employs the following strategies:

1. "Observation and analysis of audience behaviour as participants interact with the system" (Bilda et al., 2006).
   How: Direct observation (studies one and two) and video documentation (study two only).

2. "Observing whether the participants have the experience the artist intends them to have, i.e. are they able to interact through the intended layers/ stages of the system?" (Bilda et al., 2006).
   How: Combine observation and interview through video documentation

3. "Identify whether the artwork is engaging and producing presence-based experiences" (Bilda et al., 2006).
   How: Direct observation / interviewing process / ITC-Sense of Presence Inventory Questionnaire (ITC-SOPI).

This method of implementing key questions relating to methods of observation allows for analysis of audience behaviour interacting with the system.

3.3.3 Data Gathering: Interviews

Interviews with participants are used to evaluate their experience. Conducting interviews requires the use of skills such as careful listening, noting nonverbal cues, monitoring the progress of a conversation while participating in it and taking notes (Cohen and Manion, 1994). They also require careful planning and preparation.

> "To conduct interviews that are useful for research purposes, researchers must, among other things, develop as much expertise in relevant topic areas as possible so that they can ask informed questions; consider very carefully such questions as who to interview, how many people to interview, what type of interview to conduct, and how the interview data will be analyzed; and learn established techniques for ensuring that the interview data are unbiased (even seemingly

> subtle factors like the interviewer's mood, personality, dress, and manner can alter participants' responses and bias the data!)" (Doyle, 2006).

The design, implementation, and analysis of interviews requires consideration of a number of factors.

A. Selecting Participants

According to Doyle (2006) the selection of participants should represent a random sample of the population of interest. In the studies conducted for this research project subjects were chosen based on their interest, availability and response to a widely distributed Invitation in the form of an email. In study one the participants were mainly specialists in the field of human-computer interaction and art systems as they were based at the Unversity. For study two members of the public visiting the Powerhouse Museum, Sydney were encouraged to book sessions.

> "In addition to choosing participants randomly, a strong effort must be made to ensure that a high percentage of people selected in the random sample actually end up participating. That is, you must achieve a high "response rate" to your requests for interviews" (Doyle, 2006).

B. Preparing to Interview

The preparation required to organize interview sessions necessitates a great deal of advance preparation. Each interview question, including any introductory comments, must be scripted.

> "Writing valid, reliable, and unbiased standardized survey questions and organizing them into an effective interview script is a complicated art and success can only be achieved by subjecting the script to a rigorous process of review and revision (Doyle, 2006).

Having prepared an interview script, it is important to consider the other elements associated with the interview process. The interviewer's style can influence how people answer questions, and therefore, the interviewer should aim to conduct the interview in a uniform style across all participants.

C. The Interview Process

The researcher's goal during an interview process should be to say as little as possible. This requires, for example, that even when a participant has answered a question as part of a previous answer, the question must be read and answered again. Also, if a participant begins to volunteer an answer before the entire question is read, they should be asked to wait until they've heard the entire question. Of course, deviations from the interview script are often necessary to provide clarification or feedback to the participant or to probe for more detail when the answers are too general to be useful. Suggestions for accomplishing these tasks while ensuring standardization are detailed below:

> **1. Clarification**. "The first strategy to try when participants ask for a question to be clarified is simply to repeat all or part of the question. If this doesn't work, the interviewer should be able to draw upon a prepared list of definitions and stock answers to frequently asked questions" (Doyle, 2006).
>
> **2. Feedback**. "It is important for the interviewer to provide their subjects with feedback when they are doing well in order to encourage them to listen carefully and to give thoughtful answers. This feedback may be in the form of a nonverbal smile or nod or a short encouraging phrase. Verbal feedback should be selected from a prepared list of stock phrases such as "That's useful information" or "That's the type of answer we're looking for" or "Thank you, that's helpful" to ensure that the feedback is uncorrelated with the content of what the participant is saying. However, care should be taken to ensure that positive feedback is given only for satisfactory performance" (Doyle, 2006).
>
> **3. Probing**. "If a participant's performance is unsatisfactory, the interviewer must employ unbiased techniques to encourage answers that are more complete, appropriate, and thoughtful. These strategies of "probing" for more information may be just a pregnant pause to encourage the person to fill the silence or a direct request for further information. Verbal probes should, like feedback phrases, be chosen from a stock list of phrases such as "Could you explain what you mean by that?" (Doyle, 2006).

3.3.4 Data Gathering: Participant Profile Information

Participant profile information forms provide background information about the characteristics of participants engaging in the evaluation process. This data includes the

age, sex, education and prior experiences of the participant. The gathering of this information allows for comparison of profiles to determine any similarities or differences that might affect the overall outcomes of the study.

The International Society for Presence Research (ISPR) states that the characteristics of the ideal participant rely on his/her willingness to suspend disbelief and his ir her knowledge of and prior experience with the technology (ISPR, 2000). Others have undertaken research in respect to participants' general ability to sustain presence engagement.

> "Since presence is, for us, a reflection of the extent to which an individual is engaged with (and feels able to act in) an external world rather than with an internally modeled world, we would expect personality factors that are known to affect this relation to also affect experienced presence. For example, we might expect that extrovert personalities in general experience higher presence than introvert personalities. Similarly, elderly people might be expected to experience less presence in common situations than the young" (Waterworth and Waterworth, 2006) p.92.

If this is true and a characterisation of an extroverted person is one who predominantly engages with the external world rather than the internal world of imagination and mental processes, then what does that say about the introverted participants experiences? Regardless of participant's character traits, experiencing presence requires a state of absorption or attention from the participant that involves:

> "...an openness to experience emotional and cognitive alterations across a variety of situations, which also seems to be important in predicting the tendency to experience presence" (Waterworth and Waterworth, 2006b) p.92.

In terms of classifying participants' personal characteristics and the experience of presence, Table 2 *Presence in Relation to Personal Characteristics and States* (tentative) by Waterworth and Waterworth aims to determine if there is such a thing as an ideal participant (see section 2.1.6).

Hence, participant profile information when used in conjunction with observation of the participant and interview with the participant, may assist in determining various character

traits and personal attriibutes that may influence the participant's ability to experience a presence-generating art system.

3.3.5 Data Gathering: Gaining Participants' Attention

William James, in his 1890 textbook *Principles of Psychology*, remarked:

> "Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentration, of consciousness is of its essence. It implies withdrawal from some things in order to deal effectively with others, and is a condition which has a real opposite in the confused, dazed, scatterbrained state which in French is called distraction, and Zerstreutheit in German" (James, 1890).

Examples include listening carefully to the sound of the ocean while ignoring other conversations in a room (the cocktail party effect) or having a mobile phone conversation while driving a car.

This research project aims to identify participants' experiences of attention through the five different kinds of activities of growing difficulty as discussed in *The Clinical Model of Attention* by Sohlberg and Mateer (1989). These researchers discuss the hierarchic model in respect to the recovering of attention processes of brain-damaged patients after coma.

Level of Attention	Outcome
Focused Attention	The ability to respond discretely to specific visual, auditory or tactile stimuli.
Sustained Attention	The ability to maintain a consistent behavioral response during continuous and repetitive activity.
Selective Attention	The ability to maintain a behavioral or cognitive set in the face of distracting or competing stimuli. Therefore it incorporates the notion of "freedom from distractibility"
Alternating Attention	The ability of mental flexibility that allows individuals to shift their focus of attention and move between tasks having different cognitive requirements.
Divided Attention	This is the highest level of attention and it refers to the ability to respond simultaneously to multiple tasks or multiple task demands.

Table 5. The Clinical Model of Attention by Sohlberg and Mateer, 1989

This PBR project explores participants' physical and psychological experiences of an art system built to generate presence-based engagement. A variety of data collection methods are to be conducted with participants in a two-part study producing knowledge about human-computer interactions (Bilda et al., 2006, Bilda, 2006a, Costello et al., 2005, Omodei et al., 2002, Suchman and Trigg, 1991).

3.4 Research Context and Environment

This research was undertaken at Creativity and Cognition Studios (CCS) at the University of Technology, Sydney. CCS provides a studio environment for both teachers and students to practice their creative work and undertake research in an inter-disciplinary framework of arts science and technology. Here the context of the new work and the research process is situated within a safe environment, one that fosters learning outcomes of a high standard with day-to-day support. At CCS resources are available in order that new work may be carried out within the context of a studio environment that provides a supportive technical team and flexible access to equipment and facilities. The environment for learning and utilising reflection-in-action supports the PBR process encouraging students to work collaboratively, share skills and support each other in an inclusive and encouraging manner. Because the local context is focused on arts, science and technology domains, the organization provides an environment or space that influences the artist / researcher / student through identifiable frameworks. Knowledgeable peers and teachers influence the atmosphere within the studio facilitating a culture of shared interest and interlinked practice. CCS therefore provides an ideal environment for PBR providing supportive structures that encourage academic rigour, collaborative investigations and creativity. The context must include:

> "...the total cultural, social and political environment in which reflection takes place. This broader context is so all-pervasive that it is difficult to recognise its influence. It is, however, mirrored in and is in turn modified by particular local settings within which learning occurs: the classroom, the course and the institution" (Boud and Walker, 2002).

Furthermore CCS and Sydney's Powerhouse Museum collaborated in order to create an exhibition environment called Beta_Space for the evaluation of the systems being developed by practitioners at CCS. Beta_Space is a gallery environment designed for exhibition of interactive art systems where systems in a beta stage of development are exhibited and evaluated with the general public. Located in the *Cyberworlds Gallery* within the Powerhouse Museum Sydney (PHM), NSW, Beta_Space assists in the development of new relationships between participants and interactive art. In order for practitioners to evaluate or test their systems and for participants to experience new work, media rich environments like Beta_Space prove to be a valuable asset to creative practitioners facilitiating an environment for evaluation. Participants become integral to the creative process as they assist artists and curators by interacting with prototypes and

relaying feedback about that experience. Collaborative engagements that foster creative environments like Beta_Space give consideration specifically to the usability and accessibility of technologically supported interactive artworks, for participant engagement.

> "First, and most importantly, it (Beta_space) is focused on audience experience rather than technology. Beta_Space is about interaction, and issues such as robustness, usability and audience satisfaction are therefore central to its research aims. Secondly, Beta_Space does not provide a fixed technological exhibit, or even a fixed technological delivery system but rather a research rationale and a shared commitment backed up by flexible resources" (Edmonds and Muller 2006).

Examples like Beta_Space demonstrate how it is possible to exhibit technologically challenging works in contemporary art spaces where curators see dynamic interactive art systems as an integral component of the art world at large (Lally, 2006). Interactive digital works produced at the Creativity and Cognition Studios (CCS) are frequently exhibited in a public sphere at Beta_Space where systems are evaluated with both general museum audiences and professional colleagues. For more on Beta_Space see: *PEGASYS* Drive/Folder 5 and *PEGASYS* Drive/Folder 3

3.5 The Presence Components of the Design Methodology

The art system's design methodology focussed on determining measurements of presence through the degree of immersion experienced by the participant of the system's media content and the system's technological form. By incorporating understandings from previous research into presence into the design of the system the following table outlines the three main components to be considered: content, form, and participant, and which presence signifiers are most likely to occur. If the first set of requirements are carried out successfully (to induce core presence and proto presence), then the third element of extended presence engages, enhancing the participant's presence-based experience (Riva et al., 2004).

Content	Media Presence	Audio-Visual Media	Pictorial Realism	Spatial Presence	Proto Presence	Core Presence
Form	Media Presence	System Response Time	Ecological Validity	Sensory Presence	Proto Presence	
Participant	Inner Presence	Meaning the User gives to the Stimuli	Extended Presence			

Table 6. Content, Form and Participant: informing the design of an art system

The methodology used in this PBR project is designed in order to test participants' experiences of the degree of immersion by examining the following attributes: content in respect of Media Presence (2.1.6.2), form in respect of Media Presence (2.1.6.1) and participant engagement as a component of Inner Presence (2.1.6.3). Table 6 identifies the content form and participant as key categories. It then considers whether the art system tests that category from a psychological (Inner Presence) or physiological perspective (Media Presence), how it will do this and which of the three layers of presence are anticipated to be experienced by participants.

As Riva states,

> "Optimal presence in a mediated experience arises from an optimal combination of form and content. The form must provide the means for a convincing perceptual illusion, but the content should be integrated with (and so attract attention to) the form for the illusion to happen convincingly" (Riva, 2004, p.416).

3.5.1 The Degree of Immersion: Content

Table 8 outlines a methodological approach devised to evaluate the art systems use of narratives and emotional content based on previous research into presence. It identifies which researchers have tested what and how this informed the design of the system built to measure immersion.

Previous work in presence identifies a number of signifiers required when measuring participants' experiences of presence. In respect of system features that examine content, these extend to, but are not limited by, the participants experience of visual media content, how the use of motion and colour affect the participant, pictorial realism, ecological validity, sound design, narratives and a number of variables relating to interactivity. Content is also examined from the perspective of evaluating the narratives and the emotional content of the system. In this way, the content is evaluated from both the media content perspective and the media meaning or intention perspective.

As Table 8 indicates, in respect to content creation, Insko et. al. question whether it is possible to generate and measure presence in low stress environments. Thus, the content of *PEGASYS* was designed in order to create a sense of peacefulness, a repose from the hustle of everyday living. However, the narratives embedded are '*designed for maximal presence*' as prescribed by Riva (2004, p.417).

Previous Research in Presence	Methodological Approach Taken
CONTENT : Media Presence	**Questionnaire and Interviews**
Narratives and Emotional Content	
Insko et. al. question whether it is possible to generate and measure presence in less intense environments. "Most experiments into presence are based around media content that aims to induce fear or produce stress. This has been gauged to be the standard as participants are more likely to respond dramatically under such circumstance" Insko, 2003 p17.	This research tests this theory by creating a system that induces participants to feel calm, restful, non-fearful and relaxed.
"To design for maximal presence is to create stories we can inhabit as fully as possible. These stories are located in immersive environments and elicit embodied, unselfconscious and engaged participation from all three layers of self" Riva, 2004. p.417	By undertaking interviews with participants the digital media content is tested for both the emotional response it elicits from participants and how the embedded narratives affect the participants' experiences of the content.
Previous Research	**System Design**
Pictorial Realism, Witmer & Singer, 1998 **Body Representation,** Slater & Usoh, 1993 **Presence of Others,** Heeter, 1992, Steuer, 1992 Welch et al, 1996 **Emotional Content,** Banos et al, 2004 **Making Sense' of the Media Content,** Riva, 2003 **Willingness to Suspend Disbelief,** C. Hand, 1994 **Subjective Camera Techniques,** ISPR, 2000	'Create multi narrative scenarios and let participants explore those narratives to determine if one works better than others.

Table 7. Narratives and Emotional Content: Informing the Design of an Art System

As we have seen, the characteristics of media "content" include: social realism i.e. believability, the quality of writing and acting, the physical appearance of actors, the fame or notoriety of actors and the nature of the task or activity (ISPR, 2000) (see 2.1.6.2 *Content as a Component of Media Presence*). In the context of content, Media Presence, through pictorial realism, affects spatial presence or proto presence which is '*based in embodiment*' and, therefore, assists in determining what is self versus what is not. Determined by the form of the information experienced (media content), Proto Presence requires demanding technological requisites.

The post-immersion questionnaire used in this context originated with the United Kingdoms Independent Television Commission's Sense of Presence Inventory (ITC_SOPI) and was designed in 2000 by researchers at Goldsmiths University of London (Lessiter et al., 2000). It addresses issues of presence generation and identification of presence factors namely; spatial presence, engagement, ecological validity/naturalness, and negative effects by asking subjects to agree/disagree with statements (e.g., "I had a sense of being in the scenes displayed") on a 5-point scale. The use of this adapted questionnaire allows for data gathering about participants experiences of spatial presence in the following questions as outlined in Table 8 (also see 2.1.4.2 *Spatial Presence).*

Q#	Measuring Participants Experiences of Spatial Presence / Proto Presence
B4	I felt I could interact with the displayed environment
B7	I felt that the characters could almost touch me
B9	I felt I was visiting the places in the displayed environment
B12	I felt I wasn't just watching something
B13	I had the sensation that I moved in response to parts of the displayed environment

B18	I had a sense of being in the scenes displayed
B19	I felt that the display screen was too small
B22	I could almost smell different features of the displayed environment
B23	I had the sensation that the characters were aware of me
B28	I felt I could have reached out and touched things
B24	I had a strong sense of sounds coming from different directions within the displayed environment
B25	I felt surrounded by the displayed environment
B29	I sensed that the temperature changed to match the scenes
B31	I felt that all my senses were stimulated at the same time
B33	I felt able to change the course of events
B34	I felt I was in the same space as the characters
B35	I had the sensation that parts of the displayed environment (e.g., characters) were responding to me
B36	I would have enjoyed more character action
B38	I felt as though I was participating in the displayed environment

Table 8. Measuring Participants' Experiences of Spatial Presence adapted from ITC-SOPI

Spatial presence (2.1.4.2) interlocks with sensory presence (2.1.4.3) in as much as sensory presence is the ecological validity experienced by the participant (5.3.1.3 *Creating Ecological Validity*). Sensory presence is gained through the system's ability to produce a sense of naturalness, usually a tactile engagement through the use of haptics, data gloves etc. For details on evaluating ecological validity see 6.4.3. Proto presence is a kin to spatial presence in as much as both focus on the behaviour of the body sensor input and update the display environment accordingly. If there is a delay between a physical action and deliverance of the changed attribute then this in turn will have a deleterious effect upon the participant's ability to experience presence. For more details see 6.4.2 *Evaluating Spatial Presence*.

Q#	Measuring Participants Experiences of Control /Proto Presence
B1	I felt myself being 'drawn in'
B12	I felt I wasn't *just* watching something
B17	I paid more attention to the displayed environment than I did to my own thoughts
B24	I had a strong sense of sounds coming from different directions within the displayed environment
B25	I felt surrounded by the displayed environment
B35	I had the sensation that parts of the displayed environment (e.g., characters) were responding to me
B36	I would have enjoyed more character action

Table 9. Measuring Participants Experiences of Control adapted from ITC-SOPI

The ITC-SOPI questionnaire allows for analysis of measuring participants' experiences of controlling the system, or, as the case may be, the participants' inability to control the system as much as they would like. As Table 9 illustrates, seven questions within the adopted questionnaire (ITC-SOPI) which are associated with measuring this quality (6.6.5 *Control*). The questionnaire (ITC-SOPI) also includes participants' experiences of sensory presence by asking the following questions:

Q#	Measuring Participants Experiences of Sensory Presence/ Core Presence
B5	The displayed environment seemed natural
B6	It felt like the content was 'live'
B11	The content seemed believable to me

B15	I felt the displayed environment was part of the real world
B19	I felt that the display screen was too small
B20	The scenes depicted could really occur in the real world
B24	I had a strong sense of sounds coming from different directions within the displayed environment
B25	I felt surrounded by the displayed environment
B27	I felt that the display screen was too large

Table 10. Measuring Participants' Experiences of Sensory Presence adapted from ITC-SOPI

Sensory presence is gained through the system's ability to produce a sense of naturalness; therefore, questions that pertain to participants' experiences of the media content in respect to believability and 'real world' encounters are considered here. Core presence is based largely on the vividness of the displayed environment and is equivalent to the experience of sensory presence. It requires good quality graphics and appropriate audio signifiers (see Table 10).

Q#	Measuring Participants Experiences of Time / Extended Presence
B1	I felt myself being 'drawn in'
B2	I felt involved
B3	I lost track of time
B8	I enjoyed myself
B12	I felt I wasn't *just* watching something
B32	The content appealed to me
B33	I felt able to change the course of events
B38	I felt as though I was participating in the displayed environment

Table 11. Measuring Participants' Experiences of Time adapted from ITC-SOPI

The participants' experience of time indicates whether their involvement in the media enabled them to participate in the experience through a combination of external focus and low memory load, thus manifesting and participating in a presence-based experience (see Table 11).

Q#	Measuring Participants Experiences of Involvement / Extended Presence
A1	I felt sad my experience was over
A3	I had the sense that I had returned from a journey
A4	I would have liked the experience to continue
B1	I felt myself being 'drawn in'
B2	I felt involved
B4	I felt I could interact with the displayed environment
B7	I felt that the characters could almost touch me
B8	I enjoyed myself
B9	I felt I was visiting the places in the displayed environment
B12	I felt I wasn't just watching something
B13	I had the sensation that I moved in response to parts of the displayed environment
B16	My experience was intense
B17	I paid more attention to the displayed environment than I did to my own thoughts
B30	I responded emotionally
B31	I felt that all my senses were stimulated at the same time
B34	I felt I was in the same space as the characters

Table 12. Measuring Participants' Experiences of Involvement adapted from ITC-SOPI

Extended presence is achieved through the participants' use of memory and an anticipation of the future. In this way' extended presence is generated through high thought or core consciousness incorporating both the internal and the external. It allows

for the participant who is considering both the significance and the consequence of events.

Q#	Measuring Participants Experiences of Personal Relevance / Extended Presence
A1	I felt sad my experience was over
A4	I would have liked the experience to continue
A5	I vividly remember some parts of the experience
A6	I'd recommend the experience to my friends
B1	I felt myself being 'drawn in'
B2	I felt involved
B8	I enjoyed myself
B16	My experience was intense
B30	I responded emotionally
B32	The content appealed to me

Table 13. Measuring Participants' Experiences of Personal Relevance adapted from ITC-SOPI

Q#	Measuring Participants Experiences of Distraction Factors / Extended Presence
B10	I felt tired
B21	I felt I had eye strain
B26	I felt nauseous
B37	I felt I had a headache

Table 14. Measuring Participants' Experiences of Distraction Factors adapted from ITC-SOPI

According to Waterworth et al., extended presence works best when ideal proto presence (spatial presence) and core presence (vividness of the environment) attributes exist within the tested system.

3.5.2 The Degree of Immersion: Form

In respect of measuring participants' experiences of the form, these include but are not limited to evaluating participants' experiences of the system response time, audio systems, image size and quality and a number of variables relating to interactivity.

FORM: Media Presence	Methodological Approach Taken
The Degree of Immersion	**Questionnaire**
The Three layers of Presence Proto presence, core presence and extended presence. Claim: "If proto presence is not invoked appropriately, for example with poor or slow coupling between the body movement and display changes, and then it will detract from a sense of presence in a mediated environment." Riva, 2004 p.85 Form is an attribute of Media Presence (technology) and includes but is not restricted to the following factors:	Riva et al state that presence levels are dependent upon, *how well integrated the cognitive system is to focus on the environment around the individual.* The questionnaire utilised in this project examines participants' experiences of the form identifying to what extent immersion is a component of the engagement.
Previous Research	
Immersion, Mania & Chalmers, 2001, Stanney et al, 2002, Riva, 2004, Banos et al, 2004, (Waterworth and Waterworth, 2006b), Slater 2010 **Latency of Response**, Ellis, 1997 **Audio Systems**, Darken, 1999, **Stereoscopic Presentation**, Dillon, 2001 **Visual Field**, Hatada, 1980 **Control Process**, Welch, 1996 **System Response Time**, Freeman, 2002 **Number and Consistency of Sensory Outputs**,ISPR **Image Size and Quality**, Slater & Usoh 1993, **How the Use of Motion & Color will affect the Participant**, ISPR, 2000, **Obtrusiveness of the Technology**, ISPR, 2000,	

Table 15. The Degree of Immersion: Informing the Design of an Art System

Table 15 illustrates how the research of Riva et al on the 'Three Layers of Presence' (2.1.7), can be used to inform the design of the form of an art system. This research considers the work of Riva et al to be formative in the conceptual plan of designing for immersive experiences. In order for the form of the system to comply with the prescribed formula for creating the degree of immersion, the participants' cognitive system as well as the system response time must be catered to.

Form is an attribute of Media Presence. Evaluating participants' experiences of the form assists in determining if the system and participant are engaging in interaction that facilitates presence-based experiences. The following questions in the questionnaire (ITC-SOPI) assist in measuring participants' experiences of the form of the system (see 6.5).

Q#	Measuring Participants Experiences of Interactivity / Form
B1	I felt myself being 'drawn in'
B2	I felt involved
B4	I felt I could interact with the displayed environment
B12	I felt I wasn't just watching something
B13	I had the sensation that I moved in response to parts of the displayed environment
B38	I felt as though I was participating in the displayed environment

Table 16. Measuring Participants' Experiences of Interactivity adapted from ITC-SOPI

In designing an interactive system that generates presence, the characteristics of the media/technology 'form' are to be considered. Chapter Two identified classifiable elements, all of which assist in producing proven outcomes for presence generation (2.1.4). But we should also consider the design or the 'form' of the technology which includes the number and consistency of sensory outputs, the use of motion and colour, audio volume and fidelity and aural dimensionality, visual dimensionality, subjective camera techniques such as direct address, the viewing distance and the obtrusiveness of the technology.

The Form	Evaluation Methods	Results
The number and consistency of sensory outputs	Questionnaire: B1, B2, B4, B10, B12, B21, B38 Study two interviews	6.5.2 eye-tracking device as a sensory output
The viewing distance	Study one Observation Study two Observation	6.5.2.1 the viewing distance
How the use of motion and color affects the participant	Questionnaire: A2, B13, B14 Study one interviews Study two interviews	6.4.5 Evalauting the use of motion and color
The audio volume and fidelity	Questionnaire: B24 Study one / Study two interviews	6.4.6 outcome of the audio systems
The visual and aural dimensionality	Questionnaire: B4, B7, B9, B12, B13, B18, B19, B22, B23, B24, B25, B28, B29, B31, B33, B34, B35, B36, B38, Study one / Study two interviews	6.4.2 Spatial Presence 6.4.6 outcome of the audio systems
Subjective camera techniques such as direct address	Questionnaire: B23, B35, Study one / Study two interviews	6.4.4.Evaluating the naratives and Emotional Content

The obtrusiveness of the technology	Study two interviews	6.5.2.2 the obtrusiveness of the technology
The technology size and shape	Questionnaire: B1, B2, B4, B10, B12, B21,B38 Study one / Study two interviews	6.5.3 outcome of the eye-tracking device

Table 17. Testing the form of the sytem for evidence of elements of presence adapted from ITC-SOPI

Table 17 outlines those attributes required for the participant to experience the form of an art system in respect to previous research in presence. It identifies how the factors are to be measured and where the evaluation result is located within this document.

3.5.3 The Degree of Immersion: Participant

Earlier, section 2.1 describes presence as a phenomenological experience that is constructed when both Media Presence and Inner Presence elicit the right degree of stimuli for that individual participant. There are no hard and fast rules with generating presence-based experiences for participants and the variables are multidimensional. The table below describes how research into presence accounts for the personality types of the participants experiencing a system under evaluation. Point number 1 identifies how previous research into the impact of personality types and moods is considered for further analysis within this research context. As Inner Presence attributes are enhanced through participant enagement (the extent to which a person feels able to act), it is proposed that by examining personality traits, character traits and physical traits, links may be made with presence and the types of participants who are more likely to experience presence. By collecting personnel information about each participant and comparing and contrasting through the use graphs, it can be gauged whether age and personality, occupation and gender are factors that influence the experience of presence. This information is gathered through a methodological approach that includes the completion of a participant's profile information form and observations made during the evaluation sessions.

There are numerous researchers of presence who have been more consciously involved in creating media content that elicts a high degree of stress or induces a state of fear. In the context of this research project a concerted effort was made to address this aspect of researching presence-based experiences by creating a system that delivers content created to ellicit a calm and peaceful sense of harmony. The media content was designed to facilitate thoughtful slow engagements without any dramatically mood altering scenarios. *PEGASYS*, therefore, is intended to facilitate testing theories about the experience of presence engagement within stressful environments by providing an environment that

stimulates the sensations of presence without involving potentially stressful or distressing scenarios.

PARTICIPANT: Inner Presence	**Methodological Approach Taken**
Personality Types	**Participant Profile Information**
"Since presence is, for us, a reflection of the extent to which an individual is engaged with (and feels able to act in) an external world rather than with an internally modeled world, we would expect personality factors that are known to affect this relation to also affect experienced presence. For example, we might expect that extrovert personalities in general experience higher presence than introvert personalities. Similarly, elderly people might be expected to experience less presence in common situations that the young" (Waterworth and Waterworth, 2006 p.92)	By collecting personnel information about each participant and comparing and contrasting through the use graphs, it can be gauged whether age and personality, occupation and gender are factors that influence the occurrence of experiencing presence. See 6.6 Evaluation of Personality Types and Moods
"As most experiments into presence are based around media content that aims to induce fear or produce stress. This has been gauged to be the standard as participants are more likely to respond dramatically under such circumstances (Insko, 2003).	3.5.4 Measuring Participants Experience 7.3.4 Presence in Low Stress Environments
Previous Research	
Focus of Attention, Witmer, 1998 **Selective Attention**, Darken, 1999 **Meaning given to the stimuli**, Barfield, 1993 **Distraction**, Witmer, 1998 **Body Representation**, Slater & Usoh, 1993	
Moods	**Observation and Interview**
Moods induced by negative and positive feelings are enhanced through either tranquil or anxiety building scenarios. Waterworth et al claim that intense negative emotions tended to elicit a higher degree of presence. (Waterworth et al., 2003)	By analyzing the interview data and comparing and this with observations made during sessions with the system, participant mood can be evaluated. See 3.7 *Data Gathering for the Two-Part Study* and 6.2 *Evaluating the Two-Part Study*
"If you are in an immersive VR, but are pre-occupied with personal worries (perhaps because the mediated content is not very engaging) proto (spatial) presence and core presence (vividness) will be invoked by the medium, but not extended presence". Riva, 2004. p.414	Test for participant engagement, focus and interest. See 3.3.4 *Gaining Participant's Attention* and 6.6.2 *Attention as an Attribute of Engagement* .
Expectations Regarding the Experience, Riva, 2004 **Involvement**, Witmer, 1998 **Level of Intent**, Witmer, 1998 **Distraction**, Witmer, 1998 **Interplay of Senses and Nervous System**, Loomis 1993 **Cognitive Processes** **Perception and Action**, Gibson, 1999	The narratives provided within the content allow for playful interaction following *The Creative Engagement Model* (Edmonds (see 2.2.2 *Models for Creative Engagement*). The narratives build throughout the experience of the system through layers referred to as stages. There are three narrative stages for participants to choose from. See 5.3.1.4 *The Use of Narratives* 5.4.1 *Creating the Three Stages of Interaction* 6.3.3 *Evaluating the Three Stages of Interaction* Participant's experiences of these stages are recorded and evaluated to determine if one stage produces more engaging results than others See 7.3.3 *Interaction Design*

Table 18. Personality Types and Moods: Informing the Design of an Art System

Table 18 point number 3 refers to the extent that previous research into presence has examined the nature of the impact of these stressfull scenarios on participants. It indicates how immersion requires a degree of focus, appropriate system design for the experience of spatial presence attributes and appealing media content. By analysing the interview data and comparing this with observations made during sessions with the system, participant mood can be evaluated (*Data Gathering for the Two-Part Study* 3.7 *and* 6.2).

The narratives provided within the content allow for playful interaction following *The Creative Engagement Model* (see 2.2.2). The narratives build throughout the experience of the system through filmic layers referred to as stages. There are three narrative stages for participants to choose from (see 5.3.1.4 *The Use of Narratives* 5.4.1 *Creating the Three Stages of Interaction*, 6.3.3 *Evaluating the Designed Experience)*. Participant's experiences of these stages were recorded and evaluated to determine if one stage produces more immersive and thus, engaging experiences than the others.

3.5.4 Methods for Measuring Participants' Experiences

Participants' experiences as a component of the physiological and psychological phenomenon of Inner Presence are evaluated through the degree of immersion experienced. This research aims to determine whether it is possible to generate and measure presence in low stress environments. Participants' experiences of the system are identified in respect of the emotional response that is elicited from the participant whilst engaging with the system (6.6 *Evaluation of Personality Types and Moods*).

This theory is tested with the design and evaluation of an art system that aims to manifest a tranquil and passive response from the participant. Testing the system for presence generation will indicate whether presence can be experienced and measured in low stress environments (7.3.4).

Table 19 outlines various factors associated with participant experiences of presence. By providing multi-narrative scenarios, the system design features also aim to facilitate stories that participants can inhabit. Participants choose from three scenarios each of which offer different levels of interactivity and therefore, engagement. As we have seen, designing for creative engagement includes the application of attractors, sustainers and relaters each of which embed the participant more deeply into playful narrative, see 2.2.2 *Designing for Creative Engagement*. Evaluating how participants experience their engagement assists in determining if the participants had experiences that were presence-based (see 7.4).

Participant	Evaluation Methods	Result
Attention as an Attribute of Engagement	*The Clinical Model of Attention* Study two interviews	6.6.2 *Attention as an Attribute of Engagement*
Presence and Time Factors	Questionnaire (ITC-SOPI): B1, B2, B3, B8, B12, B32, B33, B38 Study one/ Study two interviews	6.6.3 *Presence and Time Factors*
Involvement	Questionnaire (ITC-SOPI): A1, A3, A4, B1, B2, B4, B7, B8, B9, B12, B13, B16, B17, B30, B31, B34 Study two interviews	6.6.3.1 *Involvement*
Concentration	Study two interviews	6.6.3.2 *Concentration*

Meaning the user gives to the stimuli	Questionnaire (ITC-SOPI) : A1, A4, A5, A6, B1, B2, B8, B16, B30, B32 Study two interviews Graphs	6.6.4 *Meaning the user gives to the stimuli*
Moods	Questionnaire (ITC-SOPI): B30 Study two interviews Graphs Tables 1) Study two: Did you find the experience relaxing? 2) Study two: Did you find the experience frustrating?	6.6.1 *Moods*
Control	Questionnaire: B1, B4, B12, B17, B24, B25, B35, B36 Study two interviews Results of sample audience to test 'Presence in Relation to Personal Characteristics and States (tentative)' as prescribed by Waterworth et al. 2006	6.6.5 *Control*

Table 19. Evaluating Methods for Gauging Participants' Experiences of Inner Presence

The table above outlines some of the attributes of Inner Presence required for the participant to experience a presence-generating art system. It identifies the how the factors are to be measured and where the results are within this document.

By aiming to measure the distraction factors involved we can address both the positive and the negative aspects of the participants experience. Table 20 outlines the distraction factors, how they were measured and where the results are within this document.

Distraction Factors	Evaluation Methods	Result
Negative Effects	Questionnaire:A2, B10, B14, B21, B26,B37 Study one/ study two interviews	6.7.1 *Negative Effects*
System Restrictions	Questionnaire: A2, B3, B8, B10, B14, B21, B26, B37 Study one/ study two interviews	6.7.2 *System Restrictions*
Exhibition Environment	Study two interviews	6.7.3 *Environmental Distraction Factors*
The Lighting Conditions	Study two interviews Photographs of participants	6.7.3.1 *The Lighting Conditions*
Physical and Psychological Barriers	Questionnaire: B25, B28, B34	6.7.3.2 *Physical and Psychological Barriers*
Interplay of Senses and Nervous System	Questionnaire: B5.B6, B20, B22, B29, B30, B31,	6.6 *Evaluation of Personality Types and Moods*

Table 20. The Distraction Factors Involved

Table 20 identifies distraction factors that are considered within the scope of this research. These factors potentially distract the participant from engaging with the system to their full potential. The distraction factors include, negative effects, system restrictions, the exhibition environment, the lighting conditions, the physical and psychological barriers and the interplay of senses and the nervous system.

3.6 Designing A Two-Part Study

Having designed a method for evaluating the experience of presence, the next section 3.6 presents a methodology for designing a two-part study. It does this by looking at the venue and methodology of each study 3.6.1 *Study One: Without Interaction* and 3.6.2

Study Two: with Interaction. In Study One the media content was tested, in Study Two, the system form.

PBR as a process involves considering the participant of the interactive system from conception to delivery. The methodology encourages,

> "...iterative cycles of design-evaluate redesign" (Preece et al., 2002).

Hence the two-part study. In brief, usability testing is conducted in sessions where participants are observed as they interact with the system. This method assists in revealing design flaws, such as might be found in the interface or some elements of the digital media content. Observing the participants directly identifies the most likely usability problems (see 3.3.2). Questionnaires on the other hand provide good statistical data (see 3.3.1). Interviews are also conducted in the same session and allow for individual feedback from participants. These interviews are audio recorded. Here participants are able to voice any thoughts or feelings they have about the experience that the previous methods have not accounted for (see 3.3.3). In all, this three-way process of observation, questionnaire and interview allows for evaluation of participants' engagement creating a detailed analysis of participants' true experiences of the presence-generating art system.

Three main stages of research-in-practice were undertaken in this research project. They are:

1. The formalisation of the evolution of the concept (5.1)
2. The experience of that concept having been realized in the form of an interactive art system and
3. Qualitative data gathering and analysis of participant experience (6.2)

The process then combines the above stages with the following sequence of steps:

Step 1: First it is necessary to examine the field and question what can be created to meet the research projects aims.

Step 2: Next the system design features that serve to enhance the experience and enable the participant to operate the system are considered.

Step 3: A solution is then designed and implemented.

Step 4: An iterative process begins whereby results from the first part of a two-part study inform the changes made to the system before the second part of the study is conducted.

Step 5: Repeat steps three and four as often as required.

Step 6: Follow up with the system out in the field undergoing evaluation in a public exhibition environment.

Table 21 below outlines some popular methods for designing systems. The methods in bold indicate processes that were applied in this two-part study.

Method	Cost	Output	Sample Size	When to Use
Focus Groups	Low	Non-statistical	Low	Requirements gathering
Usability Testing	**High**	**Statistical Non-statistical**	**Low**	**Design and evaluation**
Card Sorting	High	Statistical	High	Design
Participatory design	Low	Non-statistical	Low	Design
Questionnaires	**Low**	**Statistical**	**High**	**Requirements gathering and evaluation**
Interviews	**High**	**Non-statistical**	**Low**	**Requirements gathering and evaluation**

Table 21. User-Centered Design's most popular Design Methods (Fidgeon, 2009)

This chapter now goes onto describe in detail a two-part study undertaken within this research project.

3.6.1 Study One: Without Interaction

Study one tests participants' responses to the digital media content and technology display environment, conducted at Creativity and Cognition Studios (CCS) Interaction Laboratory at the University of Technology, Sydney. The sessions should be conducted between April and May, 2009. The system components being tested are the video content and quality, the audio content and quality, the suitability of the audio playback system, the appropriateness of the display environment and the exhibition environment.

The preliminary testing of *PEGASYS* is designed to give the participant an experience of the digital media content containing interactive scenarios exposing media from all three stages of the art system (5.4.1).

Each session runs as such:

- Participant is seated
- A Voice Over (VO) narrative speaks over a black screen (duration 45 seconds)
- Music joins in (duration 60 seconds)
- VO stops, changes to natural atmospheric sounds associated with the images

- Music fades out
- Participants are then required to engage with (watch) the 23 minute movie version of *PEGASYS* (see Addendum_Preliminary Evaluation Movie).

The evaluator sits discretely at the rear of the room taking notes. After witnessing the content of the art system, participants first answer the questionnaire. They then participate in an interview where the visual media and sound components are discussed in detail. These statements are later transcribed (Appendix One). In study one, the methodological approach employed four techniques: observation of the participant interacting with the system (3.7.1), analysis of the questionnaire (3.7.2), a study of the participants profile forms (3.7.3) and analysis of the content of the semi-structured interviews (3.7.4).

The sections that address the outcomes of evaluating these four techniques are as follows: the evaluator's observations of participants' experiences (6.2.1.1); the completion of a detailed questionnaire (6.2.1.2); participation in a semi-structured interview (6.2.1.3), and the completion of a profile information form (6.2.1.4).

3.6.2 Study Two: With Interaction

Study two repeats study one facilitating evaluation of participants' experiences of the interactive elements and is conducted in Beta_Space, *Cyberworlds Gallery*, Powerhouse Museum Sydney, during the month of November (2nd-27th) 2009 (See Appendix Two). In study two, 25 participants' experiences of the art system were evaluated. Participants included invited guests and the general public. Primarily this study was concerned with the opinions and reflections of the general public. Participants book with a commitment to 75 minutes of interaction and evaluation time. They must be willing to discuss the work honestly. Before they enter Beta_Space, participants sign an agreement form and the ethics-based approval form. Due to ethical constraints, people under 18 years of age do not participate in the evaluation process. Upon entrance they are escorted to a chair, which is placed centrally within the room. Adjustments are made to the system (audio and visual) to accommodate the participant who is then instructed to engage in a calibration process with the eye-tracking device (5.5.3.5) before operating the system.

Study two employs five techniques; observation of behaviour, completion of a questionnaire, a participant profile form an interview, and video and photo documentation. The study allowed for testing of presence theories in respect to: system content (6.4); system form (6.5) and participant engagement (6.6).

For an account of the evaluation process undertaken see 6.2 *Evaluating The Two-Part Study*.

3.7 Data Gathering for the Two-Part Study

3.7 Data gathering for the two-part study looks at the techniques applied, such as: observation (3.7.1), adminstering a questionnaire (3.7.2), the use of the participant profile information (3.7.3), interview as an analysis technique (3.7.4) and, finally, the application of video and photography documentation (3.7.5).

During the interaction between the participant and the system, all distractions are minimized. Pen and paper are the only tools permitted and the researcher must remain outside the field of view of the participant. Notes are taken in relation to the body language expressed and any identifying signifiers that express the depth of engagement that the participant appeared to be having. Any observations are discussed later with the participant during the interview. By addressing the criteria of audience experience as defined by Bilda et al, 2008, observation is a valid data gathering technique which was implemented in both study one and study two.

3.7.1 Two-Part Study: Questionnaire

The post-immersion questionnaire originated with the United Kingdoms Independent Television Commission's Sense of Presence Inventory (ITC_SOPI) which was designed in 2000 by researchers at Goldsmiths University of London (Lessiter et al., 2000). It addresses issues of presence generation and identification of presence signifiers. The ITC_SOPI questionnaire is divided into two sections; Part A comprises of six questions and Part B contains thirty eight questions.

Part A is concerned with the participant's thoughts and feelings directly after exposure to the media. Part B refers to participant's thoughts and feelings whilst they are engaging with the media. As with the original questionnaire, a cover sheet outlines instructions explaining the terms used throughout the document and the best method to use in completing the questionnaire. In this example, the questionnaire was administered immediately after exposure to the digital media content while the experience was fresh in the participant's mind.

A Likert scale of 1 – 5 was used to measure the outcomes where 1 represents 'strongly disagree' and 5 indicates 'strongly agree'. The questionnaire is designed to be answered

by participants in an open honest manner directly after exposure to the media content. By calculating a mean of each completed question within the questionnaire the results can be divided into four factor scores per media experience per participant. In terms of defining and analyzing presence, it is important to consider that we are seeking to identify two types of presence namely Inner Presence that includes the factors of engagement and negative effects, and Media Presence that includes factors such as spatial presence and ecological validity. By analysing participants' feedback about their experience through the questionnaire it is possible to determine if these four factors are present within the system and how participants experience the design features of the system. The four factors and their corresponding questions within the questionnaire are spatial presence, engagement, ecological validity and negative effects.

Factors	Question #	Attribute of
Spatial Presence	B4, B7, B9, B12, B13, B18, B19, B22, B23, B24, B25, B28, B29, B31, B33, B34, B35, B36, B38C	Media Presence
Engagement	A1, A3, A4, A5, A6, B1, B2, B3, B8, B16, B17, B30, B32, A1, A3, A4, A6, B3	Media Presence Inner Presence
Ecological Validity / Naturalness	B5, B6, B11, B15, B20	Media Presence
Negative Effects	A2, B10, B14, B21, B26, B37	Inner Presence

Table 22. Four Factors of Presence within the Questionnaire adapted from ITC-SOPI

Table 22 summarises Tables 9-15 which indicate the questions within the ITC-SOPI questionnaire that relate directly to the four factors and whether these factors are attributed as contributing towards the experience of Inner Presence or Media Presence. The questionnaire is also used in order to gauge participant's experiences of other presence attributes as prescribed by previous researchers of presence (see 2.1 *Presence).*

Presence Theory	PEGASYS Questionnaire (ITC's-SOPI) Evaluation Process
The Use of Motion and Colour	A2, B13, B14, B32
A Sense of Space (Spatial Presence)	B4, B7, B9, B12, B13, B18, B19, B22, B23, B24, B25, B28, B29, B31, B33, B34, B35, B36, B38
Subjective Camera Techniques	B23, B35,
Co-Presence	B23, B34, B35, B36
Form of the Technology and Interactivity	B1, B2, B9, B10, B12. B21, B38
Image Size and Quality	B19, B25, B27,
Engagement as an attribute of Inner Presence	A1, A3, A4, A6, B3,
Personal Relevance	A1, A4, A5, A6, B1, B2, B8, B16, B30, B32
Control	B1, B12, B17, B24, B25, B28, B35, B36
Concentration	
Distraction	A2, B3, B8, B10, B14, B21, B26, B37
Involvement	A1, A3, A4, B1, B2, B4, B7, B8, B9, B12, B13, B16, B17, B18, B31, B34, B30
Time	B1, B2, B3, B8, B12, B32, B33, B38
Physical and Psychological Barriers 6.13.5	B25, B28, B34
Interplay of Senses and Nervous system	B1, B5, B6, B9, B11, B12, B29, B20, B22, B27, B29, B31, B30, B38

Table 23. Indicators of Presence Attributes adapted from ITC-SOPI

In both studies, the ITC_SOPI post evaluation questionnaire was administered directly after the participants experienced the art system. The participants were requested to fill in the questionnaire as quickly as possible with immediate responses to the items in the order they are presented. The questionnaire results were tabulated using SPSS. For further information on the questionnaire see 3.3.1 *Questionnaires* and 6.2.1.2 *Questionnaire Results*.

3.7.2 Two-Part Study: Participant Profile Information

The participants' background information is collected through a survey form attached to the questionnaire, see section 3.3.4 *Participant Profile Information*. Gathering information about the type of people that are using the system can assist in identifying if there are any commonalities or differences between participant's level of engagement or immersion. This is done through a process that involves reading the transcripts of interviews, analysing questionnaire results, observing video documentation and comparing the participation profile information. The participation profile form addresses the following criteria as found in Table 24.

Participant Profile Information	Data Gathering Method
Age	Study one (CCS_April 2009) Study two (BS_November 2009)
Gender	Study one (CCS_April 2009) Study two (BS_November 2009)
Occupation	Study one (CCS_April 2009) Study two (BS_November 2009)
Level l of computer experience	Study one (CCS_April 2009) Study two (BS_November 2009)
Rate how often you play computer games	Study one (CCS_April 2009) Study two (BS_November 2009)
Education	Study one (CCS_April 2009) Study two (BS_November 2009)
Knowledge of film production	Study one (CCS_April 2009) Study two (BS_November 2009)
Prior experience of interactive art systems	Study one (CCS_April 2009) Study two (BS_November 2009)
Knowledge of augmented reality	Study one (CCS_April 2009) Study two (BS_November 2009)
Experiences with nature	Study one (CCS_April 2009) Study two (BS_November 2009)

Table 24. Participant Profile Information

This information is analysed to determine if any similarities are consistent enough to be considered worthwhiile investigating further. As well as using this information to assist in identifying the personality types and moods of the participants (6.6), this data also allows for comparisons of the session durations, age and sex, education, occupation and other background information (6.2.1.4).

3.7.3 Two-Part Study: Interview as an Analysis Technique

The interview component of the data gathering process allows for participants subjective expressions about their experience to be heard and validated. In order to gauge participants' experiences of the system the interview questions are divided into three sections, namely: visual media content, sound design and the systems form; its technology and interactivity.

- Section A addresses participants' experiences of the visual media content (6.4) and contains eight questions.
- Section B identifies participants' experiences of the sound design (6.4.6) and contains nine questions.
- Section C inquires as to participants' experiences of the interactive component in eight questions (6.5).

Study one does not include the questions in section C of the interview. In study one, the interviews are conducted in the Interaction lab directly after the participant completes the questionnaire and participant profile form. In study two the interviews are conducted in Beta_Space directly after the participant has finished the questionnaire and participant profile form. For further information on the interview process see 3.3.3 *Interviews*. The interviews were recorded into QuickTime audio files and were transcribed for use within Chapters Six *The Evaluation Study* and Seven *Conclusions*. For a detailed analysis see *PEGASYS* Drive/ Folder 5

3.7.4 Two-Part Study: Video and Photo Documentation

In study two only, each of the participants indicate his or her verbal permission for the session to be documented through video and stills photography. The video documentation is useful in identifying examples of the participants' experiencing the calibration session, learning how to operate the system and experimenting with the embedded interactivity. The captured image of the exhibition environment locates the participant's experience within the displayed environment. By watching the footage that has also captured any atmospheric sound, the evaluator can find examples of scenarios that take place between the participant and the system. These scenarios are referenced throughout Chapters Six and Seven in the evaluation study that evaluates participants experiences of the system. The still photographs of participants engaging with the art system are used in the evaluation chapter to illustrate various examples, such as participants experiences of the lighting conditions, the calibration process, the interface, the content and their position in the room.

3.7.5 Methodology Summary

Chapter Three explores the methodological approach adopted in this research project. First, it introduces a practice-based research methodology applied to support and evaluate the creative work of a presence-generating art system called *PEGASYS*. The research methods are discussed with respect to the role that *PEGASYS* can play in generating evidence, and the nature of presence is discussed in respect to how the art system features aim to influence participants' experience of the system. The section on data gathering methods discussed various techniques applied such as the use of questionnaires, the act of observation, conducting interviews and how the participant profile information can provide valid data for analysis. We also examined the processes involved in evaluating participants' degree of attention. The research studio environment was contextualized to show how it supports the exhibition environment, an environment for evaluating interactive art systems. Previously we looked at how research into presence can inform the design of system features when the degree of immersion is catered to as an important component of the measured experience. Participants' experiences are therefore discussed in respect to gathering data about their opinions of the media content, the form of the system, as well as their experiences in general. A methodology for designing and undertaking a two-part study describes *Study One: without Interaction* and *Study Two: with Interaction*. Here the chapter looks at the techniques and tools applied to collect data, such as: observation, administering a questionnaire, the use of the participant profile information, interview as an analysis technique and finally, the application of video and photography documentation.

The PBR methodology assited in both the creation and evaluation of the art system as the system developed over a period of four years. The system produced was created with evaluation methods in mind enabling various iterations of development for each step allowing for the discovery of knowledge gained through practice. In resepct to the discipline of my own practice this methodology allowed me to experiment and trial various concepts without constraining myself or the aims of the project. My usual practice of enabling others to collaborate with me on the realisation of exciting endeavours was proven again to work under these conditions, as was my ability to produce the system on no budget whatsoever. My ability to conceptualise, produce and evaluate *PEGASYS* was made possible by my extensive experience as a practitioning artist.

Chapter Four

"Set high standards and few limitations for yourself". Anthony J. D'Angelo

4 FOUNDATION

This chapter explores the evolution of my creative practice, identifying the small and the large influences in both my creative and professional career. It seeks to outline the exploratory nature of my creativity and the processes that influenced my choices and ability to undertake a PhD investigating presence-based engagement within interactive art systems. The chapter highlights the progression of accumulating skills and knowledge put into practice through creative expression. In this chapter I will discuss the arts-based industries that both sustained me and that I in turn contributed towards. These industries include: graphic design (4.1), theatre production (4.2), filmmaking (4.3), interactive multimedia (4.4) and designing creative experiences (4.5). Section 4.6. gives a summary of the foundation chapter.

Section 4.1 addresses the years between 1989-1992 whilst studying full time in a Diploma of Applied Arts in Graphic Design at the *Canberra Institute of Technology* (CIT) I started work on the local news as a Graphic Designer for ABC TV in Canberra, ACT. Section 4.2 *Theatre Production* reflects on the years from 1991 when I worked part-time with an avant-garde theatre company creating devised large-scale outdoor events (Splinters Theatre Company). From 1993-2004 I worked as a freelance production manager, stage manager, technical director, lighting designer, sound and lighting operator. In 1999 I completed a Bachelor of Creative Arts in Theatre Production with a Major in Film Studies at the *Faculty of Creative Arts (FCA), University of Wollongong* (UOW). Section 4.3 *Film*, outlines my experience in the film industry as an independent multimedia digital artist / independent filmmaker. In 2000, I worked as Project Assistant with a UOW new enterprise, Film Illawarra (McBryde, 2000) a filmmaker's online guide to the Illawarra region. From there, I moved into working from home as a director of a multimedia studio: *Smashing House Productions*, my own small business. As a self employed professional producing, directing, shooting and editing short films, I supplemented my income and developed new skills with digital technology. By 2003, I was producing interactive video for the stage and site specific events. Producing ideas in digital media form for delivery in five professional theatre productions in Wollongong NSW (see Table 30). Having completed a Graduate Certificate in Interactive Multimedia at UTS, section 4.4 *Interactive Multimedia* examines my time and practice spent creating

video works for use in multimedia installations or as interactive components for large-scale events. The website containing links to many media components, but especially films made by me, can be located at http://www.sarahmoss.com.au.

Notions of engaging audiences in presence-based experiences have been consistently at the forefront of my research and art practice. Designing engaging, creative content for participants has been fundamental in the development of my skills and degree of expertise. Whether I have been engaging and informing people through stills or video medium, the experience of creating mindfulness through attention seeking content has seen the development of my work expand to accommodate the creation of original multimedia interactive experiences for participants.

4.1 Graphic Design

In 1988, I attended The Canberra Institute of Technology (CIT) earning first an *Associate Diploma in Graphic Arts* and then a *Diploma*. These courses were both rigorously academic and creatively demanding. The course work covered design studies, methods, principles and styles whilst students developed new skills in illustration, photography, print artwork and life drawing (Edwards, 1982). Communication skills were also covered within subjects such as technical writing, communication core, history of design, the language of advertising professional practice and project management (Thompson and Davenport, 1980, Douglas, 1984). Research skills, report writing, industry specific writing and portfolio presentation were also covered. The study of the graphic arts included learning the skills of typography, graphical composition and the ability to transfer what you look at and see into a variety of media; be that by pen, paint or photography. Print methods were also investigated in-depth, demanding camera-ready artwork with specifications to exact proportions; combining copy fitting with illustrative elements (Schlemmer, 1966). Computer lessons were introduced in 1991, with subjects such as electronic imaging and computer aided graphic design being compulsory. Here, I developed skills in Photoshop 1.0. Hand rendered typography became instantly redundant, as did Letraset (when artwork was prepared by hand, Letraset came in sheets of letters and were available in a large range of typefaces, styles, sizes, and other graphic elements. The letters were transferred one at a time to the artwork), and enabled smudging the artwork in the final stages of production. The digital revolution struck the graphic arts scene significantly, transforming hand crafted artistre into a multitude of graphical interfaces. From 1989-1992, I worked as a graphic designer for the ABC TV on the Canberra local News in the ACT. Duties included the occasional preparation of visual

graphics for the local evening news. Working under live studio conditions I learnt how to collaborate, work with initiative under minimal supervision, and to work within strict deadlines. As always I have been motivated to increase my skills through self-directed learning of new technologies excelling in the use of graphic design software such as Adobe Photoshop CS, Illustrator and InDesign. I have been developing my skills as a digital graphic designer since the late 80's and continue to design graphic elements such as posters, fliers and logo designs upon request, frequently using these skills in the application of film titles and credits. As a graphic designer I understand the importance of continuity, style and elegance, each of which I aim to achieve within each creative project.

Figure 21. Examples of Graphic Design artwork by Sarah Moss

4.2 Theatre

This section briefly describes my 20 year association with the performing arts industry. For eight years I worked with Canberra based *Splinters Theatre of Spectacle* who intrigued me with their use of metaphorical allegories; their love of rich tapestries of text and performance art; their ability to combine sculpture, set painting, sound and visual imagery to sustain vast outdoor environments, turning locations into site specific works of art. Incorporating scores of ten actors, musicians and visual artists, *Splinters* collaborated in creating epic adventures for spectators who often became participants of the action as it unfolded. As my technical skills developed, I moved further into the landscape of professional theatre but the flavour of devised, slightly anarchic performance art, never left me.

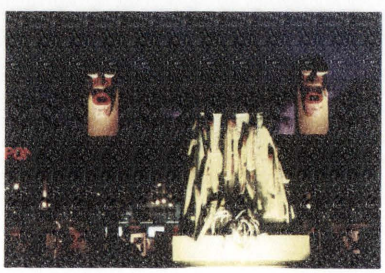

Figure 22. *Guardians of the Concourse*. Splinters Theatre of Spectacle. Canberra Theatre. 1993.

Splinters Theatre of Spectacle introduced me to a life long love of the theatre. Located in Canberra the core group consisted of art school graduates who produced cutting edge spectacle theatre combining *comedia del arte* with fireworks, music and puppets. The core group produced Splinters shows, other joined in to collaborate. before too long I became Splinters production manager. With performances staged mostly in outdoor settings the locations were often spectacular in themselves with works staged at: The Sydney Opera House Forecourt (ICON, 1992), Adelaide Jail (Adelaide Festival 1992), and Springbank Island in the ACT (Splinters, 1994).

Figure 23. Splinters Theatre of Spectacle.
Winter of the Rutting Moon. Performance Space Sydney. 1991.

In these performance events the audience were no longer spectators but become participants as they traversed the plotted path created for them; the more adventurous waded through water, took up arms and left their own identities in exchange for engaging in another reality, one in which transported time and space. In later productions, audiences were further manipulated as issues of crowd control became integrated into performance elements. The audience became a core ingredient of the event itself. Creating environments that facilitated a cross-cultural multi-platformed experience became the manifesto for this group, who strived to push audience engagement into new realms of interactivity. To some extent the company relied on manifesting aspects of presence-engagement into their performances.

Figure 24. Splinters Theatre of Spectacle.

Other performance groups took up this challenge with *Sydney Front* and *The Post Arrivalists* who equally required their audiences to be active rather than passive

responders. My experience of the theatre industry includes many areas of stage, production and marketing management. The abridged table of theatre productions (from 1991–2007) below, indicates the year of the production, the title, the theatre company involved, the venue and my role or job description.

Date	Title	Company	Venue	Job Description
2007	*Crash N Burn*	Circus Monoxide	Regional NSW	Marketing and Box Office Manager
2006	*Superb and Broken*	Circus Monoxide	Shellharbour NSW	Merchandise Manager
2002	*A Better Life*	*Illawarra Multicultural Women's Performing Group*	Sydney –New Theatre, Canberra Rep Theatre, Wollongong-	Lighting Designer and Operator
2002	*What's Her Story?*	Circus WOW	Illawarra Performing Arts Centre	Technical Director
2002	*LANDED*	A PP Cranney Production	Illawarra Performing Arts Centre	Production Manager and Technical Director
2001	*FLAME!*	Viva la Gong 2001 Twilight Spectacular Finale.	Fairy Creek, Wollongong	Production Manager and Technical Director
2001	*Drift*	*Live music and performance for Thirroul Seaside Festival*	Thirroul Life Saving Club	Lighting Designer
1998	*Autopsy*	Performance Space	The Performance Space Sydney	Production Manager and Technical Director
1997	*Waters of Brightness*	Theatre Kantanka	Chinese Gardens. Darling Harbour. Sydney	Production Manager
1997	*Track Works*	Urban Theatre Project	Granville Station	Stage Manager
1996	Living with Flowers & Delires Deliriums	TANGO 160	Canberra, ACT	Administrator and Publicist
1996	*Water Stories*	Canberra Youth Theatre & Song Nyoc Water Puppets	Darling Harbour Sydney Festival 1997	Production Manager Stage Manager Technical Director
1996	National Festival of Australian Theatre	Canberra Theatre	Canberra, ACT	Production Co-ordinator for the opening event
1996	Performing Arts Market	Australia Council	Australian National University Arts Centre	Stage Manager for outdoors events
1996	*The Walls*	Latin America Alive	Court Yard Studio. Canberra Theatre Centre. ACT	Stage Manager
1995	*The Second Scream*	Pure Theatre	The Street Theatre, Canberra. ACT	Stage Manager and Technical Director
1995	*Telling Tales*	Company Skylark	The Street Theatre, Canberra. ACT	Stage Manager
1995	*The Best of the Old and the New*	Canberra Theatre	Canberra Theatre Playhouse. ACT.	Stage Manager
1994	*The Oracle*	Splinters Theatre Company	Weston Park ACT	Production Manager Stage Manager And Technical Director
1994	*Antigone*	The Company	Australian National University Arts Centre	Stage Manager
1994	*Spitting Chips*	Jigsaw Theatre Company	Primary and secondary schools on the far south coast and Regional NSW	Touring/ Stage Manager
1993	*Metamorphosis*	Jigsaw Theatre Company	Currong Theatre. Gorman House Arts Centre	Stage Manager LX and special Fxs and SND operator
1993	*Guardians of the Concourse*	National Festival of Australian Theatre	Civic Square. Canberra. ACT	Production /Stage Manager
1992	*Thirst....is a Place*	Splinters Theatre Company	National Exhibition Centre, ACT	Production /Stage Manager
1992	*ICON*	Splinters Theatre Company	Sydney Opera House	Production /Stage Manager Outdoor spectacle staged on the Opera House forecourt.
1992		Splinters Theatre Company	Adelaide Jail Adelaide Fringe Festival	Actor and Stage Manager

1992	*Stray Toasters*	Splinters Theatre Company	Repertory Theatre in Canberra	Actor and Stage Manager
1991	*Winter of the Rutting Moon*	Splinters Theatre Company	The Performance Space, Sydney	Actor and Stage Manager

Table 25. Abridged Table of Sarah Moss Associated Theatre Productions from 1991–2007

As you can see in Table 25 my production management skills and knowledge developed from job to job as over time and throughout 1991- 2004 I was employed in the Australian performing arts scene both in the ACT and NSW. I worked as a freelance production manager, stage manager, technical director, lighting designer and sound, lighting and FX operator. Working mainly as a production manager my duties included, being responsible for budgets, organising schedules and meetings, liasing with artists and trades people, negotiating sponsorships, assisting public relations and facilitating successful outcomes. Here I demonstrate my ongoing interpersonal, oral and written communication skills with 13 years of production management knowledge and experience.

4.3 Film

In 1999, I completed a Major in Cinema Studies with courses like *Introduction to Cinema Studies* and later *Australian Screen Studies* in my undergraduate degree at UOW. In Cinema Studies we examined the texts of Bordwell and Thompson (1979), Bruce Kawin (1992), and James Monaco's *How to Read a Film* (1981). There was a practical approach to filmmaking with theory and practice combined. During the next two years, I submitted films cut on an analogue station mixed to VHS. Titled, *The World Through My Eyes* (1999) and *Mythical Mother Wanton Whore* (1999) they explored anti-hollywood filmmaking techniques, audience alienation and Sergi Eisenstein's theory of montage (Layda, 1949). I researched and wrote a paper on *Cinema Verite* and discovered the founding father of filmmaking, the work of Russian filmmaker Dziga Vertov, who in 1922 belonged to the Russian School of Montage. French film artist Chris Marker also influenced my studies with an essay written about his film *Sans Soleil*.

Figure 25. Example of still shots from films produced by Sarah Moss 2000-2005

By the end of 2000, I decided to start my own business, operating as a freelance producer / filmmaker under the guise of Smashing House Productions, which has been operating successfully between 2000-2011. During this period I produced, directed and edited

sixteen short films for clients such as Hospitals, Schools, Wollongong City Council and an OH&S series for The Timber Industries.

Below is a table of short films I produced from 2000-2009. The first column identifies the date, then comes the title of the film and who funded it. The film type is specified for classification and each film duration is clearly stated. Where an * appears I also directed or shot the content, where an # appears I cut the film and mixed the audio.

Date	Title	Funding Body	Film Type	Duration
2009	Three short films for the Memory and Place Project (MAP) * #	Film Australia	Non-fiction	3 minutes each
2006	*Blemish #*	Bluescope Steel and Wollongong City Library	Fiction	7 minutes
2004	*Welcome to Warrawong #*	Warrawong Public School	Educational	20 minutes
2004	*The Shedmen #*	The Timber Industries & 313	OH&S Training Video	2 x 12 minute episodes
2004	*Chasing a Ripple *#*	Smashing House Productions	Non-fiction	6 minutes
2003	*The Lego Way #*	Festivals Australia	Non-fiction	7 minutes
2003	*Pam and Dee Beside the Sea *#*	Smashing House Productions	Fiction	6 minutes
2002	*The Dandy *#*	Smashing House Productions	Fiction	6 minutes
2002	*A Nose of Her Own *#*	Circus Monoxide	Non-fiction	6 minutes
2002	*CONFECTION *#*	Smashing House Productions	Non-fiction	4 minutes
2001	*Young Parents Speak Out *#*	Shoalhaven Division of GP's	Educational	26 minutes
2001	*Seasonal Adjustments*	Smashing House Productions	Fiction	4 minutes
2001	*Journey of a Nation*#*	Wollongong City Council	Non-fiction	20 minutes
2000	*Care for the Carers - a Volunteers Initiative. *#*	Calvary Hospital, Kogarah	Non-fiction	20 minutes
2000	*The Making of the Sign of The Seahorse Concert.*#*	Scarbourgh Primary School	Non-fiction	35 minutes
2000	*Patrick and Jade's Big Day Out.*	Bulli Hospital	Educational	12 minutes

Table 26. Short Films produced by Sarah Moss from 2000-2009

These films can be viewed on the website http://www.sarahmoss.com.au/shpdatabase/shortfilms.html. By producing orientation films for hospitals, schools, and OH&S videos for use in face-to-face classes I developed a taste for creating engaging content using digital media. The fluidity of the digital experience led me to experiment more with other people incorporating multimedia, again pushing my boundaries re presence and creating meaningful media content.

4.4 Interactive Multimedia

From 2002-2005 I produced thirteen 'Theatrical Promotional Video Packages', which included documenting live shows, editing the content, both visuals and audio to produce a full length documentation of the performance, shot from two angles; including a three or five minute promotional video. These were delivered with a folder of JPEG stills

extracted from the video. Working pre-dominantly with Critical Mass Theatre, Circus Monoxide, Circus WOW, and Performance Illawarra I developed content that enabled clients to share their wares. As well as working in the arts, I have extensive experience in developing interactive multimedia products with teaching and learning applications designing and producing DVD's for educational and promotional purposes.

Graphic design artwork was produced for each package to highlight the contents of the trailers, personalizing the product in more detail and cutting costs for clients as years of expertise enabled me to multi-task. Table 27 *Theatrical Promotional Videos* consists of a listing of documented theatre productions between 2001-2005, promotional videos that I produced, shot and edited. The table identifies the year of the production, the title of the production, the theatre company involved, my job description and an account of the versions made, from full show to three minute items.

Year	Title	Company	Job Description	Versions
July 2005	*Surface Tension*	Critical Mass Theatre	Producer/Camera Editor	Full show – 3 camera shoot Each of the 12 scenes are available seperatly.
May 2005	*Promo*	Circus WOW	Producer / Editor	4 Minute promo Full show – 3 camera shoot
April 2005	*2005 Promotional Video*	Performance Illawarra	Producer/Direct Camera/Editor	4 minute promo
May 2004	*Big Top TVC*	Circus Monoxide	Producer/Director Camera/Editor	15 second television commercial
Nov 2004	*A Better Life*	Multicultural Women's Network	Director Camera / Editor	3 minute promo
Sept 2003	*Baggage Carousel*	Broadway & Co and Circus WOW	Producer Camera/ Editor	3 minute promo Full show – 3 camera shoot
Nov 2002	*What's Her Story?*	Circus WOW	Producer /Camera Editor	3 minute promo Full show – 3 camera shoot
Oct 2002	*A Nose of Her Own*	Circus WOW	Producer/Camera Editor	3 minute promo Full show – 3 camera shoot
June 2002	*Eccentric Acts*	Broadway & Co	Producer Camera/ Editor	3 minutes Full show – 3 camera shoot
May 2002	*Splash Happy!*	Circus Monoxide	Producer/Director Camera/Editor	17 minute promo
June 2002	*2002 Promotional Video*	Performance Illawarra	Producer/Director Camera/Editor	4 minute promo
July 2001	*A Nose of Her Own*	Circus Monoxide	Producer/Director Camera/Editor	6 minute promo
June 2001	*HAZCHEM!*	Critical Mass Theatre	Producer Camera/Editor	10 minute promo 3 minute promo Full show – 3 camera shoot

Table 27. Theatrical Promotional Videos

From 2002 to 2007, some of my multimedia works were being used as content for other local exhibitions. For example, CONFECTION, a short film which won the 2002 Short Sited Film Festival in Wollongong for best editing, was screened in and around Wollongong at various events for a number of years by Wollongong City Council's Cultural Services.

Table 28 identifies the year of the exhibition, the title of the exhibition, the company associated and the exhibition venue.

Year	Title	Company	Venue
2007	*The Feeling That You're Being Watched*	Short-Sited ten-year short film retrospective	Project Contemporary Artspace in Wollongong
2006	*The Element of Luck*	Innovation Week, Illawarra	Clifton School of Arts
2006	*The Feeling That You're Being Watched*	Short-Sited ten-year short film retrospective	Wollongong City Gallery
2004	*Through the Lens…*	Viva la Gong '04	Project Contemporary Artspace in Wollongong
2002	12 slides included in a slide installation	Viva La Gong Arts Festival	Wollongong City Council Building - exterior

Table 28. Screenings at Public Exhibitions

By 2001 I was producing interactive components for use in theatrical productions, the table below includes a list of the equipment required to stage the interactive video installations.

Year	Title	Company	Event	Equipment
2004	*Surface Tension*	Critical Mass Theatre	Project Gallery Viva la Gong Arts Festival '04	2 projectors 3 televisions 6 x DVD players Live camera
2004	*Beneath My Feet*	Circus WOW	Flagstaff Hill. Viva la Gong '04	1 Projector
Oct 2003	*Through the Lens…*	Wollongong Futures, Wollongong City Council	Viva la Gong '03 Wollongong Town Hall	3 projectors 4 televisions 6 x DVD players 65 slides
Oct 2002	*Landforms*	Circus WOW	Bruce Gordan Theatre. Illawarra Performing Arts Centre	1 Projector
July 2002	*Surface Tension (Creative development)*	Critical Mass Theatre	Hope Theatre University of Wollongong	2 projectors
June 2001	*HAZCHEM!*	Critical Mass Theatre	Wollongong City Gallery	1 Projector Live camera feed

Table 29. Interactive Video Installations

In 2003, I single handedly produced all the video content for *Thru the Lens…* a multimedia installation staged in Wollongong Town Hall during the *Viva La Gong Arts Festival*. The installation filled the hall with large-scale projections at either end, banners lining one wall, 65 slides and three televisions displaying content situated around three 'sacred' sites of the Illawarra region. It was produced with Critical Mass Theatre and Wollongong FUTURES at Wollongong City Council. thruthelens.mp4 located on the website and demonstrates some of the editing and camera skills gained and applied in order to create a synchronous two-screen projection installation. (http://www.sarahmoss.com.au/video/thruthelens.mp4).

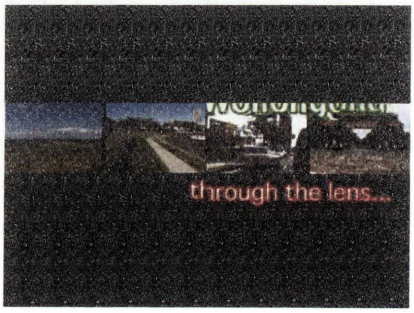

Figure 26. Screen shots from *Thru the lens...* 2004

The first image in Figure 26 illustrates how two screens have been edited to fit within one sequencer for the purpose of displaying what ultimately is four screens projected in the exhibition space through two projectors.

In October of 2002, I collaborated with Circus WOW on their production of an adagio performance called *Landforms*. Staged at Merrigong Theatre Illawarra, the video installation was devised as an interactive component of the visuals. The footage 'responded' to the action on the stage. By 2004 *Landforms* had grown to become '*Beneath My Feet*'. The event was staged as a part of the Illawarra's Viva la Gong Arts Festival 2004. Situated at night the site specific performance took place under Wollongong's Lighthouse at Flagstaff Hill. Like *Landforms* the interactivity was built into the footage, choreographed with the performers to enhance the performance visually. Funded by the NSW Ministry for the Arts and Wollongong Cultural Services '*Beneath My Feet*' incorporated stilt acrobatics, adagio, music and video. Directed by Wendy Regan and starring over twenty performers this production was a collaboration between Circus WOW, Video Artist Sarah Moss, Composer Marianthe Loucataris and Stilt Artist Lara Deek. See http://www.sarahmoss.com.au/shpdatabase/beneath.html

Figure 27. Images from *Beneath My Feet,* Flagstaff Hill 2004

In July 2002 I collaborated with Critical Mass Theatre funded as the video artist for a multi-media performance project staged at the University of Wollongong, NSW. Directed by Dr Janys Hayes *Surface Tension* a Creative Development project involved gathering data, documenting the process of creating theatre as well as participating in it.

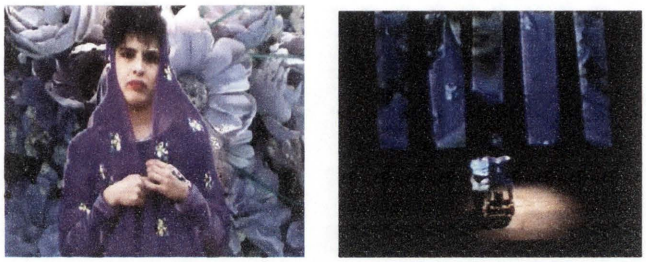

Figure 28. Katia Molena in still frames from Surface Tension Creative Development (CD) *'My Funny Valentine'*. Critical Mass Theatre. Hope Theatre, UOW, 2002

Figure 29. Jeff Stein, Janys Hayes, Bruce Keller and John Thorpe from *Surface Tension CD*. *'Talking Heads'*. Critical Mass Theatre. Hope Theatre, UOW, 2002

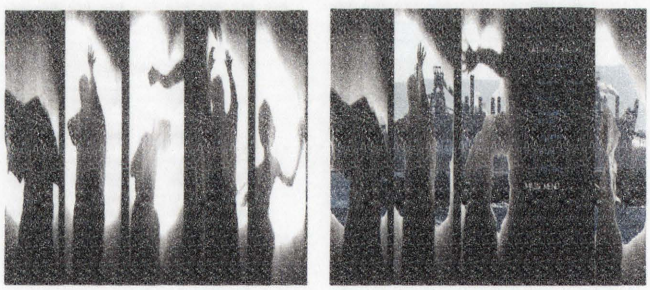

Figure 30. 'Silhouettes' from *Surface Tension CD*. Critical Mass Theatre. Hope Theatre, UOW, 2002

In October of 2004 the research continued with Critical Mass Theatre developing a professional production of *Surface Tension* for the Viva la Gong Arts Festival 2004. Staged at The Project Gallery in Wollongong the interactive video component included live recording and playback. Media content was utilized in the performance through the operation of two projectors, three televisions, six DVD players and live camera action.

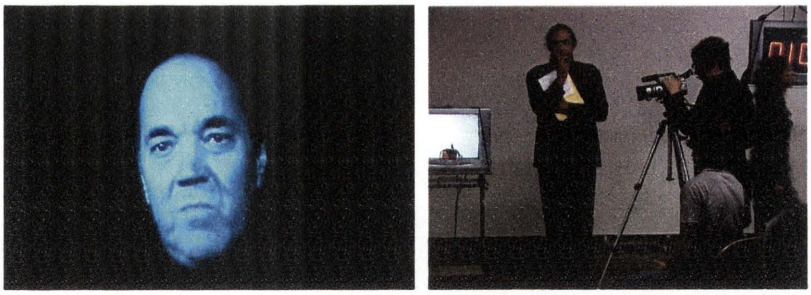

Figure 31. A digital character from *Surface Tension* and Critical Mass Theatre live at Project Gallery, Wollongong, 2004

Figures 22 to 31 illustrate the variety of collaborations undertaken with specific reference to large outdoor events and aspects of creating media that explores the challenges associated with generating presence within audience-based environments. These installations can be viewed on *PEGASYS* External Drive/ Folder 1_SM_Introduction/ sarahmoss.com.au The media files are located in a folder called sarahmoss.com.au and are accessible for viewing by opening a browser window, opening a new file, locating the shpdatabase folder and opening the file called multimedia.html. There are clips from six shows, all live performances many with additional content.

4.5 Experience Design

In 2005 I completed a Graduate Certificate in Interactive Multimedia and began a PhD in Computer Science with Creativity and Cognition Studios at UTS. *The Element of 'luck'* was developed as a pilot study to investigate how presence is generated in interactive artworks and experienced by audiences within an exhibition environment (see Figure 33A). The study examined processes in the context of conceptualising and exhibiting an interactive art system for the general public. Extensive deconstruction of the work through questionnaire and observation with participating audiences provided reflections on the process and outcomes of developing and exhibiting interactive work in public spaces. The published paper associated with this research discusses audience as participants and reflects on why interactive artworks require 'safe' environments for exhibition. *The Reflective Practitioner: In Creation of a Presence-based experience* (Moss, 2006) examines the example led by Creativity and Cognition Studios, University of Technology, Sydney in its collaboration with The Powerhouse Museum in creating Beta_Space (Beta_space, 2006): a 'safe' environment for displaying interactive works to the general public. Furthermore, the paper offers examples of good practice for creating interactive artworks and examines the creative process in respect to audience

engagement. To read the paper that relates information about the pilot study see Folder 5_ Appendix Eight/Academic Papers/ *The Reflective Practitioner*.

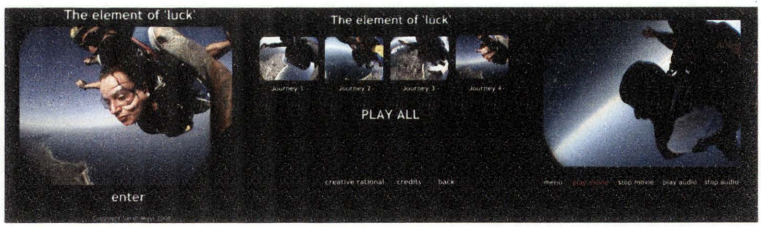

Figure 32. Screen stills of Enter, PlayAll and Journey 2 from *The Element of 'luck'* 2006

Since the first research publication in 2006 I has been writing and presenting research internationally. Designing for creative engagement *The Reflective Practitioner: In creation of PEGASYS* was co written between Moss, S. and Edmonds E.A. for OZCHI. Cairns, QLD, Australia. (OZCHI2008) and *PEGASYS: An interactive panoramic cinematic presence-generating art system* for the 15th *International Symposium for Electronic Art* (ISEA) Belfast, Ireland, UK:ISEA. A book chapter *AS it IS: PEGASYS and Presence* released November 2011 by Libra Press is in the book titled: Interacting. Furthermore a paper *The Flight of PEGASYS* appears in the journal, Interacting with Computers which has a special issue on Presence and Interacting due for publication in 2012.

4.6 Foundation Summary

Chapter Four provides a brief overview of the creative work and academic research I have undertaken in the past twenty years. The movement from engaging audiences through mass media via TV to engaging audiences one to one has seen the development of many skills over many years of labour. The work has always been challenging and the outcomes have always been beneficial. As an example of how my professional career choices have assisted my artistic ability to create *PEGASYS* please consider the following logos as each one represents a relationship developed between myself the artist, producer, researcher and the production and evaluation of *PEGASYS*.

Chapter Five

"What is television apparatus to man, who has only to shut his eyes to see the most inaccessible regions of the seen and the never seen, who has only to imagine in order to pierce through walls and cause all the planetary Baghdads' of his dreams to rise from the dust". Salvador Dali

5 NEW WORK

When participants engage willingly with an interactive art system that combines audio-visual components for generating the sensation of signifiers of presence, they are experiencing the artist's illusion; in this case an experience created to embody and trigger physical and psychological responses. *PEGASYS* integrates multimedia technologies, human-computer interaction, presence and digital networked systems, drawing from research into theories of presence. The research extends knowledge about presence in respect to the development of an art system that utilises eye-tracking technology for alternate interface navigation. *PEGASYS* is an interactive panoramic cinematic art system that provides an opportunity for both the able and disabled participant to engage with three levels of activity in a natural setting.

This chapter begins with a retrospective account of the process of the evolution of the concept (5.1), in which it details the four conceptual versions of the proposed system. The results of a pilot study (5.1.5) are then examined in respect to the contribution made to the design of the art system, likewise the results of study one (5.1.6). A description of the art system *PEGASYS* (5.2) is followed by a section briefly informing the reader of the creative team involved in the production of the system (5.2.1). In 5.3 the art system features are identified. There are seven features that distinguish the system, these features are: designing for engagement (5.3.1.1), the experience of spatial presence (5.3.1.2), ecological validity (5.3.1.3), the use of narratives (5.3.1.4), the use of colour and motion (5.3.1.5), sound (5.3.1.6) and finally the form of the system (5.3.1.7). Section 5.4 addresses content production outlining the creation of the three stages of interaction (5.4.1). The location-based film shoot (5.4.2) is then discussed in respect to the camera shelf (5.4.2.1), the video cameras used (5.4.2.2), sound (5.4.2.3) and the video-on-demand database design (5.4.2.4). 5.5 Examines the form of the system, identifying issues with eye-gaze control (5.5.1), and applying eye-tracking into the system design

features (5.5.2). 5.5.3 Exhibiting eye-gaze tracking within an art system examines; installing the device (5.5.3.1), the interface design (5.5.3.2), the icons (5.5.3.3), changing from stage into another (5.5.3.4), calibration of the device (5.5.3.5), confirming an action (5.5.3.6), and experimenting with the interface (5.5.3.7). Finally, hazards associated with the eye-tracking technology are outlined briefly (5.4.2). 5.6 Provides a summary of the chapters contents outlining how the concept impacted upon the finished product.

Three main stages of research-in-practice were undertaken in this research project.
They are:

1. The evolution of the concept
2. The experience of that concept realized in the form of an interactive art system, and
3. Qualitative data gathering and analysis of participant experience

The following section deals with Point 1: The evolution of the concept. Section 5.3 addresses Point 2: The experience of that concept realized in the form of an interactive art system. Chapter Six *Evaluation* and Chapter Seven, *Conclusions* discusses point 3: qualitative data gathering and analysis of participant experience. The evolution of the concept is now discussed in relation to the impact early research had on the conceptual design of the art system, its content, form and the nature of the proposed participant experience.

5.1 The Evolution of the Concept

The idea to create a system that utilised real-time video generated as a natural part of the progression of combining digital video data with interactivity. Designing digital experiences for participant engagement involves exploring notions of human response and computer connectivity, combining human desires with thoughtful practical creative outcomes. The art system produced and the accompanying thesis take into account that communication and presence literature distinguishes between media form (the physical objective properties of the display environment or system) and the media content (the theme, narratives or story unfolding within the display environment). For this reason, artists are exploring how to design the different parts of an interactive experience to induce relevant emotions and improve the level of involvement. This research is interested in investigating the role of media content and system form to induce relevant emotions in interactive experiences.

The investigation for this study began with an exploration of the state-of-the-art, refining the definitions of both presence and interactive art systems. A taxonomy of interactive art systems was then created with specific reference given to systems that provide a presence engagement. Existing research on presence predicts that participants can be drawn into a state of relaxation and restoration through a presence-based experience (Anne-Mie Sponselee et al., 2004, Witmer and Singer, 1998). This research aimed to both extend from this and draw fresh conclusions about how to obtain and maintain a state of harmony in a low stress mediated environment. The experience itself aimed to relax the participant and then facilitate their engagement with a system to create a peaceful, serene experience in an otherwise over-crowded noisy day. It aimed to facilitate a meditative, explorative and creative environment that draws the participant into a state of engagement via play. The immersive environment explores possibilities for developing interactive systems that bring the peace of mind usually generated by exposure to natural habitats, rather than the imposed and structured landscape of our cities. It aims to work as a de-stress tool, reducing anxiety and imposing tranquility in a relaxed one-on-one session. The work explores natural environments as healing spaces through audio-visual reproduction.

As outlined in the methodology chapter in respect to the PBR method of evolving knowledge through practice, there are a number of elements to consider. For example, if we reflect on the nature of conceptual design, the method proposed by Mayer considers "*the number of unique alternatives attempted*" (see 3.1.2). This PBR project progressed through a number of different versions or *unique alternatives*. These are: Version 1.0 *The Virtual Traveller*, Version 2.0 *Ex-_Is_Tense* , Version 3.0 *The InnerIorama,* evolving into Version 4.0 *PEGASYS*: a Presence-Generating Art System.

These versions are now discussed in relation to the reflection task characteristics of reacting, elaborating and contemplating, and the technological approach considered to enhance participants' experiences of presence-based engagement.

5.1.1 Version 1.0 *The Virtual Traveller* (June 2006)

The initial concept began by exploring the boundaries of interactive art systems and presence engagement with participating audiences. Inspired by presence research undertaken by Johnathon Freeman's, *Relaxation Island* (Freeman et al., 2004) in which a computer-generated environment (CGI) was developed to produce a 20 minute experience of a deserted beach, the idea for a two-way interaction was proposed. 1.0 *The*

Virtual Traveler included the use of two head-mounted displays, one for the Virtual Traveller in the gallery space, the other for the live avatar at the beach. This version aimed to provide information about the best art practice for creating both inverse presence and presence engagement using two head-mounted displays (HMD), wireless technologies, and two individuals in different parts of the world. The HMD's were to be crafted with the latest wearable personal electronics systems that fit comfortably and facilitate a dialogue between human computer systems interactions and audience as participants. The work aimed to explore presence engagement with audience as participants and inverse presence in terms of human memory and location. A performance context developed where issues arising from the context of determining levels of physical engagement and any verbal communication that might arise between the Virtual Traveller (VT) and the human avatar, could be discussed. The backward-forward action (Floridi, 2005) of the video and sound technology was considered in the design of the apparatus. Participants' were proposed to engage with an art system that imitates nature to the extent that the VT becomes convinced that they are there, embedded in the landscape. The HMD that they are fitted with is identical to the avatars who is situated at a beach 80 kilometers away. The participant can see what the avatar sees, speak to the avatar on the beach and make requests to engage in various levels of (inter) action. The avatar takes the VT into a relaxing harmonious environment, for example the participant is looking into is a small golden beach exposed, curved just so, with rock pools at either end and the finest ocean stretching out to infinity. The first five minutes consists of an introduction to the technology. The HMDs' capabilities and rules are explained by the avatar. There is an introductory session that consists of sitting on the beach staring out to sea with specially selected classical music (Ostrander and Schroeder, 1979). This session lasts for 10 minutes. After 10 minutes of deep relaxation the VT is taken for a virtual walk along the beach and can choose to interact with the experience-change the experience –through various levels of interaction. Levels of interaction dictate the speed and pace of the avatar's mobility, at this point there were three levels.

- Level One was a gentle walk along the beach. Included sitting down occasionally and gazing out to sea for long periods of time. Looking, watching the waves, the playful, brutal, sway of it all.
- Level Two included more playful interactive elements such as looking down at the avatars feet in the water, playing with the tide as it comes into shore etc. Skipping stones, popping blue bottles, climbing rocks…

- Level Three included yet another player, or dog or kite; anything that contributes towards facilitating a situation that is less controlled.

It was proposed by the artist that these levels of interaction could be accessed by either the VT communicating verbally to the avatar a request to change modes of interaction – by changing direction etc, or access to an augmented component of the interface; a digital reservoir of information with links to the avatars screen for non-verbal communication. The headset the VT puts on grants them access to another place within our world. Not a virtual world, this is not a game (although it easily could be...) but a real world experience, where you link with an actor who works as a guided tour host and is wearing an identical head set elsewhere in the world. The participant becomes experience bound.

As the design and production processes of developing art systems require collaborative ventures the acknowledgment and management of the organizational ability for scheduling production elements within a timeframe becomes vitally important. As we saw in Chapter Four, the artist has extensive experience in scheduling productions, considering constraining budgets and time management. As there was no budget the most important constraint became that of collaborating with professionals without the ability to pay them. In *Version 1.0* the human personnel required to design and produce the system components consisted of a team of engineers to build the HMDs', software developers to assist in the production of the augmented components, an actor representing the Avatar, a technician in the gallery space and a technician accompanying the participant (VT). The main consideration in respect to human personnel was that the artist building the system would require the assistance of a production assistant and an actor in order to test and experiment with the system as it developed. Therefore, many hours of concentrated effort would be required from certain individuals to seek satisfactory solutions in order to complete this version of the work. In addition, to some extent the proposed experience of being 'at the beach' was un-predictable as weather patterns would change the engagement on every occasion, sometimes affecting the technologies ability to deliver the experience required, hence a new design concept was considered.

For an example of the early experiments created see *PEGASYS* Drive/ Folder 2_SM_Experiments/ Experiment 1.mov (01:25 Duration).

5.1.2 Version 2.0 *Ex_Is_Tense* (November 2006)

The idea to film a location using a 360 degree camera setup formalized with the introduction of the work of Jeffery Shaw, Dennis Del Favero, Neil Brown, Ian Howard

(UNSW) Ross Gibson (Deutscher et al.), Nikos Papastergiadis, Scott McQuire (UOM), Adrian Miles (RMIT), Henry Gardiner, Pascal Vuylsteker (Mann et al.) at iCinema, UNSW. Here a 360 x 240 Spherecam Video Camera is in operation.

> "The Spherecam high-defintion digital video camera offers the unprecedented ability to record a 360 x 240 field of view at 30 frames per second with a resolution of over twenty Megapixels....It builds on research into panoramic video clusters begun at the ZKM, Karlsruhe. With it's cluster of twelve high-resolution CCD cameras recording directly to a four terabyte array of hard discs using Gigabit Ethernet technology, the Spherecam is capable of capturing over one hour of video data" (www.icinema.unsw.edu.au).

This concept differs from the original concept in as much as the production elements are intensified through application of video clips rather than video streaming. Streaming live video via an uploading system operating from a remote location potentially creates scenarios where the technology becomes unreliable. If the delivery of the media content is uncertain or constrained by the server's ability to upload and download live media, then the participants experience is not necessarily guaranteed to be consistent. As we learnt in Chapter Two, in order to create a presence engagement for participants the form of the technology must assist in maintaining the 'flow factor', which is the ability for the participant to interact with the technology in a reliable forward backward motion. Therefore, the concept changed to adapt to the fact that the form of the technology in Version 1.0 is potentially unstable. Also, I felt that the video output from the spherecam distorted the image, transferring it from the format participants are accustomed to and thus presenting its own set of post-production challenges.

Version 2.0 Ex_Is_Tense consisted of the idea that sprung from the previous version in as much as the beach was still the location for documentation. The idea adjusted to documenting a beach on a number of days and under different weather conditions, in real time, interlinking the numerous clips for participant interaction. This way the system could offer a number of beach experiences for participants. The participant was proposed to move about in the virtual digital landscape by accessing additional media clips from 'hot spots' embedded throughout the media files. Typical scenarios might include: Autumn: full moon rising, Winter: warm late afternoon, sun setting behind the escarpment, Spring: low tide, mid morning, sunny day, Summer: around midday on a hot sunny day, with perfect waves and no clouds.

In wanting the participant to explore the remote location in a hands-free dynamic and immersive context the implementation of brain–actuated control (BAC) was considered. In this technique the brain's electrical activity is recorded and applied in real-time as a direct control interface to operate physical devices and computers. BAC may also be referred to as a direct brain interface or EEG-based control (Melzer and Moffitt, 1997) p.338

By implementing BAC into the systems form, the participant was proposed to navigate the journey or experience, with 4 simple control words, these were:

PLAY STOP BACK NEXT

Where PLAY = GO, STOP = Loop, BACK= takes the participant to a different, slower, more meditative level of interaction within the system and NEXT = sees the participant move up a level of engagement.

5.1.3 Version 3.0 *The InnerIorama* (March 2007)

Version 3.0 *The InnerIorama* combined elements previously discussed in Versions 1.0 and 2.0. At this point a production team would design the head-mounted displays (Mann and Drakos, 1998, Melzer and Moffitt, 1997) that implement a brain interface (Makeig et al., 2000) providing navigation through brain-actuated control software (BAC) (Nasman et al., 1997) and sensor apparatus for biotechnological input. A video-on–demand (VOD) database retrieval system could implement video augmentation which could overlay the video clips through software programming, facilitating ethereal qualities to the experience and expanding upon layers of meaning (Milgram and Colquhoun, 1999, NSCA, 1995). In terms of sound, diagetic (natural live sounds) audio recording and, playback, including the ability to create surround-sound environments; expertise about speaker placement in HMD, and spatial audio installations for exhibition spaces produce for the participant a truer sense of the space and time in which they are engaging (Forrester, 2000). Here, participants engage in 20/30-minute sessions with head-mounted display technology that combines a hands-free interface, namely BAC connecting with a database containing audio-visual information that is retrieved upon user request (VOD). The interactive art system was to be operated through electrical signals from the users facial muscles, eye movements and brain waves. These signals are detected through a headband worn across the user's forehead underneath the HMD (Junker, 2007). The

HMD provides a window into a simple explorative engagement with video clips that enable the user to traverse natural environments pieced together by a narrative, prescribed by the participant. Audio components vary with the addition of baroque music overlaid with diagetic sounds of the chosen environment (Ostrander and Schroeder, 1979). The objective being to create a dynamic-interactive art system that is portable, non-intrusive and simple to operate.

In aiming to develop a hands free system, one that does not rely upon mouse control or keyboard control the concept of implementing BAC into a device became an ideal solution for navigating an interactive video installation. A non-invasive brain-actuated control system could facilitate communication through a hands-free interface, providing an avenue for exploration of and experimentation with this technology in respect to presence-generating interactive art systems; enhancing system and human performance in a networked entertainment device. For examples of the media content considered at this point of the process see: *PEGASYS* Drive/Folder 2_SM_Experiments/Experiment 2 (02:02 Duration).

However, the ideas associated with implementing BAC took a back seat when eye-tracking technology became known to the artist. The main reason being that I met a research team from SmartLab Digital Media Institute in Prague while attending the Mutamorphis conference in 2008. The InterFaces Project was already conducting experiments with eye-tracking in Britain and Dublin, designing creative interfaces for new engagements for people with severe disabilities such as Cerebral Palsy. I approached them and was encouraged by them to participate with their support in a similar experiment using video.

5.1.4 Version 4.0 *PEGASYS* (November 2008)

The final version of the conceptual design took various elements from the previous versions (the use of a performance element, creating a hands-free interface, video-on-demand and three levels of interactivity) and combined them with two new considerations. These new elements namely, eye-tracking and binaural recording, contributed greatly to the systems form, content creation and delivery.

In order to create a sense of Inner Presence for participants (as previously discussed in Chapter 2) several techniques were considered. These include the use of a diagetic surround-sound score to assist in drawing the participant into the environment (5.3.1.6), mood enhancers such as the choice of location that aimed to soothe and enchant the

participant (**5.3.1.4**), and the comfort of the participant in the exhibition environment. The technology consideration had by this time turned to the implementation of utilizing eye-tracking technology as the tool for accessing data in a hands-free experience.

5.1.5 Pilot Study Results

The first year of investigating presence within interactive art systems saw the development, exhibition and evaluation of an art system titled *The Element of 'Luck'* (2006) and a pilot study investigating presence. This process focused on collating data through questionnaire and observation of audience engagement and user experiences of a touch screen kiosk presentation exhibited as part of Innovation Week Australia at the Clifton School of Arts. Falling into the category of a dynamic-passive interactive (Candy and Edmonds, 2002) the prototype facilitated an extended dialogue through a paper presented at *Engage-Interaction, Art and Audience Experience* a symposium presented by Creativity and Cognition Studios (www.creativityandcognition.com), and the Australian CRC for Interaction Design (ACID).

The content of the pilot study exposed the participant to a view of the world from a skydivers perspective. This new way of seeing was interpreted by the artist as manifesting a presence engagement for participants as a new experience of the world (as viewed from 12500 feet above ground) was provided for them. The significance of data collated determined that this was true.

In order to calculate a participant's experience of the work a questionnaire contained six sections and a place for comments about: 1) the participant; 2) presence; 3) the work; 4) the 'PlayAll' section; 5) interactivity and finally; 6) general questions. It was an anonymous, non-intrusive questionnaire that the participants choose to complete. Ten participants filled in the questionnaire. The results indicated that ninety per cent of participants experienced a sense of 'being there' (9/10, 2a, Pilot Study) and fifty percent reported a sense of 'falling through space' (5/10, 2d, Pilot Study) thus some sense of spatial presence was confirmed. Spatial Presence is informed by a participants experience of the physical world, it includes perceptual immersion, transportation of participant, a sense of physical space that ultimately creates a sense of 'being there' (see 2.1.4.2). The questionnaire revealed that participants overwhelmingly concurred that the interface created with which to navigate the work was not signposted correctly. The navigation relied on simple word instructions rather than symbols. This seemed to cause confusion for some players. The navigation facilitated access to four Journeys or 'PlayAll'. Play

Movie, Stop Movie, Play Sound, Stop Sound text lay at the base of each image. The questionnaire revealed that some participants were confused by the interactive elements (5c). Feedback revealed the use of classic digital symbols; for example using the symbol > to indicate play, would have been easier to 'read' than the text itself.

The questionnaire also revealed that although only 30 per cent of participants utilised all the interactive options, sixty per cent said they would like to access more interactive components (3/10, 5b, Pilot Study). The conclusion drawn from this data indicates that a majority of participants did not fully explore all the interactive options on offer. Problems related to interface design obstructed the 'flow' of the engagement. There were also technical issues with sound as the availability of headphones did not ensure that each participant chose to wear them; whilst 60 per cent (6/10) reported that wearing headphones was not a deterrent the remainder of the participants who filled in a questionnaire chose not to wear them, thereby radically reducing the possibilities for full interaction and engagement. Observation of the gallery audience revealed that they failed to understand what was required of them. It might have served the work better to display a poster inviting audiences to touch and explore. As observed, some visitors to the gallery did not take enough time to get past the introductory level. They watched the opening images and then walked away. When these people were questioned as to why they did not pursue the engagement they generally responded that they were not sure that they should touch, they thought it better not to touch and so chose not to. Observation from a distance provided feedback about audiences, which contributes towards the work in practice.

In exploring the attributes of presence, results indicated that participants of this study experienced both perceptual realism of sensory presence and spatial presence (ISPR, 2000). As we have seen presence is generated by human sensory experiences gained through technologies that enhance the interaction between humans and computers facilitating a virtual experience. Thus a sense of '*being there*' was reported by participants of the interaction in respect to their degree of immersion (Lee, 2004).

To access the media go to: *PEGASYS* Drive/Folder 2_SM_Experiments/ The Element of 'Luck' (FLASH Application required to play). To read the paper in full see: *PEGASYS* Drive/Folder 5_ Appendix Eight. Academic Papers/ The Reflective Practitioner: In Creation of a Presence-based Experience.

5.1.6 Study One Results

The first part of the study as discussed in Chapter Three section 3.6.1 assisted in directing the system development by contributing information about participants' experiences of the digital media content. Participants undertook an evaluation process as described in 3.7. What follows is the outcomes of study one in which the participants watched a 23 minute film containing built in motion. To view the film see *PEGASYS* drive/Folder 4_ PEGASYS_Evaluation Film for study one (08:22 Duration). Drag and drop into QTMP. Try reducing the image size if lagging occurs.

***Motion*:** In respect to the panning effects built into the experience, the motion attempted to imitate the interactive components of the finished system for evaluation in study two. Some participants of study one commented on how the media experience made them feel dizzy,

> "The panning made me very dizzy, at the beginning. I didn't notice it towards the end maybe I just became accustomed to it or if it slowed down. I don't know but when it panned across I got very blurred and kind of a bit dizzy and not nauseous as such but you could almost get that kind of sensation coming on". *Study One, Participant #3/ Comment made during the interview*

> "The initial jerk when panning began was slightly jarring but became less noticeable with time". *Study One, Participant #23/ Written comment made on the questionnaire (ITC-SOPI)*

Outcome: In respect to this information the panning motion of *PEGASYS* was very carefully considered. The aim was to deliver a system that panned at a speed that was not too slow or too fast. It was imperative to design the system in such a way that it did not make people feel dizzy and yet gave them enough control to pan at a regulated comfortable speed.

***Ecological Validity*:** In respect to the participants experiences of the digital media content analysis of the adapted ITC_SOPI questionnaire revealed that: 48 percent felt that the content seemed natural and 68 percent felt they were visiting the place depicted. 56 percent felt that the content was 'live' and 24 percent indicated that the content seemed believable to them. In light of this information it became apparent that participants generally experienced the content as appearing to be natural but not necesserly believable.

Outcome: Changes were made to the look of Stage Three. Initially the characters were divided into split screen spaces, where the characters become framed within the location and therefore isolated from each other. In aiming to create a more natural and believable experience of the content these frames were removed, thus binding the characters within the same space and breaking down the aspects of voyerism that were dominating the previous experience.

Illusion Component: This was supported by comments made during the interview sessions where participants expressed that they either enjoyed the 'flaws' in the technical composition, would like them to become more of a feature or that they should be dispersed with altogether.

Outcome: Much to the artists surprise the majority of participants expressed that they enjoyed the ethereal qualities of the content and encouraged elements such as 'slipstreams' as interesting design features embedded within the system (see 5.3.1.4 *The Use of Narratives* for a detailed account of how this information was integrated as a system feature).

Technology Display Environment: In respect to the size of the display environment only 12 percent felt that *the display environment was too small* and 4 percent felt that *the display environment was too large* thereby indicating that the size of the display environment was suitable for public exhibition at Beta_Space (the venue for study one being the same size and proportions as the venue for study two). *Outcome:* Perfectly fine to leave as is.

Character Action: Less than a third of participants (28 percent) indicated that they *would have enjoyed more character action* thereby indicating that the characters as they were depicted were adequate.

Negative Effects: Negative effects associated with the experience of viewing the content were minimal and did not require addressing.

Sound: In respect to the sense of sounds coming from different directions within the displayed environment (B24, Study 1) 56 percent of participants indicated that the sounds required a more focused surround-sound environment to enhance this aspect of the content. Study one included a single audio track built into the 'movie' file and played through a two speaker PA. The audio track in study one was designed to include a wide variety of sounds in order to evaluate the experiences of the participants, gaining

feedback for system amendment in study two. Some participants had this to say about their experiences in relation to audio volume and fidelity:

> "There was somewhere the waterfall wasn't in view but it was still quite loud and I was kind of thinking that would be behind me now, but it wasn't. I kind of knew where it should be or at least I thought I did anyway". *Study One, Participant #2/ Comment made during the interview*

> "Water sounds too dominant in parts".
> *Study One, Participant #10/ Written comment made on the questionnaire (ITC-SOPI)*

> "The water sounds were too loud, blocking just about everything else".
> *Study One, Participant #14/ Written comment made on the questionnaire (ITC-SOPI)*

> "Water sounds too loud, particularly at first".
> *Study One, Participant #20/ Written comment made on the questionnaire (ITC-SOPI)*

Outcome: In the interviews participants expressed their concerns over certain sound elements such as the noise of the running water being too loud and the use of various sound effects that hindered the participant or made them feel uncomfortable. The issue of sound as a digital media component and as an environmental factor was considered in more detail for the delivery of sound in study two.

Enjoyment: Lastly 84 percent of participants indicated that they *enjoyed themselves* (B8, Study 1) and 76 percent would *recommend the experience to their friends* (A6, Study 1), therefore confirming that the experience of the digital media content of the art system produced pleasing results for audience members.

The Experience of Presence: In respect to knowledge gained through analysis of study one results it was interesting to note that through the use of the questionnaire a sense of presence was indicated to have existed for participants'. As study one focused on the experiences of the digital media content and contained no interactivity the presence-generating aspects of the system were predicted to be minimal. However the questionnaire results revealed that certain attributes associated with presence-based engagement were experienced by some of the participants, some of the time. 80 percent *felt themselves being 'drawn in'* (B1, Study 1), 56 percent of participants *felt involved* (B2, Study 1) and 60 percent indicated that they *lost track of time* (B3, Study 1). These results were pleasing as *PEGASYS* implemented interactivity designed to enhance

presence engagement, clearly if presence signifiers were already clearly indicated to exist within the content, then the system was well on its way to meeting its research aims.

To read the paper associated with the outcomes for study one see *PEGASYS* Drive/ Appendix Eight/Academic Papers/ *PEGASYS*: An Interactive Panoramic Cinematic Presence-Generating Art System.

5.1.7 Conclusions Drawn from the Previous Studies

The pilot study informed the design of the art system in a number of ways, firstly it became apparent that audiences often require encouragement to participate, secondly that the systems interface must be clearly labeled and unambiguous, thirdly that the use of headphones in a public exhibition arena greatly enhances the potential for participants to experience a presence-based engagement.

In brief the items listed below were identified through a pilot study and study one results, they are:

- Audiences often require encouragement to participate
- The systems interface must be clearly labeled and unambiguous
- The use of headphones in a public exhibition arena greatly enhances the experience for participants
- Careful attention must be paid to the systems panning motion in order to avoid the associated negative effects.
- The sense of sounds coming from different directions within the displayed environment need to be consistent. The sound track used in study one was a direct clip of background noise rather than a mixed audio experience.
- Modifications to Stage Three visuals were required
- Extension of 'slip stream' illusion components would be appreciated by audiences.

These identified components were modified in order to enhance the potential for participants to experience a presence-based engagement through time-based media.

5.2 *PEGASYS*: A Presence-Generating Art System

PEGASYS is a time-based presence-generating art system. Shot and displayed in high definition video with surround-sound audio, *PEGASYS* provides immersive engaging experiences for participants. The art system facilitates a unique interactive cinematic experience for participant's as they navigate a projected interface through an eye-tracking device. The networked system accesses a dynamic database of audio and video data clips enabling participants to pan the media content in 360 degrees. There are three levels of stimuli, or 'stages' as they are refered to in this project, which enable participants to make creative choices about where they wish to be located within the systems content and define for themselves the engagement through individual narrative selection. Participants explore the system through the eye-gaze interface that enables them to move forward and backwards between the stages, choosing in stage three to add more sound elements if they so wish. As participants move from one stage into another the stimuli changes the experience and additional interactive elements emerge. Participants experience an exclusive natural environment played back in real-time and on-demand. *PEGASYS* provides not only entertaining experiences but is seen to produce a new place for relaxation, personal reflection, and exploration of the artists illusion.

Designed in order to produce sensations associated with presence engagement *PEGASYS* provides people with a realistic sense of the feeling that they are somewhere else, located within the media content, transported by the systems form. Fidelity of representation is said to be crucial in the experience of presence and here participants witness naturalistic elements such as water, wind and shadow moving throughout the location or they can remain in a static position simply observing the intricacies of an unknown natural landscape, moving, changing and 'breathing'. *PEGASYS* designed to generate the sensations of presence-based engagement encourages participants' to pay attention to the minute detail of life assisting them to discover new ways of seeing.

See PEGASYS Drive/ Folder 7_*PEGASYS* / Examples of the New Work

5.2.1 The Creative Team

Various interdisciplinary personnel were required to design, build and produce *PEGASYS*. The skills base of the creative team was role specific to their specialization, each member exploring collaboratively the creation of the system. In this case two technologists assisted in the development of the system. Initially technologist Robin Gareus from *xjadeo.sourceforge.net* assisted by educating the artist about novel ways to

impliment the concept of playback of multiple clips running in sync. The first technologist onboard was Dr Alastair Weakley who built the database retrieval system in Apple Quartz working with QuickTime video files as supplied by the artist. The second technologist, Oleg Sakharov implemented an eye-tracking interface using Tobii software on a DELL PC. Messages sent from the X120 eye-tracker were recieved in Tobii Studio software installed in the DELL PC which was networked to the video database. This then activated the appropriate audio and video clips in the requested sequence. In terms of sound, diagetic (natural live sounds), additional sound effects and musical scores are embedded within the system functionality for participants to access. The creative team also included Marianthe Loucataris a sound composer who sponsored the research by donating copyright free music and assisted in the enginnering of the two atmospheric sound tracks used in Stage One and Stage Two.

This system not only provides new experiences for able-bodied participants but extends into facilitating memorable experiences for the physically disabled. Eye-tracking technologies rely on hands-free interfaces thereby enabling physically disabled participants to experience the same computer-based system that an able bodied participant might engage in. The PEGASYS interface was designed in consultation with SMARTlab's Principal Investigator in Multimodal Interfaces and Assistive Technology, Mick Donegan. Tobii Technologies (www.tobi.com) sponsored the use of an eye-tracking device for study two (for more information see 5.5 *The Form of the System*). To view the credit role see PEGASYS Drive/ Appendix Three/ Exhibition Venue and Publicity Material.

5.3 The Art System Features

The two main themes concerning the generation of presence within the context of this research are Inner Presence (2.1.5.1) and Media Presence (2.1.5.2). Three subsections to evolve from Inner Presence and Media Presence are the media content, the systems form and the participant's ability to willingly participate in the experience. These factors influenced the design of the art system in respect to building something that could test the research aims and assist in answering the research questions. The art system was designed to examine a range of presence signifiers that stemmed from previous research into presence (2.1 *Presence*). The evaluation process is required to identify presence signifiers, such as, to gauge the depth of engagement of participant's experiences and to gain insight from their experiences of spatial presence through pictorial realism. The system was required to be designed to meet these needs. The ecological validity of the system was also considered in respect to participants' experiences of the system. The use

of narratives and emotional content are added as design features adhearing to the implimentation of the enagement models (5.3.1.4). The use of colour and motion (5.3.1.5), and sound (5.3.1.6) as design features are discussed next. Lastly we look at the form of the system and discuss how this is proposed to impact on the participant's experience (5.3.1.7). For the results of participants' experiences of the art systems design features see Chapter 7.

5.3.1 The System's Seven Design Features

The system was designed around issues pertaining to previous research in presence. These features include the ability to design for creative engagement, the sensation of spatial presence, the experience of ecological validity, the use of narratives, the use of colour and motion, audio and the system response time. These seven features of *PEGASYS* are now discussed.

5.3.1.1 Design Feature One: Engagement

Engagement is a key factor in respect to experiencing psychological immersion. Engagement includes the participants' ability to get involved, facilitating a psychological immersion that can be a two-way communication with another person or with an artificial entity e.g. computer system. Engagement can be achieved even when the communication is in fact one way, i.e.; TV programs where the actor talks directly to the viewer (ISPR, 2000). Engagement is an Inner Presence component (2.1.5.1) however it is also associated with participants' experiences of both the content and the form of the system. In order to engage the participant two engagement models (2.2) are implemented into the systems design to include the use of designing with interaction modes and phases (2.2.1) and implementing the use of attracters, sustainers and relaters (2.2.2). For a detailed account of how designing for creative engagement was experienced by participants see 6.3.

5.3.1.2 Design Feature Two: Spatial Presence

Spatial presence transmits a sense of physical space, transporting the participant into the landscape producing a 'sense of being there', for more information on spatial presence see 2.1.4.2 and for how to measure it see, 3.5. In respect to designing the art system's features the exhibition location had to be considered as the system was limited to fit inside the exhibition space (3.4). The display environment covers one wall of Beta_Space. The art system was designed as a 2D experience, hence the system was not designed to surround the participant but designed through form and content, to produce the sensation of a 360 degree view. The form through gaze panning left and right, the

content through playback of real time audio-visual data. In order for spatial presence to be experienced by participants of the art system, it is important to consider that participants must feel that they are not just watching something but can interact with the system, that they are able to change the course of events and participate in the system outcomes. Experiencing the sensation of moving in response to the system, and feeling immersed to the point of 'being in' the scenes depicted, are qualities that the sensation of spatial presence enhance. One aspect of creating a sense of spatial presence within the system requires that the participant experiences the sensation that parts of the content are responding to their actions, experiencing the sensation that the characters are aware of their presence. Creating systems that use media and form to immerse participants'; enable them to feel like they are in the same space as the onscreen characters; feel like they could touch the characters, is to create systems that facilitate the sensation of spatial presence experienced. Digital media enables creators of alternative environments to predict the movements of the participants and as interactivity becomes embedded within the engagement the likelyhood that immersion occurs within the digital place increases. The experience of the sense of spatial presence is determined by the participants' level of engagement with the system. When participants are engaged with the media content to the extent that they feel like they have visited the places in the art system, then they are displaying the same physical attributes required for visiting real places, hence some degree of spatial presence has been experienced.

Spatial presence was implemented into the design features of the art system through consideration of the sort of system that could be developed in order to reduce physical embodiment and enhance spatial awareness. The system design process excluded the use of certain technologies such as head-mounted displays, haptics, 3D graphics. Due to this, the participants are unlikely to feel that they can reach out and touch or smell things in the media content. However, the system was designed to produce a hands-free engagement through the implementation an eye-tracking device. This device facilitates an experience for participants' that involves new technologies in an interactive engagement, joining participant and system in an interactive environment, one in which spatial presence may exist. Individuals personal evaluation based on appeal and believability of both the system form and its content, determines if spatial presence attributes were experienced by participants' of the system (6.4.2 *Evaluating Spatial Presence*).

5.3.1.3 Design Feature Three: Creating Ecological Validity

In presence terms ecological validity is akin to sensory presence (2.1.4.3) and is gained through the systems ability to produce a sense of natural order. To work best it requires high quality images and an efficent playback system. The pictorial realism and the visual depth are important factors in the ability of a displayed environment to create a sense of depth and hence presence. By addressing ecological validity as a design feature we are able to ensure that creating and maintaining a sense of the natural state of the chosen environment within the systems content is adhered to. Participants of this system should feel that the environment is natural, believable and part of the real world. In the sense that video is the key media, maintaining the feature of believability in respect to the content feeling 'live' should be attainable. Auditory cues are also associated with an increase in sensory presence engagement more on which can be found in section 5.3.1.6 *Sound.* For more see 6.4.3 *Evaluating Ecological Validity (Sensory Presence).*

5.3.1.4 Design Feature Four: The Use of Narratives

This research investigates the role of media content to induce relevant emotions for users in interactive experiences. Drawing from the models of engagement (2.2) the system design incorporates three stages of interaction. each stage has its own narrative style.

The first stage draws the participant into a relationship with the natural content of the environment. This stage encourages participants to draw breathe and focus on the natural ebb and flow of life changing around them. It simply represents *Crystal Pool* as a beautiful unchanged habitat in which to dwell and think. Atmospheric sounds play directly into the headphones and into the exhibition environment encouraging the participant to relax (see 7.4.1 *Presence in Low Stress Environments*).

In Stage Two, a character presents a new dynamic. Her narrative is flexible in as much as participants are unlikely to see her enter the environment and journey with her through out the place for the entire eight minutes, although this is possible. It is more likely that participants stumble across her somewhere within the place and then follow her around. Her narrative then, becomes a personal discovery, whereby the participant either responds by watching her or they chose to watch something else. As the music and the singing is a part of the narrative in this stage, it is also possible to enjoy the natural environment with music but without the presence of the screen character by simply navigating away from her.

Stage Three presents fourteen screen characters who are all enjoying the natural environment in their own way. Some of these characters are walking about but most of the characters remain static. This is so that the dynamic sound clips for characters can be coded into the system software with relative ease. A choreographer working with twelve artists/performers, created a site-specific, user-focused, interactive performance. Each of the twelve performers brought skills acquired through years of rigorous training or application into the chosen environment of *Crystal Pool*. Performance durations vary. The clown, for example, performs a delicate operation requiring stealth and discretion, the cameras eye probing in a voyeuristic intrusive way observes the rather odd and yet daily ritual-taking place behind the bush. The clown being equally aware of her camera (camera #2) is however, completely unaware of the stumbling lost woman and the keen winter swimmer who reside within the field of view of cameras #1 and 3. The acoustic duo (cameras 3&4) were recorded onto an independent audio device as were various sound effects such as water splashing, the sounds of bush breaking under foot, birdcalls and the hum of a girl who is lying in the sun listening to her iPod (camera #10). The sounds work on a narrative level with each of the characters. For example, when the image of the swimmer in the pool is aligned with the centre icon on the screen then sounds of splashing water are heard. The atmospheric sounds of water, wind and birds are constantly heard and new sounds layer over the top. Many of the characters have musical scores to accompany them. The system is designed in order that sounds for each of the characters will play when the participant has the character lined up with the icon, if for example, a character is lined up in the centre icon but the participant is watching someone else, the sounds for the character in the centre of the frame would be heard not the sounds for the character they are looking at. Lastly, the dynamically generated sounds are designed to activate according to the positioning of the characters along a very long sequencer, thus dynamism is created, as predictability of the playback of sounds is not guaranteed. In other words, this system design features ensured that the participant was often unsure as to how to repeat various incidents. This was a deliberate design feature and one that adheres to the concept of the creative engagement model's category of relaters (2.2.2).

Within the system, all of the stages have sounds of natural recordings of the environment. In Stage Two a musical score is added and the sounds of a girl singing. In Stage Three, of the fourteen acts five are silent, the remaining nine utilise sounds such as spoken word, live music, birdcalls, pre-recorded music, the sounds of swimming in cold water and

other extraneous sounds. These sound files play upon activation, the participant may choose what to listen too, signifying with their eyes by holding their gaze upon the invisible middle icon, what to activate next. The narratives employed within the systems media content allow the participant to explore, rest or play within the context of this new landscape, and entice participants into experiencing a new method of interacting and experiencing digital media.

> "To be in the world, to be situated at all, is to be in place. Place is the phenomenal particularization of 'being-in-the-world', a phrase that in Heidegger's hands retains a certain formality and abstractness which only the concreteness of being-in-place, i.e.; being in the place-world itself, can mitigate. Can we rediscover and redescribe that concreteness? Can we regain and restore a sense of the full significance of place?"(Casey, 1993) pg xv.

For results about how the use of narratives were explored by participants see evaluating the three stages of interaction, section 6.3.3.

5.3.1.5 Design Feature Five: Colour and Motion

In designing the art system it was important to consider the impact on the participant of the use of colour and motion. Since the system was built using real time video clips running in sync with each other, then the colour balance of each clip had to enhance the natural environment. Where video stitching occurs, the colour differences become more apparent. Hence, it is important to capture the correct daylight colours with the cameras, using the built in white balance feature.

Motion is a key factor in the interaction process as participants navigate the video clips by gazing left to right and vice versa. Thus, the systems content is potentially in constant motion. Negative effects such as feeling dizzy, disorientation and motion sickness can hinder the participant's experience and impact upon their engagement. It will help to reduce the camera motion by wind, by securing the camera to a shelf, and the base of the shelf to the ground with ballast. It is important to calibrate the video cameras prior to rolling the tape to avoid excess editing. Check the light conditions filtering into the individual cameras, constantly. For information on the evaluation of participants experiences of the use of colour and motion see 6.4.5.

5.3.1.6 Design Feature Six: Sound

In keeping with the theme of producing a relaxed experience for participants (7.3.1) the audio plays an extended purpose, a duality for creating a heightened awareness of oneself as well as sustaining the environment in which the shoot took place. It has been noted that a very specific form of music with a very specific rhythm can induce a relaxed state in the body – these types of music have proven to create a music-induced relaxation but they leave the mind alert able to concentrate. Physiologists found the rhythms of the body – heartbeat, brain waves, and so forth, tend to synchronise themselves to the beat of music. Classical music with a very slow, stately, restful rhythm induces a calm and restful bodily experience. In the early seventies experiments were conducted in Bulgaria in which people were monitored with physiological instruments. During these concert sessions participants were found to have heartbeats that were slowed by an average of at least five beats per minute. Blood pressure was down slightly. Brain waves showed beta waves decreased; brain waves slowed to the alpha rhythm. Simultaeneously, as these people relaxed, their minds were conducting strenuous mental work as these people were learning to memory 100 words of a foreign language (Ostrander and Schroeder, 1979).

In designing the interactive experience of *Crystal Pool* sound elements were considered to be of vital importance. Initially Bach's Fugues and Debussy's piano preludes were considered for inclusion as the tonal quality engages a feeling of harmonic vagueness, where an eb and flow predominates. The use of a continum of sound facilitates an environment conducive to reduce stress and anxiety, assists in creating for the listener profound states of deep mediation and relaxation, increases self awareness and has been proven to improve mental and emotional well being. These are qualities which were sort after in the production of *PEGASYS*. Therapists, new age healing centers and health practitioners implement this type of musical score precisely to encourage long-term improvement in mental and emotional well (Mcleish, 1985). Experiments were undertaken using Vivaldi Concerto No2 in F-Major, Andante and other similar pieces which became the underscore for Experiments 1 and 2 which can be located on the *PEGASYS* drive /Folder 2_SM_Experiments/ Experiment 2.mov (02:02 Duration).

Viewer feedback formed the opinion that the musical score was too well known thereby producing for observers mixed emotions as they grappled with the concept and their prior experiences of the media. The musical score was finally chosen from the portfolio of an internationally acclaimed sound artist, Marianthe Loucataris (www.MariantheLoucataris.com). Loucataris's instrumentals are composed using an open

string piano, drums and guitar. Her natural approach includes the use of harmonics as she has previously worked in the area of music therapy and is aware of how slow, stately, restful rhythms can induce a relaxed state of mind. Loucataris kindly lent her music to the developing system which was implemented in both test studies one and two. In study one her clips were juxtaposed against harsher more discordant sounds and participant feedback indicated that generally her music facilitated an imaginative and restful engagement with the media, it was well received and then implemented more strategically into study two.

Three system design features associated with the audio are now discussed in terms of their relationship to *The Creative Engagement Model* (6.3.3).

Atmospheric sounds – attractors
Compositional music score – sustainers
Sounds dynamically generated – relaters

The sound outputs during the exhibition of the art system (study two) are designed to facilitate two experiences for participants', see figure 33. First, the external sounds, those heard in the exhibition space, are constructed as a three-dimensional surround-sound environment thus enhancing a sense of spatial dynamism. Secondly, the participant wears headphones.

In study one the sound system consisted of a single playback PA with two speakers positioned downstage. In study two the sound is designed to operate for playback of three sound design elements, namely; 1) playback of atmospheric sounds, 2) compositional music scores and 3) sounds dynamically generated through interaction with the system, and heard only by the wearer of the headphones.

The atmospheric sounds are permanently distributed through one set of speakers in the exhibition space and play continuously in the headphones. Another set of speakers located at the back of the room allows the operator to mimic this sound score thus doubling up the natural sounds of running water, birds and wind. The CD player also facilitates opportunities to distribute the musical scores with sixteen compositional tracks to choose from, giving observers a taste of the participant's audio experience. The participant wearing headphones simultaneously listens to both the atmospheric sounds and which ever sounds they have activated as part of the dynamic-interactive experience in Stage Three.

A diagram of the layout of these audio systems in Beta_Space is below.

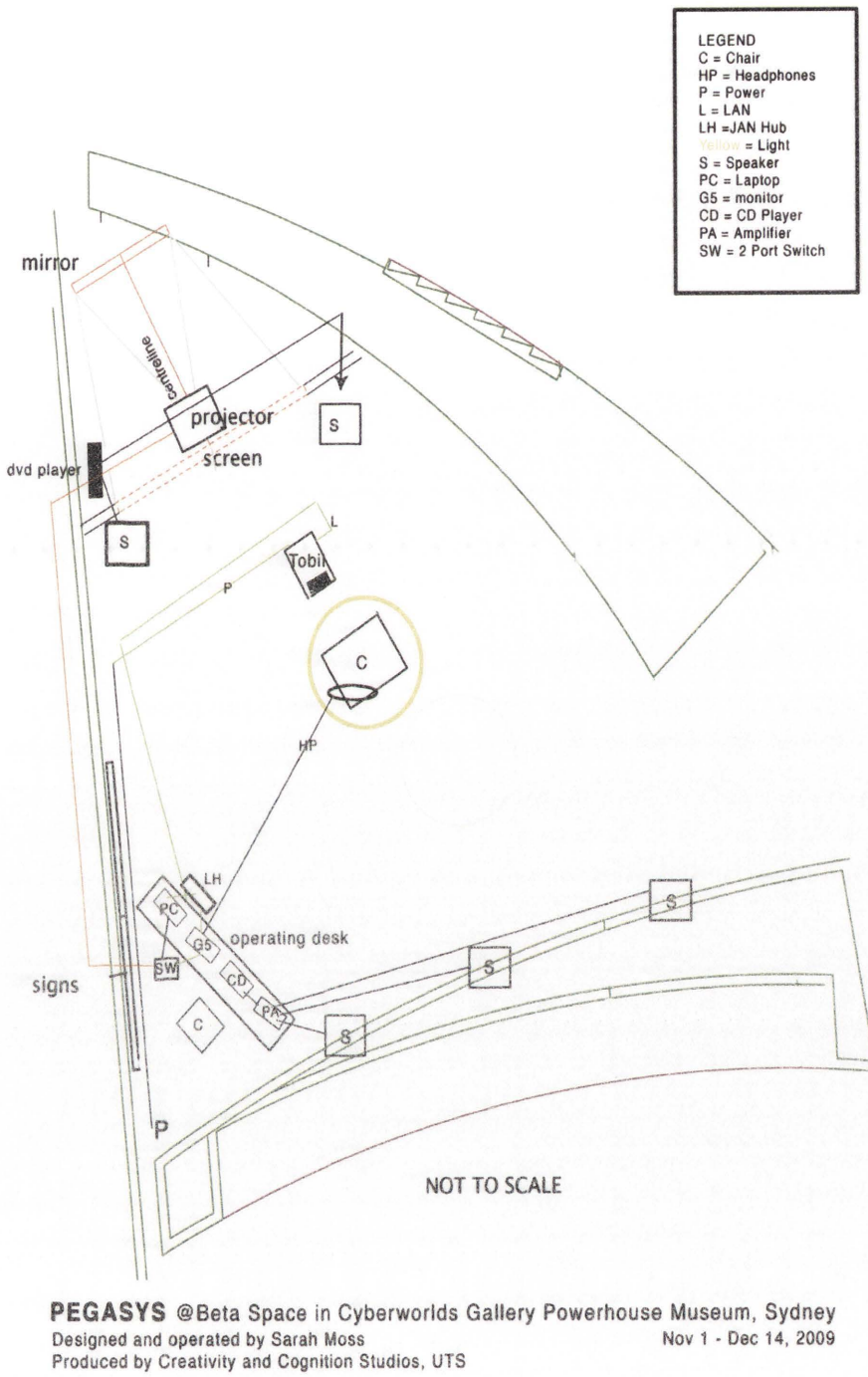

Figure 33. Diagram of *PEGASYS* as an installation exhibit in Beta_Space 2009.

5.3.1.7 Design Feature Seven: The Form of the System

According to previous research into Media Presence (ISPR, 2000), the form of the system should consider the following characteristics; the number and consistency of sensory

outputs (6.5.2), use of motion and color (6.4.5), audio volume and fidelity and aural dimensionality (6.4.6), visual dimensionality (6.4.2), viewing distance (6.5.2.1) and the obtrusiveness of the technology (6.5.2.2).

The system response time is the time taken between the participant's action and the perceived effects of those actions upon the displayed environment (Freeman et al., 2002). Latency of visual feedback has been seen to detract from presence engagement when significant intervals of time pass between the action and the re-action. Therefore the form of the technology should not hinder the participants experience and should facilitate a natural flow from participant to computer. However, this art system is designed in order to replicate a slow engagement. This means that the systems interactivity is slowed down deliberately in order to create an experience which forces participants to examine the micro, the details of each stage they are experiencing. By designing the system to respond slowly to participants demands the system itself is anticipated to hinder some participants experiences and yet it facilitates the original desire of the work, which is, to draw the participant in to a deep reflective place that encourages them to rest and engage with the natural environment and all it contains.

The art system is not designed as a game hence there should be no rush to complete viewing the content. As there is 90 minutes of unique content within the system it not anticipated that anyone would ever witness the entire media experience. Through design, the eye-tracking device meets some of the participant's demands, but as a sensory output it presents an opportunity for participants to explore the media very slowly, or in relation to the speed maintained by the participant working with the system. One of the main system design concepts is that the experience of the system should provide a relaxing engaging interaction, the form of the system, particualary the system response time is of paramount importance to achieve this aim. The interface has a built in lag, meaning that when a icon is activated through the eye-control interface the system does not always respond instantaneously. This is implemented in order that participants do not spend their entire time zooming around the stages as if in a game. By extending the experience to one in which participants are forced to abandon issues of control, the experience is thus altered for those participants who have trouble in doing so (see 6.6.5). Gathering the audio visual components required an extensive production phase that implemented the production procedures of any cinematic treatment. As we shall see, the content production involved one rigouros day of filming and twelve months in a post-production studio, editing.

5.4 Content Production

The audio-visual data captured on location produced an extensive catalogue of video with close to fifteen hours of footage captured. In section 5.4.1 *Creating the Three Stages of Interaction*, we look at the how the narratives designed to enhance the experience of the art system work in respect to the three stages. Due to its location *Crystal Pool* became the landscape of choice for digital documentation of a natural environment due to issues revolving around privacy, density of bush and water flow (5.4.2). The camera shelf facilitated the use of seven cameras, sitting side by side, to film in sync (5.4.2.1). Once the prescribed duration had expired the shelf was rotated, the tapes changed, the cameras re-calibrated and the shoot continued. The cameras used for the film shoot are discussed in section 5.4.2.2. Sound is then discussed in 5.4.2.3 with a review of the video-on-demand database design implemented to deliver the digital media content (5.4.3). The location based shoot took place during the course of one day (1st July 2008). Approximatley twenty people assisted in the production of the content by either assisting in the production of the camera-shelf, securing the video cameras, working as production assistants or acting as characters within the environment. For a detailed account of production personnel see *PEGASYS* Drive/ Appendix Three/ Exhibition Venue and Publicity Material.

5.4.1 Creating The Three Stages of Interaction

PEGASYS contains three layers of interaction, referred to in this document as stages. These stages increase in media content or activity, each stage providing a different view of the same location with additional interactivity embedded. In this way each stage can be measured for presence engagement attributes independently through an interview process that addresses participants experiences of both the visual and aural content. By providing the participant with a contrast of media that is similar but different, comparisons can be drawn about participants' experiences of the system. In all three stages participants experience the documented natural environment of *Crystal Pool*.

5.4.1.1 Creating Stage One

Using the camera shelf (described in 5.4.2.1) the natural environment was documented in real time. The cameras were calibrated for varying levels of exposure and captured uninterrupted for twelve minutes before the shelf was rotated 180 degrees and the process repeated. In post-production the footage was edited into four widescreen clips (1450x1080) each clip running in real-time in sync with the other and stitched to fit next to the adjacent clip. The video clips loop as does the diagetic sound. Participants access

five minutes of synchronised footage that presents for them an uninterrupted 360 degree view of the natural location and its habitat. Participants can choose to pan the image left and right, or exit Stage One at any time by activating the NEXT icon through eye-gaze control, moving them into Stage Two. See *PEGASYS* Drive/ New Work/ Still Frames/ Stage One and Folder 7_New Work/1. Stage One, Clip 1.mov (Duration 05:15)

5.4.1.2 Creating Stage Two

The same environment with slightly different camera alignment includes the presence of a character who engages with the camera system as if it were a person in situ. This stage involves a semi narrative, in as much as the character traverses the landscape in both a clockwise and anticlockwise fashion and it is anticipated that the participant will follow her. A musical score introduces the character by signifiying her appearance through a sound cue, the character hums a little tune as a prelude to the musical score allowing enough time for the participant to locate her within the landscape, depending upon where the participant had been previously located within the media. An option to move either BACK to Stage One or NEXT to Stage Three is presented to the participant as soon as they enter Stage Two. See *PEGASYS* Drive/ New Work/ Stage Two_Examples of Still Frames and Folder 7_ Examples of the New Work/2. Stage Two, Clip 2.mov (Duration 07:51)

5.4.1.3 Creating Stage Three

Each of the fourteen performers were arranged within the field of view of one camera or another (the system being constructed of seven cameras but providing opportunity for fourteen fields of view when rotated 180 degrees, see 5.4.2.1). Sounds for each of the individual characters are embedded within Stage Three and are operated through the invisible middle icon built into the *PEGASYS* interface. *PEGASYS* Drive/ Folder 3_ Stage Three_Examples of Still Frames and Folder 7_ Examples of the New Work/2. Stage Three, Clip 3.mov (Duration 10:10).

Figure 34. Images from the film shoot at Crystal Pool.

5.4.2 The Location-Based Film Shoot

The Sydney Royal National Park faces the Pacific Ocean and is accessible by both road and boat. Within Sydney's Royal National Park lies *Crystal Pool* the subject matter for the art system's content. In the late 19th Century places like *Crystal Pool* were considered to be "pleasure gardens", a source of great beauty where visitors to the park could rest, relax, bushwalk and swim. Research undertaken by New South Wales Parks and Wildlife Services (NPWS) indicates that exposure to naturalistic settings has a considerable influence on the human ability to restore its natural state of equilibrium. The publication 'Healthy Parks Healthy People' states that by visiting parks one can;

> "... simply escape the stress of daily life and indulge in the peace and tranquillity of the natural environment. Parks are good for you! Research shows that visiting a park for recreation and relaxation can help to lower stress levels and blood pressure, boost immunity, promote healing, improve mental wellbeing, and enhance your quality of life" (Maller et al., 2002).

In searching for the essence of nature or 'the thing itself' (Casey, 1993), *PEGASYS* facilitates an examination of an environment without the constant reminder of human effort. Within the developed system it is possible to experience the landscape without any reference to man, obliterating the humanistic invasion and simultaneously devising a method of reduction, one that alleviates the landscape from any connection with man, facilitating a focus of discovery; a rich new world of wondrous beauty to explore. Like the Australian Aboriginal population of a century or two ago, long before European invasion, contemplation of a life ruled by fishing, cave dwelling, story telling and sleeping, contributes towards our ideas of an idyllic paradise. Here rest and recreation is as much a part of life as the habitat is to the habitus. In the context of habitat the chosen landscape for audio-video surveillance is buried deep within the Royal National Park, located 29 km south of Sydney. *Crystal Pool* is a naturally formed ecosystem with cascading waterfalls and abundant wildlife. Within the park the aura of mystery and romance provides an ideal escape from general city life.

The average winter temperature range for the area where the location–based shoot took place is 6-17 degrees Celsius (42-63 degrees Fahrenheit) with the average rainfall per year at 1214mm and the number of rain days per year at 100. Scheduling the shoot in the middle of winter gave rise to issues of vehicle accessibility, an abundance of water flow (generating issues of volume control of dynamic sound) within the pool and surrounding

waterfalls, and ambient temperatures of both water and air. As these elemental components were not predictable, the behavior of the weather, for instance, was to play a large role in choreographing the site-specific performance, for example, a clear day is easier to edit than a cloudy one. The experiment of living was made apparent when working with the naturally occurring elements. Experiments contain risks and natural weather patterns constitute unpredictable filmic conditions. *Crystal Pool* provides both shade and exposure to the sun with a constant source of running water (cascading waterfalls) filling a pool of considerable size. During the NSW bush fires of 2002 *Crystal Pool* was closed to the public and has not reopened. Accessible now only by foot the location is hidden from public view and has continued to grow unhindered. The landscape undulates but basically takes the form of an enclosed environment providing a 360-degree view of moving water and native bush forms. However, a main feature of the location is its inaccessibility, in order to visit *Crystal Pool* one must walk a considerable distance into the overgrown bush, there is no other access. This feature became a draw card as distance from any proximity to human interference (cars, people, planes) and digital preservation of a relatively unknown place is important to the integrity of the work. In producing a work that focuses on an unexplored landscape, in particular a difficult one to access, the landscape becomes the key subject matter of the work. The computer-based system provides engagement with a natural terrain, incorporating site-specific live performance and virtual characters, made possible through the design, production and implementation of a tetradecagon environmental audio-video camera system. See *PEGASYS* Drive/Folder 3_PEGASYS_New Work/ PEGASYS_Production/'*Crystal Pool*'.mov (04:39 Duration).

5.4.2.1 Creating The Camera Shelf

The production phase saw the development of a camera-shelf (see Figure 34) designed by the artist and built by engineers at Peabody Mining, Helensburgh. The camera shelf was built to house seven SONY HDV1080i cameras for the outdoor location shoot. Originally the design aim was to have seven cameras strategically spiriralling away from the centre of a circular steel plate. It was proposed that the 45 degree angle required by each camera would sufficiently capture a full 360 degrees allowing for a slight overlap in footage content making the stitching process easier and retaining the real-time component important to the work. However, upon experimentation with a paper prototype and one camera, it was decided that seven cameras would fit generously on a 180 degree semi-circular shelf and capture a decent overlap. It was decided then that implementing the steel shelf in order that it would rotate, spiralling up and down a centre pole, allowed the

shelf to move up and down for ideal shot composition and turned a design element into a feature. Ballast was placed at the opposite end to the cameras onto a shaft designed to hold the gym bell weights. The shelf was clamped to the centre pole and can move only when manually operated, either up or down and in a permanent 360 degree rotation. (see Figure 34). The shelf was supported by a web structure secured onto the centre pole and it in turn connected to three tripod legs. These legs rest inside the upper part of a three-wheeled camera tripod accessory (see Figure 34). The camera-shelf was designed to support the real-time panoramic video capture of the environment in 180 degrees. Each of the seven cameras records one field of view (FOV). In order to capture a full panoramic view the shelf rotates 360 degrees, in this case creating fourteen camera views, with varying degrees of FOV overlapping (See Figure 35).

Figure 35. The Camera Shelf holds 7 HDV1080i cameras rotating 360-degrees.

Capturing a 360 degree panoramic view using the camera shelf provided the visual content for *PEGASYS*'s visual database. The rotation function facilitated an interaction with the environment that allowed for real-time panoramic capture of the moment. The shelf itself was placed on leveled ground for which packing blocks were used. Ballast was used to hold the plate securely with tripod head fixtures positioned beneath the cameras in order to keep them in place. The cameras were positioned on the shelf in such a way that the LCD screens were accessible to the director and choreographer who in turn could orchestrate the action of the performers (artists) when required (see Figure 36). A clapperboard was used on location as a tool for synchronising the audio-visual components, for indicating when recording devices were in operation and for cueing the performers actions.

Figure 36. View of the Artist with the operating Camera Shelf

Camera battery life was extensive and allowed for extended periods of using the cameras LCD monitors. As it was not possible to implement external monitors (the use of generators prohibited due to noise pollution issues) it was important that both key creatives' (the director and the choreographer) understood the landscape and its potential use as a stand-alone set. With a limited capture time enforced in order to avoid excessive data capture, the shooting schedule was tight and demands on cast and crew constant throughout the one day shoot. See *PEGASYS* Drive /Folder 3_New Work/ PEGASYS_Production /The Camera Shelf.mov (01.11 Duration) and Folder 5_Appendices/ Appendix Nine/ The Film Shoot.

5.4.2.2 The Video Cameras

The video cameras used in the deployment of capturing the content for the art system were chosen most part for their ability to operate in high definition video (HDV). As technically appropriate tools their specifications and capabilities were compatible with the demands and inquiries of this research. The seven cameras used were SONY HDV1080i's which were borrowed from the Media Store at Humanities and Social Sciences (HSS) at UTS. Permission was sought and gained to loan the cameras from the Media Centre Manager after a thorough investigation into insurance cover entitlement through UTS. As an approved UTS project, insurance was gained in the usual procedures although extra precautions were taken in order to cover the premium. A contract for insurance covering a site-specific location based shoot, UTS equipment and personal cover for the researcher, was put into place. A contract covering the cameras for accidental damage, or perceived damage, was signed by the researcher and the second supervisor, as the primary supervisor was AWL. The cameras or camcorders themselves are High Definition Video (HDV). It is claimed by the manufactures (SONY, 2006) that HDV provides the extra quality of emulating a more cinematic look than the previous digital cameras were capable off. The cinematic experience is generated through the cameras ability to capture using the 25p (progressive) acquisition that is recorded as 50i by dividing each frame into two fields.

5.4.2.3 Creating the Visual Reference Guides

By cutting still frames from each of the fourteen fields of view (FOV) visual reference guides (VRG) were created in Adobe Photoshop for each of the three stages as illustrated in Figure 38. The VRG indicates how much FOV overlap was captured and where to crop each frame in respect to video editing. They also provided the artist with information about the digital composition of each of the fourteen cameras FOV producing detailed

data analysis for the video post-production edit. Each VGR represents a 360 degree view of *Crystal Pool*.

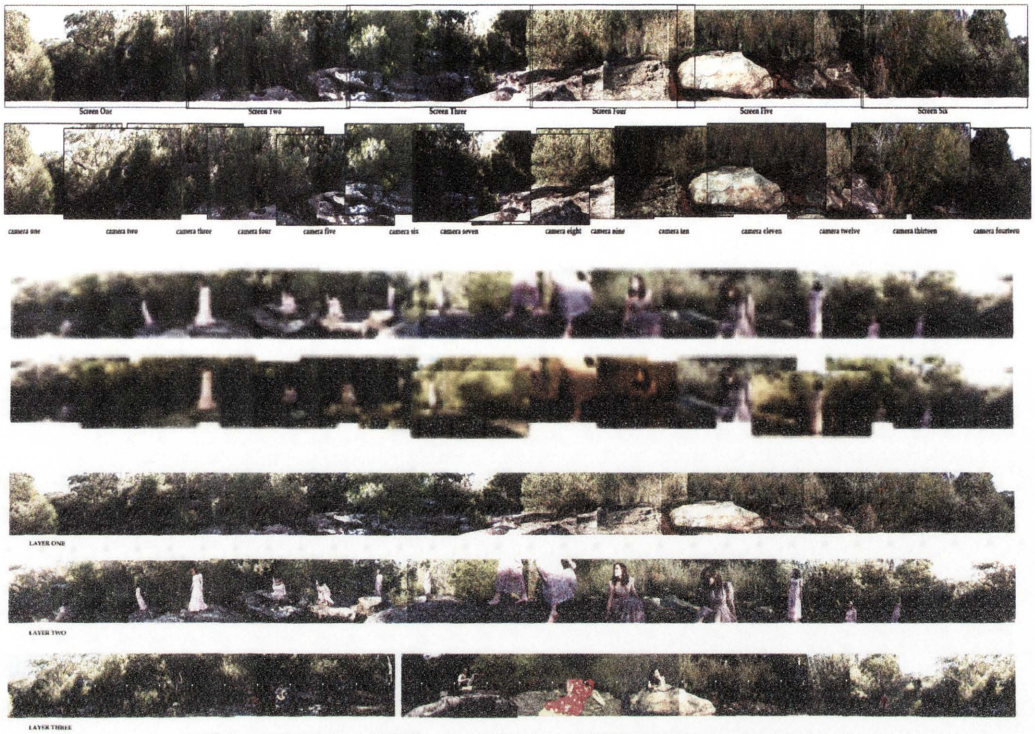

Figure 37. Visual Reference Guides (VRG): All Three Stages

These VGR images become representative of the location, as slowly, cropping the image, testing this way and that they come to represent *Crystal Pool*. By advantageously cropping and editing new layers, one is continually blending and melding the digital image in search of true replication. Experimentation with still frames allowed for immeadiate results although these files were not small they were easier to work more quickly in than large data video files. The VGR's were produced in August 2008 and assisted in the video edit substantially.

5.4.2.4 Creating Sound Elements

"Binaural: adj 1: relating to or having or hearing with two ears; "binaural hearing" [syn: binaural, biaural] [ant: monaural]"

The diagetic audio was captured using a binaural sound capture device designed specifically for the bush environment. Additional lapel microphones and DAT machines were in use for recording specific sound effects (birdsong, splashing etc).

Binaural recording is a method of recording audio that uses a special microphone arrangement intended for replay using headphones. Dummy head recording refers to a

specific method of capturing the audio, generally using a bust including pinnae (outer ears). The device was produced by sound engineer, Tim van de Berg, director of Illawarra Production Services (for an illustration of the device used on location see Figure 39). A binaural recording device is a two-channel listening device equalized in-situ to compensate for differences between left and right earphone transducers, and the ears themselves. The quality of the audio is accomplished during a process that captures original sounds at their source using two channels, which later plays back into the headphones using two channels. The system improves the listening experience for a participant through the use of sound clips created for participant engagement with headphones. Therefore, the reproduction of the atmospheric sounds, recorded using a binaural recording device, should assist in creating a more dynamic surround-sound score environment; enhancing the participants' experience of the environment they are viewing (Gilkey and Anderson, 1997).

A ten minute sound score was also composed by extracting live sound from each of the fourteen cameras. In this way a surround soundscape was produced as elements of running water were juxtaposed with wind and bird calls in post production. A process of positioning the sound elements according to their location within the exhibition environment. Here a dual playback sound system splits the room, with two speakers at one end and three at the other.

Figure 38. The Binaural Sound Capture Device on location at *Crystal Pool*

As Stage One required only the natural sounds of *Crystal Pool*, a five minute soundscape was enginnered to replicate a surround-sound installation. Two playback systems were designed to produce this effect in the exhibition space, and the participant is wearing headphones in order to block extraneous sounds from their engagement. In Stage Two a solo piece of music is introduced to create a more dynamic and cinematic experience. Stage Three introduces an additional twelve pieces of music which were sequenced to

play upon participant activation. In this way the music takes a more central role as diagetic sounds continue to play, underscoring the screen characters melodies. Each piece was chosen to capture and represent the screen characters persona, with a broad range of musical styles implemented to create and sustain, depth and breadth of engagement.

Index #	What	File Name	P#1	P#2	P#3	Code	Running order	
1	General background	S1.wav	0			[0,"s1.wav"]		[0,"s1.wav"]
2	Stage Two background	S2.wav	0			[0,"s2.wav"]		[0,"s2.wav"]
3	Swimmer	S3.Wav	7.314	16.03	24.61	[7.314,"s3.wav"]	S6	[0,"s6.wav"]
4	Bushwalker	S4.Wav	7.314	16.03	24.61	[16.03,"s4.wav"]	S8	[1.317,"s8.wav"]
5	Clown	S5.wav	7.944	16.41	25	[25,"s5.wav"]	S11	[3.504,"s11.wav"]
6	Drifter	S6.wav	0	8.424	16.94	[0,"s6.wav"]	S13	[4.697,"s13.wav"]
7	Lamas	S7.wav	0.6378	9.236	17.69	[9.236,"s7.wav"]	S14	[5.608,"s14.wav"]
8	Illustrator	S8.wav	1.317	9.882	18.4	[1.317,"s8.wav"]	S3	[7.314,"s3.wav"]
9	Adagio	S9.wav	1.715	10.31	18.86	[18.86,"s9.wav"]	S7	[9.236,"s7.wav"]
10	Painter	S10.wav	2.576	11.06	19.56	[11.06,"s10.wav"]	S10	[11.06,"s10.wav"]
11	Woman	S11.wav	3.504	12.05	20.58	[3.504,"s11.wav"]	S12	[12.8,"s12.wav"]
12	Girl	S12.wav	4.266	12.8		[12.8,"s12.wav"]	S15	[15.25,"s15.wav"]
13	Birdwatcher	S13.wav	4.697	13.46	21.86	[4.697,"s13.wav"]	S4	[16.03,"s4.wav"]
14	Birdmann	S14.wav	5.608	14.06	22.79	[5.608,"s14.wav"]	S9	[18.86,"s9.wav"]
15	Guitarist	S15.wav	6.9	15.25	23.9	[15.25,"s15.wav"]	S16	[21.26,"s16.wav"]
16	Girl	S16.wav			21.26	[21.26,"s16.wav"]	S5	[25,"s5.wav"]

Table 30. Wav Sound files for *PEGASYS* Application

Table 30 illustrates how individual sound clips were programmed to respond to participants interaction. When a participant lined a screen character within the invisible middle icon (see 5.5.3.3) of the interface a WAV file was programmed to respond. Column one of the table refers to the audio clip number, column two indicates who or what the file is associated with, column three gives the file name. Columns four, five and six indicate where on the sequencer these clips are permitted to play, note that each WAV file is accessible in more than one location depending on where the participant is located along the sequencer (the act of panning the 360 degree environment means that the media is capable of panning left or right for an extended duration). Column seven gives the code allocated to that WAV file and column eight presents a running order of sound clips in the event that no sound clips are activated in the third stage of interaction. See *PEGASYS* Drive/ Folder 3_New Work/ Sound Files/ www.Marianthe Loucataris.com

5.4.3 The Video–On-Demand Database Design

As we saw in 5.1 *The Evolution of the Concept*, the final system design is comprised of a series of technologies, knowledge of which grew from conceptual thinking and planning about various system designs, refered to as Versions. In this case there were four

versions, three of which included the feature of video-on-demand (VOD) as a delivery output. Each iteration changed the system's design features until the ability to produce a working system became feasible.

Research into systems known to support VOD concluded that existing systems were cost prohibitive and or technically so complicated that their physical constraints prohibited them from further consideration within this research project. Interactive Television (iTV) is one example. This industry merges the internet with digital TV enhancing the experience of traditional TV in two dimensions: enabling interactivity and distributing video-on-demand scenarios. The iTV framework requires a content provider and broadcaster to transport the technology to the reciever computer. An interface allows for a two-way interaction with the receiver computer, from which the data can be accessed through a remote control device, visual display technology or an accessory (Schwalb, 2004).

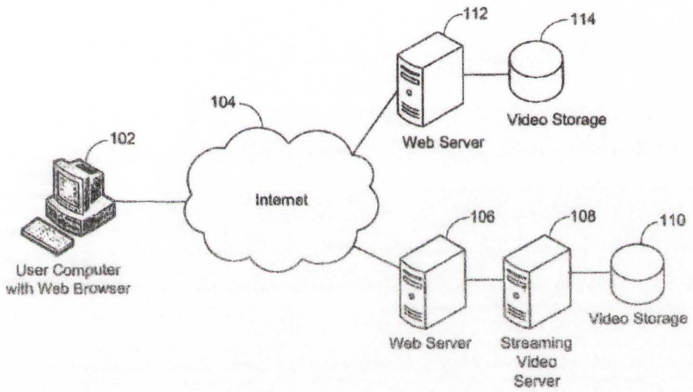

Figure 39. Method for Streaming Panoramic Video and images between a server and browser-based client application. Schwalb, 2004

Table 31 illustrates the VOD building blocks required in post-production to deliver the content to the viewer in the context of ITV.

Video Aquistion	Video Encoding	Video Processing	Video Management
Satellite Reception	MPEG-2	Transcoding	CAS/DRM
Off-Air Reception	MPEG-4AVC	Transcripting	Remote Operations
Satelite Off Air Fibre Receivers	Standard Definition	Splicing	Metadata
Signal Conversion	High Defintion Audio Encoding	Multiplexing	Billing
			VOD Servers
			Video Applications

Table 31. Video-on-Demand

Implimenting this type of system into *PEGASYS* was too large scale for this research project thus, a new method for delivering the video clips in a panoramic form was required.

One suggestion arose through conversation with Sid Fels, Associate Professor and Director of the Media and Graphics Interdisciplinary Centre (MAGIC) at The University of British Columbia. Fels suggested the use of an autostitch application. This software creates panoramic images from stills taken to form a panoramic image. On the 24th November 2007 an experimentation was done at a sight called HoneyMoon Bay, in NSW, Australia. Here, seventy still shots of Honeymoon Bay were taken with which to experiment by creating panaramic views. Close up shots were dentified as well for insertion in an interactive experience. In Photoshop CS pans 1 and 2 were created with 16 stills in HMB_Pan1 (side A) and 16 in HMB_Pan2 (side B). These files were then layered together within the one frame measuring 175cm x 10cm. For a detailed view see the *PEGASYS* drive accompanying this document.

Figure 40. A 360 degree Panoramic of Honeymoon Bay, NSW. Shot in still frames

The experimentation continued by using the original stills in a stitching software to test the results. The results were not good, indicating that extreme precision would be required in order to recreate the vista in full. The idea of using stills software to stitch the images into place required first breaking down the video stills frame by frame. The stills are stitched together and then played back in real time through Quicktime by turning them back into a movie file. The task of breaking each HDV clip into separate file formats and stitching them back together seemed insurmountable. Another option had to be explored.

By January 2009 consultation with Donegan, the assistive technologies specialist, confirmed that the HDV clips were required to be navigatiable via a series of interface icons or 'click icons'. This action could move the video clips across the screen but it would not assist them in running in sync from frame one. The aim then became to design a system that could load and play in-sync, three different streams of video data and many more sound cues.

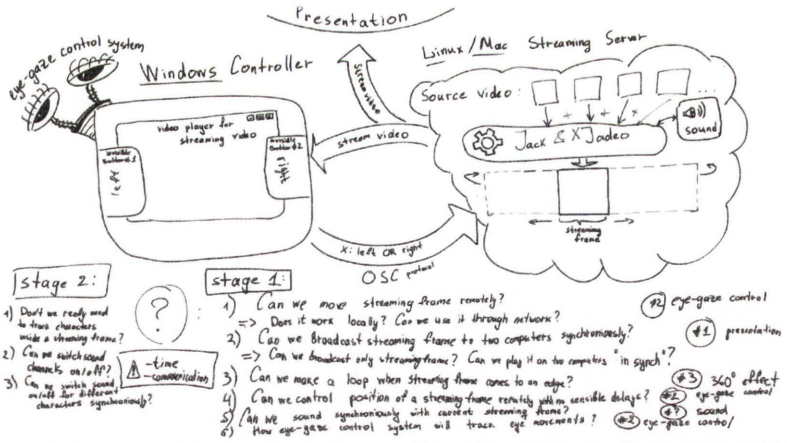

Figure 41. Conceptual Design for the System Operations by Technologist Oleg Sakharov

The images below are still frames from each of the video segments taken on location (see Figure 42). The color grading has not taken place here so it is possible to see what the original media looked like before corrections were made. Each one of Stage One clips (fourteen FOV) were five minutes in duration, Stage Two clips have a duration of eight minutes and Stage Three clips run for ten minutes.

Figure 42. Illustration of the 42 HDV clips before Post-Production

For a preview of how the VOD system looks in operation see *PEGASYS* Drive_ Folder 6_ Application. Instructions on how to operate the system are also found in Folder 6. This media application enables the participant to navigate the full 360 degrees and access the three stages of visual content. Sound is not included as a working component in this application. Below are examples of the variation of canvas sizes created to determine which was the most efficent and effective in playing back in real time.

File Dimension	Outcome
4000 x 1080	Custom Anamorphic / CODEC: AIC / Name: RAW

File Dimension	Outcome
2880 x 1080	Custom / CODEC: HDV1080i / Pixel: HD 1440 x 1080 Produced enough room for approximatly 300 degrees of the scene

File Dimension	Outcome
1440 x 1080	16:9 / Anamorphic Off / CODEC: Apple ProRes (HQ)

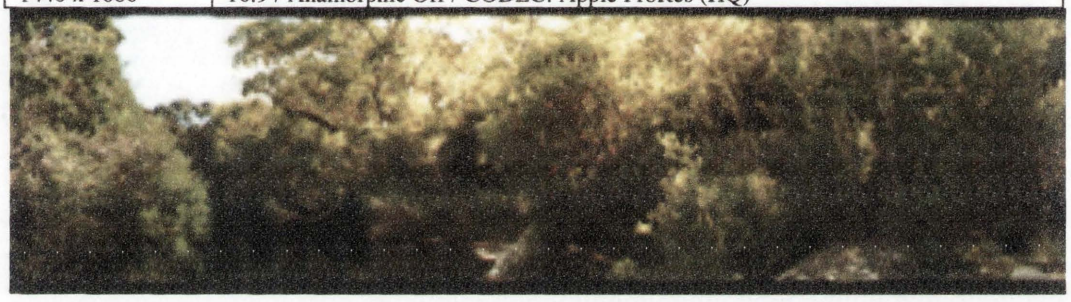

Figure 43. Canvas Sizes

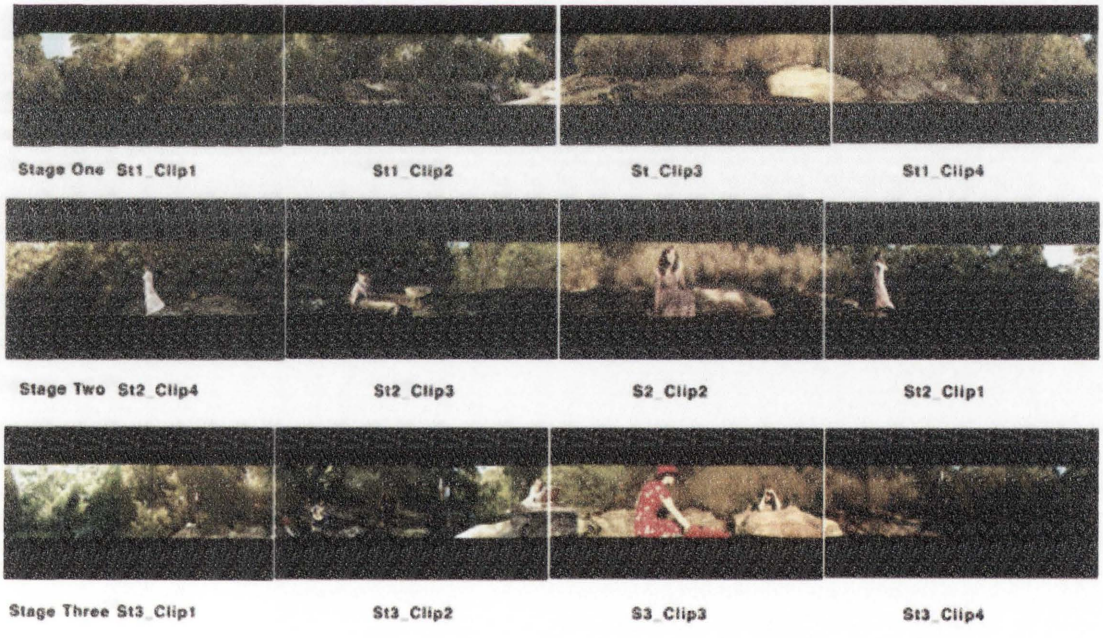

Figure 44. Illustrates each of the Four Clips for each of the Three Stages

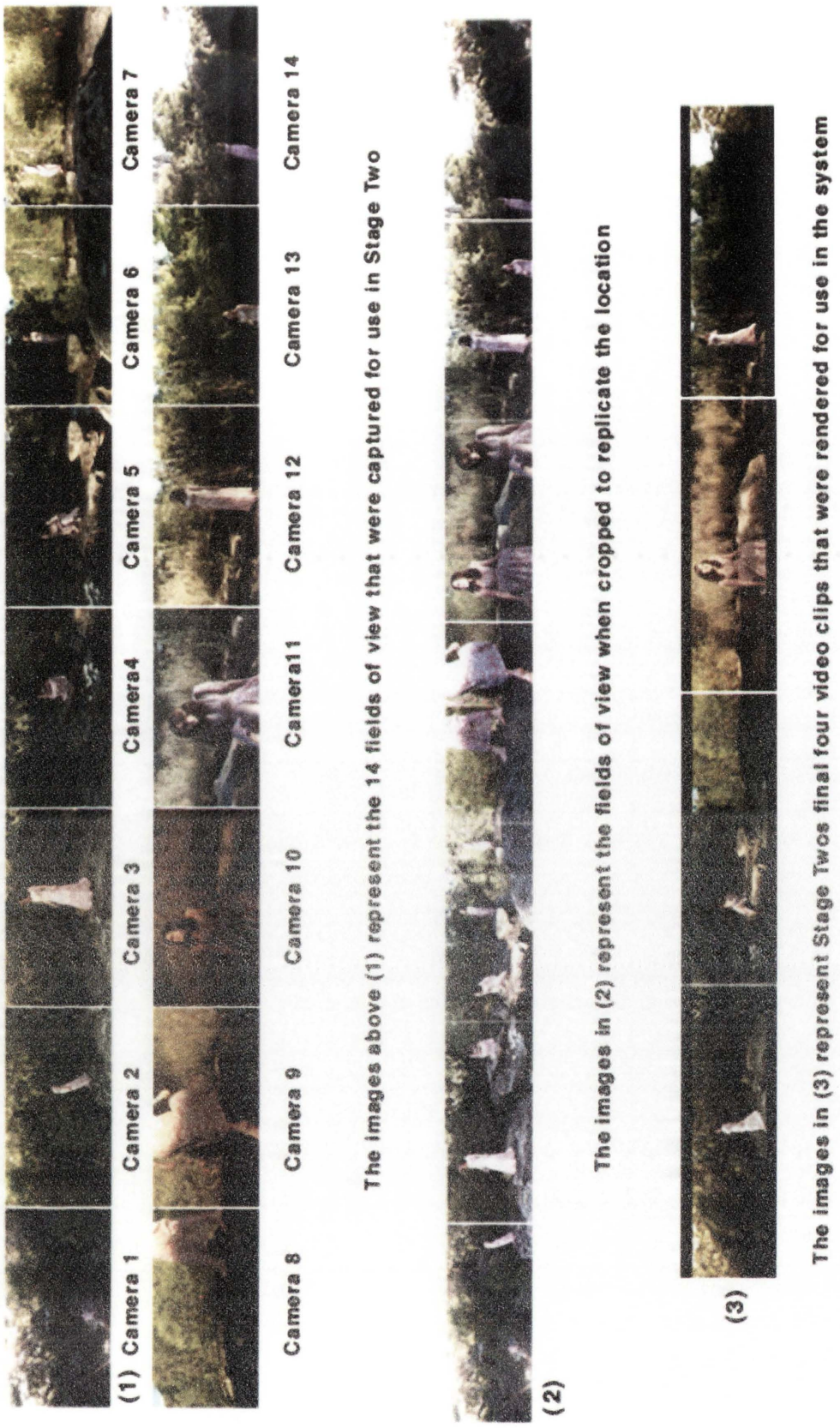

Figure 45. Illustrates the process for clips created for Stage Two

Figure 48 illustrates how the fourteen FOV from each of the seven cameras were cropped first into seven video clips and finally into four. For a closer examination of how all the clips were created from the captured footage see *PEGASYS* Drive/Folder 3_PEGASYS_New Work/Visual Reference Guides (VRG).mov (01:37 Duration). In this movie you can also view the editing suite configuration.

5.5 The Form of the System

According to previous research into Media Presence (ISPR, 2000), the technological form of the system should consider the number and consistency of sensory outputs (see 2.1.6.1). The sensory output in this case refers to the system response time taken between the participant's action and the perceived effects of those actions upon the displayed environment (Freeman et al., 2002). Latency of visual feedback has been seen to detract from presence engagement, when significant intervals of time pass between the action and the re-action. The form of the technology should not hinder the participants experience and should facilitate a natural flow from participant to computer. For more on the form of the system see 5.3.1.7.

5.5.1 Identifying Issues with Eye-tracking Control

In the section 2.4.1.2 we looked at how eye-tracking technologies are improving peoples lives through research into the implementation of creative interfaces. This research questions as to what influence, if any, eye-tracking has on a participant's experience of a presence-generating art system. Factors associated with eye-gaze control that relate directly to this work are: the design of the systems interface, interface usability, target areas or icons, the training associated with trial and error, the technological aspects of calibrating the device, the response of the system to human input, emergent narratives and their influence on the decision making processes of the participants, issues of stress attention and focus, and environmental conditions and personnel factors. These factors have been discussed by other researchers who introduce a number of additional issues to consider. These issues are:

- Calibration of eye-tracking system with participant (Dorr et al., 2007)
- Confirming an action (Dorr et al., 2007)
- Training associated with trial and error of procedures involved in not looking at certain regions of the screen in order to avoid confusion (Dorr et al., 2007).
- Designing the interface with big target areas to benefit an eye-tracker (Agustin et al., 2007).
- Researchers interested in emergent narrative (Perreira et al., 2007).

Gaze trackers rely on the technologies ability to focus on the participant's pupil to track the eyes progress. Environmental conditions can affect the calibration as too much light in a bright environment reduces the size of the pupil (Droege et al., 2007).

Researchers in this domain are conclusively determining that gaze-based interfaces may be considered superior to traditional tools for interactivity even with users who have had no previous experience of the technology (Droege et al., 2007). This research tests the factors mentioned above through observation and interview. One factor to consider for implementing eye-tracking into the system design includes the fact that the interface should be simple enough for participants to understand the navigation methods after only a short period of instruction. By observing and interviewing the participants it should be possible to determine what role the eye-tracking device plays in manifesting or detracting from the sense of presence. Participants are observed using the system which is evaluated based on their responses through questionnaire and interview.

5.5.2 Applying Eye-tracking into the Design Features

The art system design considered a number of factors. In Chapter Two, the attributes that contribute towards the experience of presence were identified and extrapolated upon. This revealed that the main contributing elements for system design consisted of, or were determined by; the form of the technology; the content of the system, and amongst other things, the participants' ability to suspend disbelief and engage with the system in a willing way, one that replicates the experiences of every day. These three key factors, form, content and participant were considered in respect to what is known about how presence is experienced. This PBR process set out to discover if the attributes of eye-tracking technology could in fact enhance or detract from participants' experiences of presence within an art system.

Eye-tracking devices alleviate the requirement for the participant to involve their body in the experience and are designed in order to meet the requirements of participants with limited physical maneuverability. For example people with conditions such as motor neurone disease (MND), cerebral palsy and other "locked-in syndromes". By using eye-tracking software it is not the participant who is physically required to move but a computer driven system that facilitates access to the audio-visual content. Previous research into eye-gaze interaction (Da Silva et al., 2007, Dorr et al., 2007, Figueiredo and Gomes, 2007) confirms the author's experiences of designing interfaces for presence engagement (Moss and Edmonds, 2006) suggesting that participants are more likely to

periodically immerse themselves if the interface and general environment does not preclude them from doing so. Therefore, an art system that does not require the usual body parts (arms, hands, head) to operate, facilitates an engagement that can be solely focused on navigating through gaze point switching or eye-tracking. Operation of the art system was structured around the use of a Tobii X120 eye-tracker that facilitated an interaction between participant's navigational demands and aforementioned audio and video clips.

Eye-gaze technology otherwise referred to as eye-tracking, enables participant's to navigate an interface embedded within the displayed environment. Participants simply move their eyes to interact with the digital media content rather than using a mouse or keyboard. Participants of *PEGASYS* pan around *Crystal Pool* using an eye-tracking device (X120) that activates the video-on-demand (VOD). It is estimated that participants of a hands-free system are more likely to become 'located' within the content and therefore less likely to be distracted by other worldly events, in other words the state of presence is much more likely to occur.

The Tobii X120 Eye-tracker is designed and packaged into a single unit that has no moving tracking devices, this is anticipated to allow for movement of head and upper body to the extent that *PEGASYS* requires for its participants. The built-in head movement compensation function ensures that eye-tracking is maintained throughout the experience, providing the participant with flexibility around accessing the hands-free interface. The tracking unit can be adjusted for automatic calibration although in this case a volunteer assists in the deployment of the technology. Eye-trackers work on basically anybody with fully functional eyesight, glasses and contact lenses do not hinder the process and 'drift compensation' allows for changeable exhibition light conditions. Standard interactive techniques and hardware (such as the mouse, keyboard, joystick) are replaced with a technology that simply requires the movement of the eye to deploy an interactive motion.

5.5.3 Exhibiting Eye-tracking Within an Art System

The art system described in this report utilised a Tobii X120-203-73700036 eye-tracker (hereby referred to as the X120) to produce a hands-free engagement. This device executed a signal to the Windows XP software in a PC which then transfered data to a Macintosh G5 computer. The Macintosh application worked on two levels. First the OSC Sender received the data signals transmiting them to the receivers of an application built in Apple Quartz Composer. This was networked using LAN technology. A 2 Port KVM

switch allowed for the control of two computers from a single UBS console. The operator / evaluator was able then to switch between the interfaces of both the PC and the Macintosh computer. The rear projected digital display screen received data from the projector which had two inputs to allow for the switching mechanism to operate.

5.5.3.1 Installing the Eye-tracking Device

The X120 and a height adjustable floor stand were delivered to CCS Interaction Lab in early October 2009 approximately three weeks before exhibiting in the exhibition space, Beta_Space (see Figure 49). As the technologists had busy schedules time constraints meant that long days stretched into long nights as we experimented with the technology. The third party code had been previously written and tested for use within the networked system however the installation and configuration of the device to the system was a demanding process. There was a lengthy installation process with software downloads and hardware configuration for use in Windows XP.

Using the application Tobii Studio in conjunction with the X120 it was possible to configure the system for use with a projection screen rather than a computer monitor which is standard for its use and application. In the projection screen setup it was important to ensure that the eye-tracker was able to track the eyes over the entire screen in order to ensure full coverage of the media by the tracker. This was done by configuring the X120 to operate to the correct screen size, with the correct distance to the screen, and the correct tilt angle of the eye-tracker at CCS before installing it in Beta-Space. We learnt through process that when positioning the X120 within the exhibition space there are four items of paramount importance to ensure that the X120 is able to operate efficiently. These are that:

- The X120 is placed below the projection screen without covering the bottom of the screen for the participant watching the screen.
- The distance from the participant's eyes to the tracker is approximately 70 cm.
- The eye-tracker is placed so that the gaze angle does not exceed 35 degrees to any point on the screen.
- It is very important to calculate the correct distance from the tracker to the screen otherwise the eye-tracker cannot track the entire area. If the eye-tracker is placed to close to the screen there is a risk that the gaze data for the corners of the screen is not collected. The correct distance is calculated by using basic trigonometry including the gaze angles and the screen size.

Figure 46. The Tobii X120 in use at Beta_Space

A secondary monitor (see Figure 47) was used to view the eye movements made by the participants' during the session, by using the live viewer function in Tobii Studio.

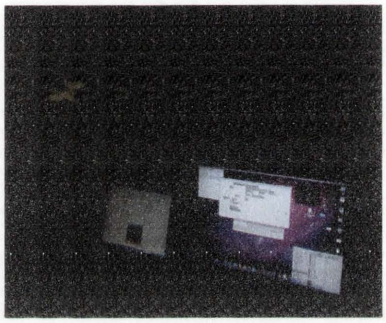

Figure 47. Secondary Monitor (PC laptop) Positioned on the Left

In respect to the form of the technology and how it influenced the characteristics of the system for the participant we need to consider a number of factors. Factors associated with gaze-control that relate directly to this work are; the technological aspects of calibrating the device, the design of the interface/ interface usability/ target areas, participant training associated with trial and error, the response of the system to human input, emergent narrative / issues of stress, attention and focus, environmental conditions and personnel factors.

5.5.3.2 The Art System's Interface

The interface was designed in consultation with Donegan from Smartlab Digital Media Institute in the UK. Meetings took place at CCS in Sydney Australia in September 2008 and then at Smartlab in London, UK in June 2009. Primarily the aim was to design an interface that was so simple in its intention that no misunderstanding could occur for the participant (see Figure 51). It was designed to work in relationship with an introduction of how the interface works which was given by the evaluator (who was also the technical operator). The introduction on how to operate the interface followed the calibration process that each participant undertook.

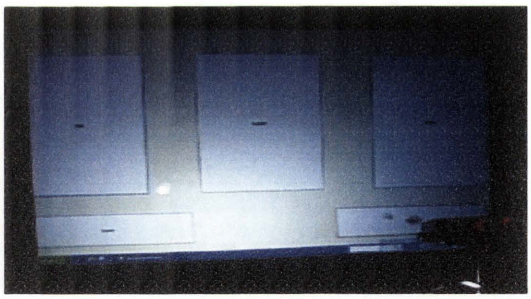

Figure 48. The *PEGASYS* Interface

The interface consists of 'live' areas or icons, each of which is activated by means of eye-gaze alternatively known as eye-dwelling. The participant must hold their gaze upon the designated area for approximately four seconds in order to activate it and initiate a response. As illustrated in Figure 51 the large icons on either side pan the footage left and right accordingly, the centre icon activates sound clips in Stage Three only, and the bottom icons move the participants from one stage into another. These active areas are invisible in the *PEGASYS* experience. The participant has to remember where they are and what they do or else they are free to experiment. A red circle appearing on the interface indicates that the eye-tracker is getting a reading from the participant and shows where they are looking. When contact has been made by the participant, the interface indicates that an action can take place by highlighting a flashing red box on the icon in question.

5.5.3.3 The Interface Icons

The interactive icons are represented as text in gold Helvetica font on a black background. They are designed to reduce ambiguity by clearly stating what each icon will do.

Figure 49. Interface Icons

5.5.3.4 Interface Interactivity

Changing from one stage into another is achieved at any time during the session. Next Stage and Previous Stage icons are embedded in the black interface below the visual content. The participant simply has to activate, by holding their gaze on the icon to move between stages. As Stage One had no previous stage only the Next Stage icon is viewable.

Figure 50. Illustrates the Next Stage icon

Figure 51. Illustrates both icons.

Stage Two is the middle stage and therefore has both the icons on view. Stage Three is the last stage and therefore one can only move back into the previous stage.

Figure 52. Illustrates the Previous Stage icon.

Each stage is linked so that dependence upon where the participant is located in the environment when they activate the 'next stage' or 'previous stage' icons, locates them in the same place in the new stage.

5.5.3.5 Calibration of The Eye-tracking Device with Participant

Participants under went a process requiring calibration of the system in order to establish a number of factors. These factors include the calibration of the device to the participant's particular physical attributes, instruction on the functionality of the system and an introduction on how to operate the systems interface.

In the exhibition space the evaluator is also the technical operator and assists the participant by instructing them on how to operate the system. It is important to consider that the participant's physical placement in front of the X120 is a major contributing factor to the systems ability to function as designed. First the participant sits in the chair in front of the X120. They then have to maneuver themselves into a position that allows the device to read their eyes without obstruction. Using the 2 port splitter switch an image of the MyTobii desktop was projected onto the screen. A track status window allows both

the participant and the evaluator to see if the X120 can read the eyes as demonstrated in Figure 56. A track status sound of beeping can also be implemented to assist the participant. The two dots symbolizing the eyes are required to be as close to the centre of the track status window as possible. The closer the participant is to the ideal location the faster the beeping sound.

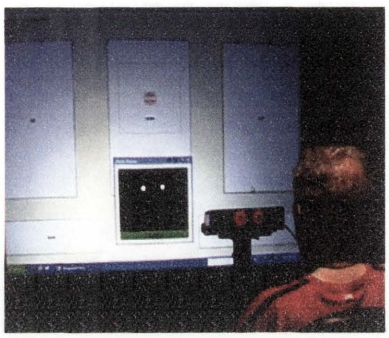

Figure 53. Example of the Track Status Window

In the Figure 56 example the track status window is positioned at the bottom of the screen and has the green strip running underneath it. The strip is green when the device could read the eyes and red when no dots appeared thus indicating that it could not track the participant's eyes.

- When the eye-tracker seemed unable to detect the participant's gaze it was that the line of sight from the eye-tracker was obscured. Reasons for this were attributed to:
- The participants head being required to be approximately 60/70 centimeters away from the X120, not more or substantially less
- Half closed eyes or droopy eye lids covering the eyes
- Positioning the X120 too low, in which case nose or cheekbones covered the eyes from the view of the tracker
- The participant's head had to be positioned straight in comparison to the X120

Many of these factors were overcome through the use of the chairs ability to be raised and lowered, it was also possible to change the height adjustable floor stand used to hold the eye-tracker. Occasionally an additional light source was required to illuminate the room and hence enhance the view to the participant's eyes (6.7.3.1). Once the X120 and the participant were aligned the calibration process began. Calibrating the X120 for each participant was necessary in order to teach the system the characteristics of each participant's eyes. First a pulsating circle moved across the screen, the participant follows the circle across the screen focusing on the black dot in the middle of the circle.

Next, a plot representing the quality of the calibration is displayed. The more concentrated the green and red lines were in the circles in the plot, the better the calibration. This process was repeated until a perfect calibration was indicated.

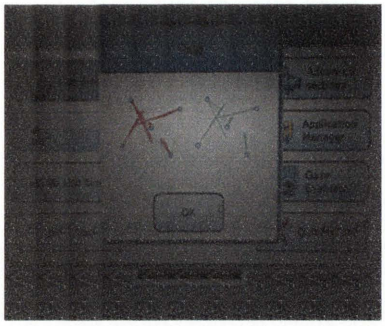

Figure 54. Example of the Plot Window used in Calibration

Figure 57 Illustrates an example of bad callibration. In this case the process would be repeated until all the colored lines are represented as dots. Once the operator is satisfied, a grid size test was then conducted. This enabled the participant to test the eye-tracking device as a form for creative engagement.

5.5.3.6 Confirming an Action

The grid size test illustrated to participants how they should use the eye-tracking device to assist them in interacting with the art system. This time the pulsating dot indicated to them where they were looking on the screen. As participants moved from one item to another the pulsating dot would rest where their eyes lay. If they held their gaze for a few seconds the pulsating dot would activate the box containing the item and the box would also pulsate. In this way participants had an opportunity to understand the relationship between their gaze and the control it offered in terms of interactivity. The items on the screen gradually became smaller and smaller thus the participant was required to move about more freely and experiment more rapidly with the interface. This test also indicated whether the device was configured properly for the participant. If they were unable to activate the items then a new calibration was undertaken.

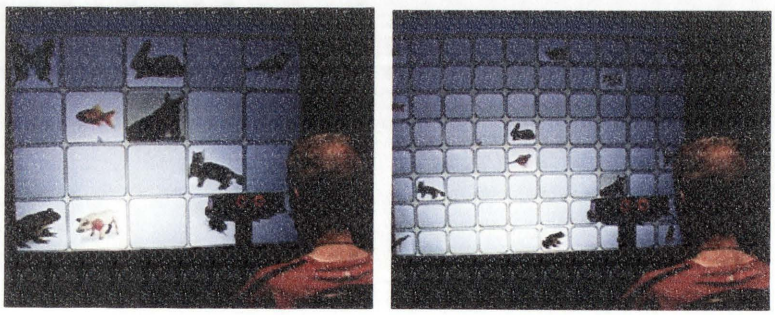

Figure 55. Examples of the Grid Size Test

5.5.3.7 Experimentation with the *PEGASYS* Interface

The *PEGASYS* interface consisted of three large panels or icons and two smaller ones located in the bottom right and left hand corners. Once the participant understood how to operate the eye-tracking device using the grid size test, they were instructed upon how to operate the *PEGASYS* interface. It was explained to them that the rectangles on the screen represented invisible icons embedded within the video content or more to the point designed as interface target areas. In Figure 59, the target areas are illustrated behind the track status window. The red pulsating dot in the centre target area or icon represents where the participant is looking. In this example the outline of a red box is also visible. This red box illustrates to the participant that an action is occurring due to their extended point of gaze. Participants were encouraged to experiment with the interface and ask questions about it if they so desired.

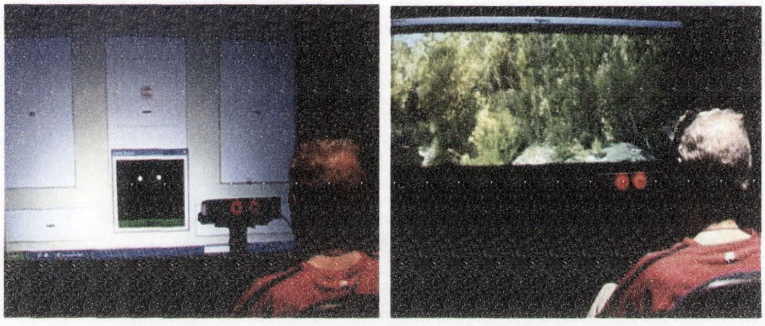

Figure 56. Examples of the *PEGASYS* Target Areas

There were a number of factors that the participants were made aware of at this stage of the process. These factors were:

- That the icons although invisible during the operation of *PEGASYS* are still located within the interface, as illustrated in this mode
- That holding their gaze in the space where the large icon on the left is will pan the visual media to the left.
- That holding their gaze in the space where the large icon on the right is will pan the visual media to the right.
- That holding their gaze in the center icon will, in Stage Three only, activate and play sound cues through the headphones.
- That holding their gaze on the bottom right icon will take them forward into a new stage and that the icon on the bottom left will take them back a stage.
- That in order to move between stages they must either wait for a period of time to elapse (30 seconds) or pan either left or right in the stage they are in and then activate the move.

5.5.3.8 Other Issues associated with Eye-gaze Control

The table below outlines issues associated with eye-trackers as discussed by previous researchers and identifies the outcomes of this research through interview and observation. The video documented sessions also assisted in determining these results.

Issues Associated with Eye-Gaze Control	Researchers
Calibration of Eye-tracking System with Participant	Dorr, Bohme et al. 2007
Confirming an Action	Dorr, Bohme et al. 2007
Overcoming these issues: Research in Action: At the beginning of each session a calibration took place that taught the system the characteristics of each participant's eyes. During the calibration the participant followed a pulsating circle moving over the screen. Generally, participants were found to have no difficulties in following this procedure. Next, a grid size test was conducted to teach the participant how to activate the icons embedded within the interface. Animals were chosen as the image which displayed on a grid pattern. This grid size test reduced the size of the icons with every test until the participant has moved from 2x3 grid to 8 x10 grid. The participant focused on the animal of choice until a 'ping' sound and visual cue indicated that the icon had been activated. This confirmed the action. Most participants had no trouble in completing this action. The *PEGASYS* interface was displayed upon the screen and the participant learnt how to operate the icons in respect to their input and expected outcomes. By holding their gaze on the icon participants could clearly see how the pulsating red dot activated the icon. Some participants had trouble understanding how this action caused a reaction when the media was introduced. Most participants required that the *PEGASYS* interface and the PEGASYS content screen were flicked between a number of times in order that they could see where the icons lay within the media content framework.	See **5.5.3.5** *Callibration of the eye-tracking device with the participant.* See **5.5.3.6** *Confirming an action* See **5.5.3.2** *The Interface*
Training associated with **trial and error of procedures** involved in not looking at certain regions of the screen in order to avoid confusion	Dorr, Bohme et al. 2007
Overcoming these issues: Research in Action Some participants did note during the interview that they found the trial and error process quite demanding. Participants who spent an extended time on the system, or who 'got' the system were able to navigate as they chose, others found it more difficult to avoid looking at certain areas where icons were embedded – thus causing a reaction. Overall participants were mostly concerned with getting the system to do as they expected it to rather than working out how to operate the system as it was designed.	See **5.5.3.7** *Experimentation with the PEGASYS Interface*
Designing the interface with **big target areas** to benefit an eye tracker	Agustin, Schantz et al. 2007
Overcoming these issues: Research in Action The *PEGASYS* Interface had large invisible icons which more than adequately covered the area of the media content. The only issue that arose was that for some participants the bottom right hand icon (which enabled people to move into the next stage) was partly covered by the X120 device. Rather than reducing the hit and miss ratio the larger hit area worked well for most people but it was found to cause some confusion. Some people found the hit area too large and underplayed the systems ability to operate through the large hit area icons. The design of the icons or interface played an extremely important role in the overall interaction flexibility and design aesthetics.	See **5.5.3.3** *The Icons*
Researchers interested in emergent narrative.	
Eye-gaze interfaces facilitate non-intrusive equipment for eye-tracking. Perreira Da Silva et al research concerns issues of stress, attention and focus of the player as they observe player behaviour. They conclude that player stress is observable and is detectable through body language. The ability to design a 'game' with a guaranteed variation of stress during 'game' execution facilitates a certainty that players or participants will not become over stressed thus retaining an element of 'fun'.	Perreira Da Silva et al 2007
Overcoming these issues: Research in Action *PEGASYS* was designed to encourage a stress free experience. Generally this was found to be achieved, however, the eye-tracking device became a source of stress for some participants. Through observation of the video documentation it is possible to identify at what point the situation becomes frustrating for these participants. The non game aspect of the design did however include 3 stages of	See **5.3.1.7** *The form of the system*

interaction thus the 'fun' element was maintained (80% agreed to enjoying themselves).	
Lighting Conditions	
Gaze trackers rely on the technologies ability to focus on the participant's pupil to track the eyes progress. Environmental conditions can affect the calibration as too much light in a bright environment reduces the size of the pupil. Likewise researchers also concluded that operating systems in conditions with high infrared level – natural light, or with halogen lights impedes the ability of the technology to read the pupil adequately and consistently.	Droege, Geier et al. 2007 Figueiredo and Gomes 2007
Overcoming these issues: Research in Action Difficulties with issues of environmental light conditions were ongoing throughout this evaluation process. To the contrary of other researchers, this process was hindered by lack of light and some participants required an additional lighting source. The infrared aspect of the technology did not seem to enhance the system. The lighting conditions therefore became a unique feature of each participant's experience. Only about a quarter of participants could operate the system with no additional light source.	See **6.7.3.1** *Lighting Conditions*

Table 32. Some of the Factors Associated with Eye Control Technology

5.5.4 Hazards

5.5.4.1 Emission of Near Infrared Light

The MyTobii X120 eye-tracker contains illuminators that emit light in the near infrared (NIR) spectra. The light emission levels were tested at ETL SEMKO in Stockholm according to the European laser safety standard IEC/EN 60825-1/A1-A2 and the US standard Laser Notice No. 50. These standards regulate the safety of products containing illuminators emitting light in the near infrared spectra. The standards contain test procedures to verify that the emitted light will cause no thermal injury to the retina of the eye of a person being exposed to the light. Under regular operation of a MyTobii product, the user is exposed to less than 0.1%(1/1000) of the accepted long-term exposure according to IEC/EN 60825-1/A1-A2 and Laser Notice No. 50. (User Manual: MyTobii Version 2.4 p.12)

5.5.4.2 Near-Infrared Thermal Hazards to the Lens

Prior research into near-infrared (NIR) light indicates that it may accelerate the ageing process of the lens of the eye. A relevant publication discussing a study of glass and steel workers is "Evaluation of Optical Radiation Hazards" by Sliney, D.H. and Freasier, B.C. (1973). This study examines the outcomes for the workers who were exposed to infrared irradiances as low as 0.04-0.008 Wcm-2 daily for 10-15 years. At this rate many of the workers developed lenticular cataracts. Measured against this study a participant of an eye-tracking device would be required to use the device for eight hours a day, seven days a week for 1000 years to receive the same exposure. (User Manual: MyTobii Version 2.4 p.12).

5.6 New Work Summary

This chapter began with a retrospective account of the process of the evolution of the concept in which it detailed the four conceptual versions of the produced art system. The results of a pilot study and likewise the results of study one were then examined in respect to the contribution they made to the art systems development. A description of the art system *PEGASYS* was followed by a section briefly informing the reader of the creative team involved in the production of the system. Next, the seven features that distinguish the art system were identified; engagement, spatial presence, ecological validity, the use of narratives, the use of colour and motion, sound and finally the form of the system. The section examining content production outlines the creation of the three stages of interaction particularly in relation to the location-based film shoot. The camera shelf and the video cameras used, the sound and the video-on-demand database design were then discussed.

Identifying issues with eye-gaze control and then applying eye-tracking into the system design meant that certain variables had to be addressed in respect to exhibiting eye-gaze tracking within an art system. These issues focused on installing the device, the interface design, interacting with the icons, changing from one stage of interactivity into another, the calibration of the device, confirming an action, and experimenting with the system response time. Finally, hazards associated with eye-tracking technology were outlined briefly.

Chapter Five New Work aims to assist the reader in gaining a perspective on the creative process undertaken to produce *PEGASYS*. Drawn together from influences as diverse as presence, interactive art systems and eye-tracking technology, *PEGASYS* is the manifestation of a research process that combines synchronous engaging content with the experience of navigating an interface through participant's eyes only.

The results of study one indicated that 84 percent of participants *enjoyed themselves* and 76 percent would *recommend the experience to their friends* therefore confirming that the experience of the digital media content of the art system produced pleasing results for audience members. In respect to knowledge gained through analysis of study one results it was interesting to note that through the use of the questionnaire a sense of presence was indicated to have existed for participants'. As study one focused on the experiences of the digital media content and contained no interactivity the presence-generating aspects of

the system were predicted to be minimal. However the questionnaire results revealed that certain attributes associated with presence-based engagement were experienced by some of the participants, some of the time. For example, 80 percent *felt themselves being 'drawn in'*, 56 percent of participants *felt involved* and 60 percent indicated that they *lost track of time*.

These results were pleasing to the artist as *PEGASYS* implemented interactivity designed to enhance presence engagement, clearly if presence signifiers were already indicated to exist through participants experience of the content then the system was well on its way to meeting its research aims. The ability of the system to seem to generate presence engagement with participants before interactivity became a feature illustrates how the choices made in preparation for the film shoot were appropriate and thoughfully considered. Choosing a location that drew participants into an environment of natural beauty, providing various engagement factors such as a variety of screen characters and re-creating diagetic sound elements all assisted in generating a sense of presence for participants.

In brief, the items identified through pilot study and study one results indicate that audiences often require encouragement to participate, that the systems interface must be clearly labeled and unambiguous, that the use of headphones in a public exhibition arena greatly enhances the experience for participants, that careful attention must be paid to the systems panning motion (form) in order to avoid the associated negative effects, that the sense of sounds coming from different directions within the displayed environment need to be consistent and not neceserly 'real life', that modifications to Stage Three visuals were required and finally that any extenstion of 'slip stream' illusion components would be appreciated by audiences.These identified components assisted in modifications to the system design in order to enhance the potential for participants to experience a presence-based engagement through a time-based media installation. For more information about the system see: *PEGASYS* Drive /Folder 5_ Appendix Six_System Operations/Instructions and Appendix Seven_System Technical Specifications.

The next chapter, Chapter Six Evaluation, describes how the experiments undertaken in the second part of the study assisted in evaluating participant's experiences of *PEGASYS*.

Chapter Six

"He who has never swooned is not he who finds strange palaces and wildly familiar faces in coals that glow; is not he who beholds floating in midair the sad visions that the many may not view; is not he who ponders over the perfume of some novel flower".

Edgar Allen Poe

6 EVALUATION

This chapter evaluates the data gathered using a systematic approach as outlined in Chapter Three. The comments made during the interview underlie the quintessential nature of the participants' interaction; their engagement and their experience of the system. The comments themselves provide many interesting observations but quite often the subtext contains a sense of wonder and astonishment.

> "I found my eyes following light and movement. I also tried experimenting with looking at things, which didn't particularly catch my eye - and also following what seemed to be the direction of sounds. I have no obvious clear conclusions but am pleased to have done it. At one stage I felt I was being hypnotized".
>
> Study Two. Participant # 6. Comment left on the questionnaire.

The chapter examines the results of the evaluation data from studies one and two. As study one results and impact were discussed in 5.1.6 *Study One Results* and 5.1.7 *Conclusions Drawn from the Previous Study*, the data from study two is examined in detail here.

The chapter starts by revisiting the research questions (6.1) and moves into discussing the two-part study (6.2) in respect to the process of evaluating the outcomes through observation (6.2.1.1), questionnaire results (6.2.1.2), the interview process (6.2.1.3), and the participant profile information (6.2.1.4). 6.2.1.4 extends to include information derived from each of the participants' sessions including session durations (6.2.1.4.1), age and sex (6.2.1.4.2), participants' occupation (6.2.1.4.3), and the time of the day of each session (6.2.1.4.4). Section 6.2.1.5 summerizes the use of video and stills documentation for data gathering that took place during the course of study two.

Section 6.3 *Evaluating the System Design* identifies how the system features were devised by applying two models for creative engagement. *The Model of Engagement*

(2.2) and *The Creative Engagement Model* (2.2). It addresses how the engagement models were implemented into the five steps system design for *PEGASYS* (6.3.3). Particular attention was paid to the process involved in designing to enhance experience through interactive modes and phases. The application of attractors, sustainers and relaters is also demonstrated.

6.3.3 *Evaluating the Designed Experience* is broken down into five parts in order that the audio-visual media components can be addressed individually and yet contextualized. *Step One* (6.3.3.1) includes the use of atmospheric sounds, *Step Two- Sustainers in Action* (6.3.3.2) includes a look at how the compositional music score was perceived, and *Step Three* (6.3.3.3) includes a section on how the dynamically generated sounds were received by participants. *Relaters In Action* are described in sections 6.3.3.4 Steps Four and Five (6.3.3.5).

Evaluation of the *Systems Features* in respect to participants' experiences of them is addressed in the next two sections. Section 6.4 focuses on the digital media content in respect to participants' experiences of it, namely; participant engagement (6.4.1 *Evaluating Engagement as a Design Feature*), the visual media content (6.4.2.*Evaluating Spatial Presence)*, 6.4.3 *Evaluating Ecological Validity (Sensory Presence*), 6.4.4 *Evaluating Narratives and Emotional Content* and 6.4.5 *Evaluating the use of motion and colour*. The section addressing sound design follows (6.4.6 *Evaluating the Audio Components*, 6.4.6.1 *Audio Systems*, 6.4.6.2 *The Surround-Sound Environment*, 6.4.6.3 *The Use of Headphones)*.

Next, section 6.5 considers the *Systems Features* in respect to the form of the technology. The systems form is considered in respect to participant's experiences of it, namely; the system response time: 6.5.1 addresses evaluating the system response time, and 6.5.2 as a sensory output. 6.5.2.1 examines the ideal viewing distance and 6.5.2.2 looks at how obtrusiveness the technology is. Evaluating participants' experiences of eye-gaze tracking is addressed in section 6.5.3. This concludes this investigation into eye-tracking and art systems with a summary of eye-gaze and its impact on participants'.

Section 6.6 *Evaluation of Personality Types and Moods* is divided into five sections. Its main aim is to alert the reader to the intricate nature of the experience of presence, to remind the reader that experiencing presence is not due soley to the system design features but requires that the participant enagages with and is absorbed by the interaction. Participants' personality type and mood affect the outcomes of these experiences and this

section identifies some of the signifiers that exist to evaluate how these other factors influence the enagament. *Moods* (6.6.1) are addressed first followed by 6.6.2 *Attention as an Attribute of Engagement*. In this section participants level of attention is evaluated, discussed and proven to be a reliable data gathering indicator (3.3.5 *Gaining Participants Attention*). The five sections evaluate attention as; focussed, sustained, selective, alternating and divided.

Presence and Time Factors (6.6.3) include elements such as the participants levels of involvement (6.6.3.1) and their ability to concentrate (6.6.3.2). 6.6.4 *The Meaning the User gives to the Stimuli* also addresses participants issues with control (6.6.5).

By comparing and contrasting differences and commonalities of an individual participant's personal factors we can see how the experiences of an art system differ and scrutinize the percieved factors impacting on participants responses. This section addresses the distraction factors associated with experiencing the system (6.7), it addresses the impact of the negative effects (6.7.1) associated with the system restrictions (6.7.2). 6.7.3 outlines difficulties related to the environmental distraction factors including the exhibition lighting conditions (6.7.3.1), and the physical and psychological barriers (6.7.3.2). It closes with a summary of Chapter Six (6.8).

This chapter examines the results of a methodology, a plan, devised to create, measure and understand participants' experiences of an art system constructed to enhance presence engagement. It draws upon the evaluation data of a two-part study contrasting non-interactivity with interactivity, through questionnaire (ITC-SOPI), participant profile information, interview and video documentation. Data analysis included logging and transcribing an observational point of view; analyzing the questionnaire (ITC-SOPI) results in the context of known presence attributes such as; spatial presence, ecological validity, negative effects and engagement. Transcriptions of the interviews were made. Participant responses were tabled along with additional participant quotes left on the questionnaire (ITC-SOPI). Participants' profile information was charted in SPSS, statistical software that implements predictive analytical technology, allowing for analysis of commonalties and differences.

6.1 Research Questions Revisited

The research questions are:

1. How can previous research in presence inform the design of an art system?

2. In what way did the art system design features contribute towards the participant experience? In particular what influence does eye-tracking technology have on the experience of presence-generating art systems?
3. What are the factors influencing an individuals' ability to experience presence-generating art systems?

This research examines participants' experiences of an art system's components and features, designed to enhance the experience of presence through creative engagement. This chapter evaluates the data gathered during the two-part study.

6.2 Evaluating The Two-Part Study

The art system's design methodology focussed on determining measurements of presence through the degree of immersion experienced by the participant of the system's media content and the system's technological form. By incorporating previous research into presence the art system consists of three main components: the digital media content, the system's form, and the participant's willingness to participate in the experience. The degree of presence-based immersion was thus examined in the context of 1) media content and 2) system form, in relation to Media Presence, and participant engagement as a component of Inner Presence. The research inquired as to whether interactivity increases participants' experiences of the many variables that define presence.

The methodological approach adopted in this PhD project is practice-based research (PBR) which supports evaluation of creative work projects like this one. Gathering data through an iterative process generates knowledge through experience that can be examined, with wisdom retained. In this project the research context and studio environment were contextualized to support the exhibition and evaluation environment for the two-part study undertaken. The study examined first the digital media content and technology display environment with no interaction (study one) and then the same content enabling participant interaction (study two).

Study one was conducted at Creativity and Cognition Studios (CCS) Interaction Laboratory at the University of Technology, Sydney[2] between the months of April and May in 2009.

Study two was conducted in Beta_Space, *Cyberworlds Gallery*, Powerhouse Museum Sydney[3], during the month of November (2nd-27th) 2009. Twenty five people participated

[2] www.creativityandcognition.com

in each study involving: live video and stills recording, participation in a questionnaire (adapted ITC-SOPI), and involvement in a semi-structured interview. A participant profile form was also completed .

As study one results and impact were discussed in 5.1.6 *Study One Results* and 5.1.6.1 *Conclusions Drawn from the Previous Study*, this study is not discussed in as much detail as study two, which is examined here.

6.2.1 Study Results

Section 6.2 discusses the two-part study in respect to the process of evaluating the outcomes through observation (6.2.1.1), questionnaire results (6.2.1.2), the interview process (6.2.1.3), and the participant profile information (6.2.1.4). 6.2.1.4 extends to include information derived from each of the participants' sessions including session durations (6.2.1.4.1), age and sex (6.2.1.4.2), participants' occupation (6.2.1.4.3), and the time of the day of each session (6.2.1.4.4). Section 6.2.1.5 summerizes the video and stills documentation process that took place during the course of study two.

6.2.1.1 Observation in Practice

In study one observation of the participants' experiencing the audio visual media took place from the rear of the room where the observed could not detect the observation process with any accuracy. This allowed the observer to study the participants unhindered. Generally speaking the participants, once seated, remained on the couch facing the digital display screen, watching and listening to the media. All the participants were observed continuously for the full duration (23 minutes). No notes were taken that were not technical or practical (see Figure 61).

Figure 57. Participants of Study One in Creativity and Cognition Studios

In study two the participant was being observed from the corner of the room. Positioned behind the operating console, this point of view afforded full visual access to the

[3] www.betaspace.net.au/content/view/68/

participant facilitating a relationship between the operator/ observer and the participant (see Figure 57). All the participants were observed continuously for the full duration which was determined by the participant. By observing whether the participants are able to interact through the intended layers/ stages of the system it was possible to determine if the experience they were having is the one the artist intended for them to have. Later in the interview process it was possible to discuss with each participant observations made during the participants interaction, these observations are supported through the video documentation captured at the time.

Figure 58. Study Two in Beta_Space

Figure 59. The Observational Point of View of the Participant in Study Two

The participants' behavior was observed in order to establish if they were interacting with the system as it had been designed. By combining observation of the participants with observation of the Track Status window (5.5.3.5 *Calibration of Eye-Tracking System with Participant*, Figure 54), it was possible to note when participants activated icons to implement change, when they were trying to activate icons but not holding their gaze for long enough, and when they appeared to be in need of assistance. This became a very useful tool in decifering how well integrated the system was in meeting the participants needs, and led to some interesting observations made about participants issues with trying to control the system, when they were actually not operating the systems full functionality. Many observations were made about what was appearing to be happening in terms of human-computer interactions, these observations appear throughout Chapters Six and Seven. One example is when the Track Status window (see Figure 53) indicates that the participant has not held their gaze long enough to activate the icon, and yet the participant is obviously attempting to do so. They repeat this action again and again in an

effort to control the system but somehow their gaze is not strong enough, held long enough, to connect with the system. About a third of the participants were able to operate and navigate the system with ease and efficiency after only a short period of adjustment, a few took no time at all, but the rest had to overcome this problem by adapting their behaviour. Some struggled longer than others, but all persisted as the average session duration was thirty five minutes. Results of the questionnaire reveal that in study two, 88 percent of participants enjoyed themselves.

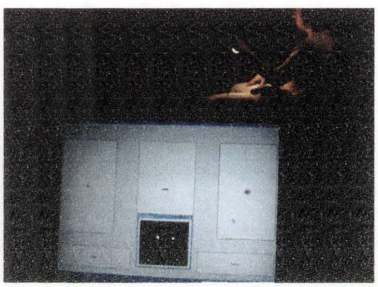

Figure 60. Example of the Track Status Window and the Participant Interacting

The tiny red dot indicates where on the interface the participant is looking (for a more detailed description see 5.5.3.5).

6.2.1.2 Questionnaire Results

The questionnaire results are implemented throughout this chapter and can be found in: 6.4.1 *Evaluating Engagement as a Design Feature*, 6.4.3 *Evaluating Ecological Validity*, 6.4.4 *Evaluating the Narratives and Emotional Content*, 6.4.5 *Evaluating the Use of Motion and Colour*, 6.4.6. *Evaluating the Audio Components*, 6.5.2 *The Eye-Tracking Device as a Sensory Output*, 6.6.3 *Presence and Time Factors*, 6.6.3.1 *Involvement*, 6.6.4 *The Meaning the User gives to the Stimuli*, 6.6.5 *Control*, 6.7.1 *Negative Effects*, and 6.7.3.2 *Physical and Psychological Barriers*.

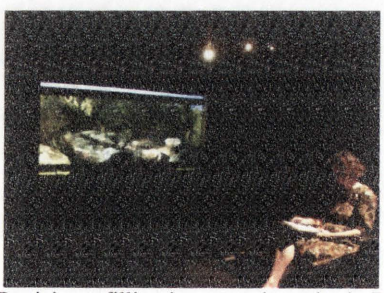

Figure 61. Participant filling in a questionnaire in Beta_Space

The questionnaires were numerically arranged from one to twenty five, as per participant. Graphs were created in SPSS using a simple Bar Graph in order to visualise the outcomes

(see Tables' 43, 48, 51, 52, 53, 56). Tables were also created in SPSS based on frequency variables, the outcomes of which you will find embedded within this chapter.

6.2.1.3 The Interview Transcripts

The interview transcripts of both studies allowed for an in depth investigation of participants experiences of the art system. The interviews provide evidence in answer to research questions. The transcripts contained within Appendix One have been tabulated to include the question and then the response given. The responses are listed numerologically from participant one to twenty five. In the authors opinion the interviews provided the most detailed data analysis of the participants experience as each person took the time to give in great detail an explanation for their motivations, their intentions and their choices. Quotes from the interview sessions are scattered within this chapter and Chapter Seven and give a great deal of insight into the participants' experience of *PEGASYS*. See *PEGASYS* Drive/ Folder 5_*PEGASYS*_APPENDICES/ Appendix One_INTERVIEW: Questions & Answers.

6.2.1.4 Results of the Participant Profile Information (PPI)

The participant profile information form that each participant filled in post questionnaire, facilitates an in depth data analysis of those participants as a group of people. It also assists in comparing and contrasting various scenarios in respect to participant's age, sex, level of education and personal interests. The information sheet, for example, addressed participant's level of computer experience, their interest in computer games, their knowledge of media production, their interest in nature and their previous experience with art systems (see Table 33).

Question	Study One	Study Two
Age	20's: 28% 30's: 20% 40's: 24% 50's: 12% 60's: 16%	20's: 16% 30's: 16% 40's: 28% 50's: 16% 60's: 24%
Gender	Male: 44% Female: 56%	Male: 44% Female: 56%
Computer experience	Basic: 12% Intermediate: 44% Expert: 44%	Basic: 24% Intermediate: 56% Expert: 20%
Rate how often you play computer games	Never: 64% Occasionally: 24% Often: 8% 50% or more: 4%	Never: 68% Occasionally: 24% Often: 8%
Education	HSC: 4% Diploma: 4% Degree: 24% Post-Grad: 68%	HSC: 4% Diploma: 8% Degree: 32% Post-Grad: 56%
Knowledge of Film production	None: 28% Basic: 32% Intermediate: 40%	None: 24% Basic: 4% Intermediate: 24% Expert:12%
Prior experience of interactive art systems	Yes: 52% No: 48%	Yes: 36% No: 64%

Knowledge of augmented reality	None: 36% Basic: 32% Intermediate: 24% Expert: 8%	None: 32% Basic: 36% Intermediate: 20% Expert: 12%
Experiences with nature	Occasionally: 56% Often: 12% 50% or more: 12% Everyday: 20%	Occasionally: 28% Often: 28% 50% or more: 12% Everyday: 32%

Table 33. Participant Profile Information

In study one, twenty five people participated in the evaluation sessions of the media content in development for the art system. The evaluation sessions took place at Creativity and Cognition Studios at the University of Technology, Sydney. Most of the participants attended alone although there were several sessions with two or three people as requested by the participants. Of the tweny five people, 56 percent were female and 44 percent male; 28 percent were in their twenties with 52 percent in the over forties bracket. In terms of their computer experience, 44 percent were at an intermediate level and 44 percent were experts in the field. 12 percent indicated a basic level of computer experience. 64 percent of participants claimed to never play computer games, with 36 percent indicating that they had no knowledge of augmented reality systems. In terms of knowledge about film production the highest percentage was 40 percent who indicated an intermediate level of understanding. 52 percent of the participants had prior experience of interactive art systems. 69 percent had completed tertiary education to a post-graduate level and finally 20 percent had experiences with nature everyday (for more details on the study see 3.6.1 *Study one: Without Interactivity*).

Twenty five people participated in study two conducted in Beta_Space at the Powerhouse Museum in Sydney (3.6.2 *Study Two: With Interactivity*). Museum patrons, museum employees and others, booked 60 minute sessions to experience *PEGASYS* alone. Occupations ranged from arts-based industry workers (40 percent) to engineers, educators and administrators. Participants were able to determine the length of their own experience, finishing when they felt it was appropriate to do so considering any time restrictions they might have. The average amount of time spent on the system was 35 minutes with sessions ranging from 15 minutes to 72 minutes in duration. As in study one, 56 percent of the participants were female and 44 percent male. 40 percent of participants were over 50 years of age and 28 percent, or seven of the twenty five, were in their 40s. In terms of computer experience, intermediate ranked highest at 56 percent, with 20 percent claiming to be experts, a decrease from 24 percent in study one. In respect to rating how often they played computer games, 68 percent ranked never, an increase of 4 percent from study one. 56 percent of participants held a post-graduate

qualification a decrease of 12 percent, however 32 percent of participants in study two held degrees, an increase of 8 percent from study one. In terms of knowledge about film production, 24 percent indicated no knowledge, 24 percent indicated an intermediate knowledge, with 12 percent at an expert level, the remaining 4 percent had a basic understanding. 36 percent of the participants had prior experiences of interactive art systems. 32 percent of study two participants ranked that they had experiences with nature everyday. Four people or 16 percent had previously participated in study one and were therefore familiar with the audio-visual content. By evaluating the participant profile information we can identify any commonalities that may be occurring in respect to participants experiences of the art system (study two ONLY). This section examines Table 34 constructed to compare and contrast participant duration, age and sex, occupation and session times. It is arranged according to the duration of each session.

#	M/F	Age	Occupation	Start Time	Duration
# 5	F	25 yrs	Student	12:55pm	15
# 1	F	29 yrs	IT	11am	15
# 4	F	62 yrs	Artist /PhD Student	1.20pm	15
# 12	M	52 yrs	Artist /Lecturer	1:40pm	16
# 22	F	34 yrs	Artist	10.45am	20
# 24	F	50 yrs	Artist / Academic	10:45am	20
# 14	F	40 yrs	Artist	11:53am	22
# 10	M	51 yrs	Mining Engineer	3:33pm	23
# 21	F	50 yrs	Musician	2:00pm	25
# 19	M	46 yrs	Customer Service	2:00pm	30
# 3	M	42 yrs	Educator	10:40am	30
# 9	F	28 yrs	Education Officer	10:30am	30
# 18	M	60 yrs	Artist / Researcher	2:00pm	34
# 13	M	41 yrs	Artist	3:15pm	35
# 11	M	25 yrs	Software Developer	2:30 pm	37
# 15	F	41 yrs	Sexual Assault Councilor	12:35pm	40
# 7	M	37 yrs	Arts Worker	10:30am	40
# 25	M	64 yrs	Retired Teacher	12:05am	43
# 20	F	47 yrs	Artist	11:40am	45
# 6	F	64 yrs	Retired Teacher	11:52am	46
# 23	M	39 yrs	Engineer	1:10pm	50
# 17	F	36 yrs	Administrator	11:15am	55
# 2	F	66 yrs	Artist	3:15pm	55
# 16	M	41 yrs	Teacher	11:12am	55
# 8	F	67 yrs	Artist /Curator	11:38am	72

Table 34. Participation Information

For further information see *PEGASYS* Drive/ Folder 5_ Appendix Five_Participant Profiles.

6.2.1.4.1 Participation Duration

As you can see in Table 38 participants session durations varied during study 2. On average they spent thirty five minutes engaging, the shortest session being fifteen minutes

and the longest being seventy two minutes. Seventeen of the twenty five people engaged with the system for over twenty five minutes many expressing a desire to return, or wished that they had allocated more time to the experience. Two peoples' engagement were cut short by the evaluator to allow for time to evaluate their experience.

6.2.1.4.2 Age and Sex

When the information in Table 34 is evaluated in terms of people's age and sex, a few distinguishing characteristics can be identified. The four men in their forties spent thirty seven point five minutes on average interacting with *PEGASYS*. The three women in their forties averaged thirty five point six minutes. On average the twenty something women spent twenty minutes engaging whereas the only twenty something gentleman spent thirty seven minutes engaging with the art system. The knowledge gained about these particulary participants through data analysis indicates that the sixties brackett, in which four sixty year old women spent on average forty seven minutes engaging with *PEGASYS*, and two sixty year plus men, spent thirty eight minutes, is the age group who enjoyed the experience the most. However it may equally be that they simply had more time to spend with *PEGASYS* than the other age bracketts did.

6.2.1.4.3 Session Time of the Day

Examining the time of the day reveals that sessions taking place between the hours of 11am and 1pm were consistently longer than at any other time of the day. Eight participants or 36 percent engaged themselves for the longest periods of time here. The average time for each of the eight sessions that took place was forty four minutes.

6.2.1.5 Video and Stills Documentation

Figure 62. View of camera and chair set up in Beta_Space for Study Two

Video and stills documentation provides examples of participants' interacting with the system and stills are embedded throughout this chapter and Chapter Seven. The still photographs of participants engaging with the art system are used in this chapter to

illustrate various examples, such as participants experiences of: the lighting conditions, the calibration process, the systems interface, the content and their position in the room (see Figure 62). The *PEGASYS* drive contains numerous QuickTime video clips illustrating phases of interaction as they occurred for participants'. See:
PEGASYS Drive/ Folder 5_ Folder 4_ Evaluation/ Chapter Six_Evaluation/Demo#1- Demo#4.

6.3 Evaluating the System Design

This section addresses how the engagement models were implemented into the five steps system design for *PEGASYS*. Particular attention was paid to the process involved in designing to enhance experience through interactive modes and phases. The application of attractors, sustainers and relaters is also demonstrated.

Step One

The Model of Engagement:

Interaction Mode: Unintended

Interaction Phases: Adaptation

The Creative Engagement Model:

Attractor: Introduction to the operating system

Sustainer: Interface design simple and effective.

PEGASYS: Callibration with the eye-tracker

Step Two

The Model of Engagement:

Interaction Mode: Deliberate

Interaction Phases: Anticipation / Learning

The Creative Engagement Model:

Attractor: Navigating the *PEGASYS* projected eye-tracking interface

Sustainer: The location and the surround-sound design

PEGASYS: Stage One: is a five minute experience of a 360 panoramic cinematic view of a place called *Crystal Pool*. It loops after a short fade to black at the end of five minutes.

Step Three:

The Model of Engagement:

Interaction Mode: Intended/In Control

Interaction Phases: Anticipation / Deeper understanding and Learning.

The Creative Engagement Model:

Attractor: New content alters the pace of the interaction.

Sustainers: The sounds of a girl humming act as a signifier to find her; the addition of music enhances the diagetic soundscape.

Relaters: Guided interaction is introduced as participants learn how to follow the screen character as she moves throughout the landscape. Plus, an option to move either BACK to Stage One or NEXT to Stage Three is presented to the participant as soon as they enter Stage Two

PEGASYS: Stage Two: has a duration of eight minutes then it fades to black and loops. This stage involves a narrative and facilitates investigation of presence features such as co-presence and the presence of others.

Step Four:

The Model of Engagement:

Interaction Mode: Intended/Uncertain

Interaction Phases: Adaptation / Deeper understanding

The Creative Engagement Model:

Attractor: 12 screen characters appear increasing the interaction experience

Sustainers: Dynamic sound component introduced

PEGASYS: Stage Three: has a duration of ten minutes then it fades to black and loops. 12 performers demonstrate skills and personal interests in and around Crystal Pool which has become a site-specific, user-focused, interactive performance environment. Performance durations vary.

Step Five:

The Model of Engagement:

Interaction Mode: Unexpected

Interaction Phases: Adaptation

The Creative Engagement Model:

Attractor: Interactivity increases as participants adapt their behaviour.

Sustainer: Multi-viewing options.

Relator: Dynamic sound content explored as a feature

PEGASYS: Stage Three: contains dynamically generated sounds which are designed to activate, under a steady gaze, according to the positioning of the screen character on the display environment.

Following the creative engagement models the narratives provided within the content of *PEGASYS* allow for playful interaction.

6.3.1 Evaluating Interaction Modes and Phases

The Model of Engagement was considered in the design of the systems functionality and this section gives an example of how it was received. Table 38 in 6.3.2 illustrates how these modes and phases became a part of the designed experience of *PEGASYS*.

By isolating one participants experience and analyzing her comments made during the interview process, we can identify how the designed interaction modes and phases were experienced by her (Bilda et al, 2008. p.11). Participant #8 was chosen to illustrate an example of how the *Model of Engagement* worked in action, as she had a prolonged engagement with the system that enabled her to learn more about it, to work with it and learn how to better control it.

#	Sex	Age	Occupation	Time of Day	Duration
# 8	F	67 yrs	Artist /Curator	11:38am	72 minutes

Table 39 indicating the personal characteristics of Participant #8

In study two participant #8 made the following comments during interview. Be aware that these comments have been extracted from a larger context and would have related to a question concerned with either, the visual media, experiencing the sound or the form of the system; the interaction.

Step 1		The Model of Engagement
Interaction Mode	Unintended Mode	"The participant expectations are not yet set."
Interaction Phase	Adaptation	"The participant adapts themselves to the changes in the environment."

"Well I was fascinated because I spent the first 15 minutes interested in the structure and looking at the placement of all the different screens together".

Step 2		The Model of Engagement
Interaction Mode	Deliberate Mode	"The participant has a limited idea of what the system is doing, and expects features and functions to work as he/she expects."
Interaction Phase	Learning	"The participant starts developing an internal /mental model of what the system does, this also means that they change their expectations, emotions, and behaviors, access memories and beliefs."
Interaction Phase	Anticipation	"The participant knows what the system will do in relation to their initiation."

"I was actually... had to go through a process of being annoyed with myself that I was so technically inept. That I couldn't move ... so I was in a controlling position. I was trying to control how I was going to see it, which you should be

able to do, but for some reason I wasn't controlling it. I then realized that I move all the time, my whole being is all about movement and here I have to be relatively still and that is the most difficult thing. I could not concentrate and be still physically because the whole of my being is all about movement, so when I tweaked on that I could move about in the chair and hold the focus, and I could move quite a lot, did you see how much I was moving? And that was when it became really enjoyable, ok? It became great, where as before that I was getting frustrated because of my ineptitude".

Step 3		**The Model of Engagement**
Interaction Mode	Intended / in control Mode	"The participant is capable of setting a purpose for his/her actions and expectations about the outcome."
Interaction Phase	Anticipation	"The participant knows what the system will do in relation to their initiation."
Interaction Phase	Deeper Understanding	"The participant reaches a more complete understanding of the system and what their relationship is to the system."
Interaction Phase	Learning	"The participant starts developing an internal /mental model of what the system does, this also means that they change their expectations, emotions, and behaviors, access memories and beliefs."

"I loved the playfulness of it. I think that and the gentleness of the place; I loved the cultural nuances that you've brought to it. The references to what are Australian, what is the bush, the familiarity and the layering of references to visuals and sound. I am now imaging nostalgia to say *Picnic at Hanging Rock* so all of that would be there, the moving pictures nuances would be there too".

Step 4		The Model of Engagement
Interaction Mode	Intended / Uncertain Mode	"The participant starts expanding his/her intentions for actions and expectations about the outcome".
	Adaptation	"The participant adapts themselves to the changes in the environment".
Interaction Phase	Deeper Understanding	"The participant reaches a more complete understanding of the system and what their relationship is to the system".

"I was fascinated at the patterns you were creating, light and dark, shadows and shape, texture and how you were enticing the viewer to engage with all of the technicalities of the moving image. And I didn't mind the disjuncture in fact I found it intriguing because it actually engaged me further and it tied me into wanting to seek more knowing".

Step 5		**The Model of Engagement**
Interaction Mode	Unexpected	"Refers to the stage where the participant questions his/her intentions, expectations about outcomes and what the system can deliver".
Interaction Phase	Adaptation	"The participant adapts themselves to the changes in the environment".

> "It was painful and I think that's an important thing, you've got to get through that phase, go through the frustration, through all the personnel shit through all of that crap until you get to the stage of participating. Because you are the participant but you are also involved in the whole dynamic, to really enjoy it".

As we can see this participant grew to understand the design features that enabled her to explore the system in depth, as her understanding of how the system worked, changed.

6.3.2 Evaluating the Design of the Art System

Table 35 illustrates how engagement models were integrated in the design of *PEGASYS*.

A Model of	Engagement	*PEGASYS*	*The Creative*	*Engagement*	*Model*
Interaction Modes	*Interaction Phases*		*Attractors*	*Sustainers*	*Relaters*
Unintended	*Adaptation*	***STEP 1 Calibration of the eye-tracker***	*Introduction to the operating system*	*Interface design, simple and efffective*	
Deliberate	*Anticipation* *Learning*	***STEP 2 Stage One***	*Attempts are made to operate the eye tracking interface*	*360 degree view* *Diagetic sound score*	
Intended / *In control*	*Anticipation* *Deeper Understanding* *Learning*	***STEP 3 Stage Two***	*New content alters the pace of interaction*	*The sounds of a girl humming* *Introduction of a musical score*	*Guided interaction*
Intended / *Uncertain*	*Adaptation* *Deeper Understanding*	***STEP 4 Stage Three***	*13 avatars increase the interaction engagement*	*Additional fast paced visual media* *More choices of stimuli*	*Dynamic sound content introduced*
Unexpected	*Adaptation*	***STEP FIVE Stage Three***	*Interactivity increases as participants adapt their behaviour*	*Multi viewing options*	*Dynamic sound content explored as a feature*

Table 39. *PEGASYS* as a dynamic-Interactive Art System

Table 35 illustrates how the The Model of Engagement interaction modes and phases provided a structure that supports the addition of Creative Engagement Model's attractors, sustainers and relaters. A creative engagement was then designed with respect to the art system's seven design features (5.3, 7.1).

6.3.3 Evaluating the Designed Experience

The following five steps indicate how the art system was designed to adhere to the principles of the creative engagement models described above. Research into presence engagement and computer-generated interactive systems was also considered.

6.3.3.1 Step One

Required callibration of the eye-tracker. *PEGASYS* requires each participant to first undergo a callibration with the eye-tracking device. Here they also learn how to navigate the interface and hold their gaze to operate the system. Their behaviour is often unintended as they learn to adapt to the technology. The *Attractor* here being an introduction to a unique system that enabled participants to pan and hold video images with their gaze through a projected eye-tracking interface *Sustainer*: Interface design simple and effective.

6.3.3.2 Step Two

Stage One was initially designed as the primary source for examining presence-generation within an art system. This is because the location, the subject matter, Crystal Pool represents a natural habitat a place as yet unhabited by man. It is a protected place. Here participants experienced changeable engagements within the same location; panning left and right they observe naturalistic elements such as running water and wind moving throughout the location, wind through the trees. Participants may remain in a static position within the frame by gazing in the middle of the screen, here their periforal vision fills in the gaps as they simply observe the intricacies of an unknown completely natural environment. The media content of *PEGASYS* was of utmost concern to the artist, as a filmmaker, it was the content not the form of the system that was required to draw the participant in (see 5.3.1.1). The evaluation process included an interview that enabled participants to speak frankly about their opinions. As one participant explained;

> "I think your execution is marvelous. I don't worry about the technology for me that's not a marker of whether something is engaging on the first level, not because of the technology but because the content is engaging. What captures my imagination and my interest on the first level is the content and then I became more interested in the technology so that's just me. The first level of engagement was the content which for me means that it is working on an emotional level not just wow this is interesting technology". *Study Two, Participant #22/ comment made during the interview*

Figure 63. Screen shot from Stage One, *PEGASYS*

This introductory stage presents an unadulterated view of a natural habitat in a five-minute loop facilitating an experience of nature that is refreshing and engaging. The audio was designed to enhance the location with the use of wind, bird song and running water. In study two when participants were asked in the interview if '*Crystal Pool*' is a location they would really like to go to, the responses were unanimous.

> "Yes, I felt I'm home there. It was my place. I liked the fungi on the rocks I wanted to look closer". Study Two, Participant #2/ comment made during the interview

> "Oh yes, can I go there? It just felt fantastic. But I wouldn't want anybody else to be there, just me". Study Two, Participant #18/ comment made during the interview

> "I especially liked the location cause I've been to those places a few times before and I'vehad some amazing experiences there several times you know on different types of days. I go and spend days there you know". Study Two, Participant #16/ comment made during the interview

The following comment reflects on how the participant felt she had experienced *Crystal Pool* through the media and thus felt no strong desire to physically go there.

> "I love the bush and I love the play of light, the fact that your looking at moving images, so I really liked that aspect of it. I didn't feel like I wanted to go to that spot but I did really notice the heath plants and I thought it was very evocative in terms of a sense of place". Study Two, Participant #24/ comment made during the interview

As one of the research aims was to create a relaxing stress free environment that appealed to as many people as possible, the results of B32 indicate that 80% of study one and 92%

of participants of study two *found the content appealing*, indicating that this was achieved (B32: Study 1, 80% / Study 2, 92% agreed).

Section 5.1.6.1 *Conclusions Drawn from the Previous Studies* identified the digital media elements that were required to be adapted to enhance the experience for participants.
For study two adaptations were made to the sound score by the artistic endeavors of a sound engineer who assisted in producing three distinct sound experiences. Needless to say vast changes occurred to the audio volume and fidelity between study one and study two. In study two, Stage One implemented atmospheric sounds that ran in a loop with the visual media content. The sounds of birds, wind and running water were engineered to behave as natural sounds do, in as much as they started and stopped and became louder and softer. The atmospheric background track was used throughout each of the three stages creating a link between them. In Stage One there were no additional sounds and no audio interactive components. When asked during the interview what participants remembered of the sounds in Stage One, participants reflected,

> "I much preferred just the nature sounds. Without any music".
>
> *Study Two, Participant #18 / comment made during the interview*

> "Beautiful and I think it really hugely added to the sense of peace and relaxation that you got while you are going through the journey".
>
> *Study Two, Participant #15 / comment made during the interview*

6.3.3.3 Step Three

Stage Two facilitated the exploration of the environment with a character who explores the location in such a way as to encourage the participant to use the interface to follow her around the space sharing her experiences. The addition of a screen-based character who can be followed around the location in 360 degrees (by panning left or right) sustains participant's engagement by providing for them an activity. Sustainers were then added to maintain that engagement and enhance interaction through the use of additional viewing content and audio signifiers. As they are already accustomed with the location, the introduction of a character creates an interaction whereby participants may chose to follow and watch the character, or not. As the placement of the screen character, within the location of any of the stages at any time, depended upon her position within the 8-minute narrative,or along the sequencer, it was rare that the participant happened to find her instantly when they entered Stage Two. As a consequence a few participants watched this stage twice to see her appear at the 'start' of the narrative and follow what they

missed the first time round. To alert the participant to the presence of the screen character within the location, a sound cue is activated when the participant enters Stage Two. The background sound track now also contains the sounds of a girl humming and singing. Some of the participants of study two had this to say about their experience of Stage Two:

> "Yeah, I really liked how when I went in the second mode and I was sort of looking for the girl and I heard her singing it sort of gave me hope that I'll find her, and I liked that". *Study Two, Participant #8/ comment made during the interview*

> "The one person was fantastic because I identified with her. She came in first and then I lost her so I was exploring the space and when I found her later on it was at once delightful. I identified very closely with her, she was doing the same kind of wandering about that I would do if I were there, doing nothing". *Study Two, Participant #4/ comment made during the interview*

Figure 64. Screen shot from Stage Two, *PEGASYS*

The sound design also influenced the participant's experience. Each of the three stages have their own sound design following the influence of the *Creative Engagement Model* (2.2.2). Participant's had this to say about the sound design in Stage Two.

> "It was really appealing to watch her move about and once the music started too, I wanted to watch her a bit more". *Study two, Participant #9/ comment made during the interview*

> "That was really nice as well. It's a nice dynamic going from that kind of ...it being completely natural. I mean you wouldn't expect anyone to be there, its totally isolated and it was really nice being able to pan around and just hear the sounds of nature and then in Stage Two it was, the singing was really beautiful and it was kind of, haunting and something's happening and you look around. And then you see, well I saw the flash of a person. I thought something's

> happening over there and just following her was really nice. Yes, I really enjoyed the singing". *Study Two, Participant #17/ comment made during the interview*

Sustainers were introduced when upon entering Stage Two the participant hears the sounds of a girl humming and later, singing.. The addition of a human voice in Stage Two was designed in order that participants would respond to the audio, triggering more sensory experiences. Stage Two starts with the sounds a girl humming and after about 45 seconds introduces a musical score. The music blends in with the sounds of the girl, which is heard intermittently throughout the 8-minute film experience. The atmospheric track of wind, bird calls and running water can still be heard in the background. In keeping with the theme of producing a relaxing experience for participants the audio itself played an extended purpose, a duality for creating a heightened awareness of oneself as well as sustaining the environment in which the shoot took place. The music therefore soothed the participant (see New Work section 5.3.1.6). Working as sustainers the additional sound elements drew the participants into a closer experience of the visual subject matter. Participants reflected on this during the interview:

> "Look it's an interesting relationship because the visuals are working on one particular level and the sound is taking it more into a traditional filmic dimension. But I certainly think it adds to embed people in the environment and gives a connection to that place". *Study Two, Participant #24 / comment made during the interview*

> "I liked that there were different stages. It just underlined the second stage and the music is kind of rising and I think its good".
> *Study Two, Participant #1 / comment made during the interview*

> "The music was fabulous. Absolutely fabulous".
> *Study Two, Participant #10/ comment made during the interview*

> "Good. Moody atmospheric. Suited the environment".
> *Study Two, Participant #16 / comment made during the interview*

To experience the audio visual media content from a clip in Stage Two see *PEGASYS* Drive/ Folder 7_ Examples of the New Work/2. Stage Two, Clip 2.mov.

6.3.3.4 Step Four

Relaters guarantee extended interest and were adopted through the implementation of a dynamic quality, namely multi-viewing options with invisible embedded sound cues.

Stage Three provided contemplation of the sounds and images of fourteen performers who become screen characters embedded within this Australian native bush. The relaters encouraged participants to explore further what they thought they already knew so well.

> "Last time I did it I enjoyed it just with the nature and no people perhaps with the young woman but this time I actually found myself really getting into the third stage with all the different characters because I felt at that time, I guess, I felt I was really interacting with the experience and I guess I wanted to see how I could open up these different possibilities with the different actors. So I guess it was more in terms of an interactive experience". *Study Two, Participant #15/ comment made during the interview*

Figure 65. Screen shot from Stage Three, *PEGASYS*

6.3.3.5 Step Five

Sounds for each of the individual characters embedded within Stage Three could be operated through the central invisible icon built into the *PEGASYS* interface. Screen characters had to be lined up roughly in the centre of the screen (see 5.5.3.2) after which the participant activates the associated sound cue by holding their gaze upon the central icon for approximately four seconds. Dynamically delivered sound cues meant that unless the participant was chosing through action to listen to something in particular, the system would play a randomly allocated sound clips. Some participants had this to say of their experiences of the sound relaters in respect to Stage Three:

> "The music was disparate from the actual place, I mean you can see them playing guitars and you're hearing something else and I thought that's funny".
> *Study Two, Participant #2/ comment made during the interview*

> "The thing that didn't work for me was the abrupt discontinuity between one narrative and the next. Music played and then suddenly another starts and so to

> have that discontinuity brakes away from the narrative". *Study Two, Participant #7/ comment made during the interview*

What appeared to be happening is that participants were not interacting with the system as it was designed and thus the dynamic sound elements were dominating the experience. If the participants had activated the invisible icon 'switching on' the sound cue relating to the screen character then the continuity would have been maintained, however by the time they got to Stage Three, many participants had forgotten about this interactive component and were left listening to the dynamic sounds play at random intervals (see 6.4.6.2 *The Surround-Sound Environment* for a detailed account of participants experiences as expressed by them during the interview process). Some accessed it unknowingly. To experience the audio visual media content from a clip in Stage Three see *PEGASYS* Drive/ Folder 7_ Examples of the New Work/3. *PEGASYS*_Stage Three, Clip 3.mov.

6.3.4 Summary of Evaluating the Designed Experience

Overall participants expressed delight with their engagement with the three interactive stages. The models used provided sound advice and learned processes for producing creative engagements for participants. The system having been designed to adhere to the principles of creating layers through the implementation of the *Model of Engagement's* interaction modes and phases, and the *Creative Engagement Model's* attractors, sustainers and relaters, provided a playful, creative, structured engagement that assisted in facilitating presence engagement for participants.

6.4 Evaluating System Design Features – The Content

Evaluation of the system design features through participant's experiences of the system assists in determining if participants experienced the features as they were designed (5.3 *The Art System Design Features*), and if they experienced any of the signifiers that make up the sensation of presence as it is defined within this document (2.1 *Presence*). The art system under evaluation was designed to produce a presence engagement for participants, facilitating new experiences with technology in terms of: accessing video-on-demand through a networked system that responds via an interface implementing eye-tracking interaction; ideal subjects for data gathering and analysis.

In the case of experiencing *PEGASYS* it is the participants "rays of vision" that enable them to both access the visual media (see) and command it (interact). As discussed in section 5.3 the system moves away from the traditional hands-on approach or sensor technology by providing an engagement with digital media through an eye-tracking

device (X120), that extends the participants experience of engagement and embodiment in a very unique way.

Evaluation of the art system's features in respect to participants' experiences of them is addressed in the next two sections. Section 6.4 focuses on the digital media content in respect to participants' experiences of it, namely; participant engagement (6.4.1), the visual media content (6.4.2 *Evaluating Spatial Presence*, 6.4.3 *Evaluating Ecological Validity* (Sensory Presence), 6.4.5 *Evaluating the Use of Motion and Colour*, the narratives employed (6.4.4 *Evaluating Narratives and Emotional Content*), and the sound design (6.4.6 *Evaluating the Audio Components*, 6.4.6.1 *Audio Systems*, 6.4.6.2 *The Surround-Sound Environment,* 6.4.6.3 *The Use of Headphones*).

6.4.1 Evaluating Engagement as a Design Feature

Here we will examine participants' experiences of presence engagement in respect to the media content, later in section (6.6.2) we address attention as an attribute of engagement and inner presence, in the context of participant's personality types and moods (6.6).

The questionnaire (ITC-SOPI) implemented into both studies allowed for evaluation of participants thoughts and feelings about the experiences of engagement. 6 Part A questions referred to thoughts and feelings when the experience was over, 38 Part B questions referred to participants thoughts and feelings during the evaluation process (for more on the questionnaire see section 3.7.2 *Questionnaire* and *PEGASYS* Drive/ APPENDICES/ Appendix Four_Questionnaire Results.

By analysing the results of the fifty post-questionnaires (ITC-SOPI) that were completed and considering statements made during the interviews, we are able to deduce if participants had any presence-based experiences with *PEGASYS*.

The results of data indicate that study two, in which the participant had a prolonged interactive engagement with a duration determined by their own availability, was more satisfying than study one in which participants watched a film with a duration of 23 minutes (the media content being the same in each study). Outcomes indicate that participants of study two, which included the use of an eye-tracking device, were slightly more engaged than participants of study one. This result assists us to determine that the consideration given to the system's media content had enough engagement factors to obtain and sustain participants' long term attention regardless of the system's novel form.

In study one 21/25 of participants *had the sense that they had returned from a journey*. In study two 22/25 participants also agreed (A3: Study 1, 84% / Study 2, 88% agreed). In both studies 23/25 *vividly remembered some parts of the experience* (A5: Study 1+2: 92%, 23/25 agreed). In study one 19/25 *would recommend the experience to their friends* in study two 23/25 *would* (A6: Study 1, 76%/Study 2, 92% agreed). Therefore study two that included analysis of *PEGASYS* in respect to media content and interactivity, found that adding interactivity to the experience had only a slight bearing on participants depth of engagement with the media content.

The sensation of being *'drawn in'* is a key contributing factor in identifying the experience of presence. In study two 15/25 of participants indicated that they agreed and an additional 9/25 strongly agreed that they felt themselves being *'drawn in'*. These results were slightly higher than study one in which 20/25 agreed (B1: Study 1, 80% / Study 2, 96% agreed). Interactivity, the systems form, played a role in engaging participants drawing them into the experience. The measurement of participant's level of involvement establishes if presence attributes existed in the course of the experience. In study one 14/25 agreed to feelings of involvement, adding the interaction increased this result to 18/25 participants who agreed (B2: Study 1, 56% / Study 2, 72% agreed).

Participant's experience of time is a factor that can indicate if immersion was created and sustained throughout the experience. In study one 15/25 agreed to having *lost track of time* and in study two this increased to 21/25 (B3: Study 1, 60% / Study 2, 84% agreed).

Enjoyment as a form of engagement can also be related to the experience of presence. As the results of both studies were high in relation to participant enjoyment it is difficult to ascertain whether interactivity played a role in sustaining the sensation of enjoyment or if the media content alone sustained enjoyment (B8: Study 1, 84% / Study 2, 80% agreed to having enjoyed themselves). B16 asked if participant's experiences had been intense. Interactivity increased the degree of intensity with 10/25 participants' agreeing in study one and 13/25 in study two (B16: Study 1, 40%/ Study 2, 52% agreed). The system was designed to not be intense and as such these results indicate that the system features met the research aims for some participants. Measuring peoples' level of engagement can be assisted by asking them to reflect upon what they were thinking about whilst using the system. The fact that in study two 21/25 agreed that they were *consistently thinking about what they were doing* during the session rather than other thoughts implies that the system was engaging them. As 20/25 of participants of study one also agreed that they were

paying attention, the outcome here maybe that again, the system content was ample enough to generate and sustain this feature of presence without the addition of system form (B17: Study 1, 80%/ Study 2, 84% agreed). This is interesting when later we consider the obvious influence on the participant of the systems form for interaction (eye-tracking). Finally, a good measure of participant engagement examines whether the content appealed to participants'. As one of the research aims was to create a relaxing stress free environment that appealed to as many people as possible, the results of B32 indicate that 80% of study one and 92% of participants of study two *found the content appealing,* indicating that this was achieved (B32: Study 1, 80% / Study 2, 92% agreed). And finally, a good measure of participant engagement examines whether the content appealed to participants. As one of the aims was to create a relaxing stress free environment that appealed to as many people as possible, the results of B32 indicate that 23/25 of participants of study two *found the content appealing* thus indicating that this was achieved (92 percent, B32, Study 2).

6.4.2 Evaluating Spatial Presence

Spatial presence is commonly referred to as 'physical' presence and/or perceptual immersion and produces for the participant, the sensation of a sense of space informing the sense of place. This section now addresses participants' responses of the spatial presence attributes of the art system in respect to data collected through the questionnaire (ITC-SOPI) and interview process. Results indicate that participants' experiences of presence attributes were enhanced through implementation of interactivity, in the form of an eye-tracking interface designed for the media driving the art system. It is significant to identify that designing for the experience of spatial presence includes both the media content and the system form, two areas of concern that are closely interlinked within the art systems design and functionality. In study two 22/25 of participants agreed that *they could interact* with the displayed environment (B4:Study 2, 88% agreed). This then establishes that the majority of participants' experiences of the interactive interface that utilised the eye-tracking device, was successful inasmuch as participants experienced that they could interact with the system.

The display environment was the same size in both studies (1.8m x 2.4m rear projection video wall (1024 x 768 resolution). In study one 4/25 participants thought the *display screen was too small,* in study two this increased to 9/25, which indicates that some participants of the interactive system would have preferred a larger display environment, whereas viewers of the projected film image found the media display environment large

enough (B19: Study 1, 12%/ Study 2, 36% agreed). In study one 13/25 participants indicated that they *felt surrounded by the display environment* this decreased in study two to 11/25 however four of those participants strongly agreed (B25: Study1, 52%/Study 2, 44% agreed). These figures decreased slightly with the introduction of interactivity whereas responses to the question *I felt I could have reached out and touched things* increased, again by only one person (B28: Study 1, (5/25), 20%/Study 2, (6/25), 24% agreed). Remembering that the study venues were identical and the media content was the same, the only change was the method by which the content was activated. It seems that the system form may have actually detracted from this aspect of an immersive experience.

When participants were asked in the questionnaire (ITC-SOPI) if they *felt they weren't just watching something* responses suggest that interactivity enhanced this aspects of spatial presence for participants, as the study results increased from 13/25 to 19/25 (B12: Study 1, 52% / Study 2, 76% agreed) illustrating deeper engagement at the very least. Question B13 addresses issues of perceptual immersion, engagement and spatial presence. In the context of spatial presence it may be concluded that the majority of participants of study two experienced the sensation *that they moved in response to parts of the displayed environment* as 15/25 agreed that they could (B13: Study 2: 60% agreed). Clearly then the form of the system assisted to increase this experience of presence, but we should also consider that the media content for study one was cinematically styled and designed to replicate the motion and actions of a perceived interactive experience (panning left to right and vice versa). So, study one results, with no true interactivity, were reduced but still 11/25 participants agreed *that they moved in response to parts of the displayed environment* (B13: Study 2: 44 % agreed). Responses to question B18, *I had a sense of being in the scenes displayed* also illustrates how the spatial qualities of the system design were not enhanced through added interactivity as results were slightly higher in study 1 (B18: Study 1, (7/25) 28%/ Study 2 (6/25), 24% agreed).

However, when participants' were asked if they... *felt that the characters could almost touch them* the already low results dropped by 1 person indicating that this aspect of spatial presence was not confirmed (B7: Study 1, 20% / Study 2, 16% agreed). In respect to *visiting the place in the displayed environment* 17/25 of study one participants agreed that they felt they had, and 16/25 from study two agreed, again a difference of only one person (B9: Study 1: 68% agreed, / Study 2: 64% agreed). Therefore adding interactivity did not enhance this aspect of 'being there', fostering a sense of visitation.

Smell was not a sense that was addressed in either study so the results of question B22 *I could almost smell different features of the displayed environment* are interesting as participants from both studies indicated that they experienced a sensation of it regardless (B22: Study 1, (7/25), 28%/Study 2, (6/25), 24% agreed). As the temperature in the evaluation rooms did not change and the images being viewed did not shift dramatically from one scene to another it is astounding that any participants experienced a shift in temperature. However, in study one 9/25, over a third of participants agreed to *sensing that the temperature had changed* with 6/25, nearly a quarter of participants, agreeing in study two (B29: Study 1, 36%/Study 2, 24% agreed). In these examples it appears that interactivity in the form of eye-tracking seemed to have no particular bearing on participants' ability to recall experiencing these particular spatial presence attributes within this system.

13/25 participants of study one with no interactivity indicated that they... *felt I was in the same space as the characters*, as did 12/25 in study two with interactivity. This assists to confirm that these dimensions of spatial presence attributes were not strong contributing features in the experience of the art system's design (B34: Study 1, (13/25) 52%/Study 2, (12/25), 48% agreed).

Figure 66. A Screen Shot from Stage Two.

6.4.3 Evaluating Ecological Validity (Sensory Presence)

Ecological validity and/or sensory presence is gained through the systems ability to produce a sense of naturalness and a tactile engagement. This section addresses the content analysis validity issues of: realness, behavioral realism and social realism all of which are attributes known to assist in the production of the sensation of presence. Social realism and presence is included as it refers to the media contents and the technical forms ability to construct a realistic impression. For example a well-written well-acted, filmed version of events that have occurred in the physical world, it seemed so realistic. Core presence issues are addressed in examining the ecological validity or naturalness of the environment, another component attributed to Media Presence, and is measured in the questionnaire (ITC-SOPI) in the following ways: B5, B6, B11, B20, B31.

In study two 7/25 of participants agreed that the *displayed environment seemed natural*, with an additional 9/25 strongly agreeing. As these figures were up from study one (48%) there are a number of conclusions to be drawn from this. Firstly, that interaction designed as a mechanism for delivering video-on-demand scenarios assisted in creating a more natural experience than the act of looking and watching media pass by, as implemented in study one. Secondly, that the delivery of the content, in other words the system form, allowed participants to spend greater periods of time within chosen locations within the landscape, thus it maybe that participants spent more time in sections of the media that were more 'natural' than others. And thirdly, the sound score for study two was significantly enhanced from the study one experience (B5: Study 1, 48%/Study 2, 64% agreed).

However, B6 *It felt like the content was 'live'*, scored higher results in study one as 14/25 participants agreed than in study two where 11/25 participants agreed (B6: Study 1, 56%/Study 2, 44% agreed). This behavior held true for B15 *I felt the displayed environment was part of the real world,* where in study one 13/25 agreed but in study two only 9/25 agreed (B15: Study 1, 52%/Study 2, 36% agreed). These results indicate that most participants did not feel that the content depicted a real life place. Odd indeed since the location is a real place and the content was delivered, in most part, in real time.

B11 asked participants if *the content seemed believable to them* and received higher results from participants of study two. In study one 11/25 agreed and in study two 17/25 agreed. It seems highly likely that the interplay of interactivity and sound effects both assisted in the increase of this result (B11: Study 1, 44%/Study 2, 70% agreed).

B20 asked participants if they *felt that the scenes depicted could really occur in the real world*. In respect to the previous two questions discussed it would seem that participants acknowledged that the scenes taking place could be real but denied that the scenes were real. This was probably due to the content creation in respect to colour and movement. Nevertheless, it is interesting to note that the percentages barely increased from 16/25 in study one to 17/25 in study two with embedded interactivity and additional media content (B20: Study 1, 64%/Study 2, 68% agreed).

Participants were asked if they *felt that all their senses were stimulated at the same time*. Having dismissed smell and touch as senses that are engaged in the art system, this result clearly relates to the 'other' senses that interactivity stimulates and is interesting in as much that 5/25 agreed in study one and 11/25 agreed in study two. Therefore in this case, designing in consideration of ecological validity outcomes seems to have played a small role in manifesting sensory attributes of presence signifiers for participants of the art system (B31: Study 1, 20%/Study 2, 44% agreed).

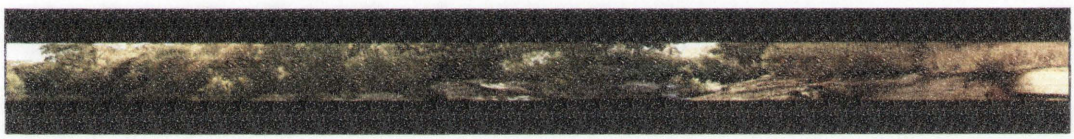

Figure 67. 180 degrees of Stage One

6.4.4 Evaluating the Narratives and Emotional Content

The participants experiences of interactive narratives as a design feature incorporated three stages of interaction and was discussed above in relation to the creativity models implemented in the design of the system. The experience of these stages was evaluated with participants in order to ascertain a number of research concerns. These concerns facilitate an interest in and allow for analysis of data gathered to discuss presence in low stress environments, and participants' experiences of the three narratives in terms of their emotional responses.

The system design incorporated three stages of interaction as previously discussed (5.4.1, 6.3.3). As each stage of interaction has its own narrative style the use of narratives as design features were evaluated with participants during the interview section.

> "What I find interesting about it all, the kind of under space, was the narrative. I think what interests me about the narratives is that it is layered on a number of levels, its layered visually and layered culturally and reminds me of the kind of

formalistic storytelling one associates with Australian landscape, particularly the fact that you've got a young female artist, you've got a Peter Weir context" (*Picnic at Hanging Rock*). *Study Two, Participant #12/ comment made during the interview*

#	Evaluating Spatial Presence	Study One	Study Two
B23	I had the sensation that the characters were aware of me	Strongly Disagree: 28% Disagree: 28% Neutral: 16% Agree: 20% Strongly Agree: 8%	Strongly Disagree: 12% Disagree: 40% Neutral: 20% Agree: 16% Strongly Agree: 8%
	Outcome:	**28% agree**	**24% agree**

Results of question B23 *I had the sensation that the characters were aware of me* illustrate that the filmic techniques employed such as direct gaze, worked to break down the 'fourth wall' for only 8/50 of the participants, however, they all 'strongly agreed'. In study 1, 7/25 agreed and in study 2 this decreased by 1 person to 6/25 (B23: Study 1, (7/25), 28%/Study 2, (6/25), 24%).

Question B34 asked if participants *felt located in the same space as the characters*, some participants agreed that they did despite the 2D display environment. In study one, 13/25 agreed and in study two 12/25 agreed. This was a surprise as the result was not anticipated. It may indicate that the filmic techniques employed such as direct gaze and panorama, were perhaps sufficient to break down the 'fourth wall' and draw participants into the dramatic narrative. Participants felt connected to the characters through the establishment of a sense of 'place'(B34: Study 1, 52%/Study 2, 48% agreed). Interactivity did not enhance this aspect.

The comment below illustrates one participant's experience of Stage Two and the emotional response created by a characters appearance in the scene,

> "I felt like a bit of a voyeur so I thought I better move on and go to the next one (stage). It was a very intimate relationship that one on one so when I moved on there was a group of people and it was easier. I mean I'm not straight but I thought the voyeuristic element was... well there's a cultural fear about staring at women. I had no problem staring at the man, there was less of a cultural issue for me there. Funny". *Study Two, Participant7/ comment made during the interview*

When video documentation of this participants experience is examined, it is clear that he participated in Stage Two for significantly less time than the other two stages. During his

forty minute interaction with *PEGASYS* he spent twenty five minutes of his time in Stage Three, ten minutes in Stage One and less than three minutes in Stage Two.

#	Evaluating Spatial Presence	Study One	Study Two
B35	I had the sensation that parts of the displayed Environment (e.g.,characters) were responding to me	Strongly Disagree: 12% Disagree: 40% Neutral: 16% Agree: 24% Strongly Agree: 4% Not applicable: 4%	Strongly Disagree: 12% Disagree: 24% Neutral: 24% Agree: 32% Strongly Agree: 8%
	Outcome:	**28% agree**	**40% agree**

However B35 *I had the sensation that parts of the displayed environment (e.g., characters) were responding to me* got higher responses in study two as 10/25 of participants agreed (B35:Study 1, (7/25), 28%/Study 2, (10/25), 40% agreed). How then is it possible for characters to seemingly respond towards the participant if they are not aware of the participant? A cross examination of the data gathered through the interview process, the participant information form and observations gleaned from the session (and supported by the video documentation) was considered but no conclusions could be drawn.

Stage Two, the middle stage, presented an interactive component unlike Stage One and Stage Three in as much as the experience was deemed to be far more intimate than the other stages. This was by far the stage people enjoyed the most. Here are some examples of how the participants felt about their experience of Stage Two.

> "The one thing I did note was that the woman in Stage Two, she nodded to the camera at some stage and that was the one thing I did pick up but then again I was intrigued by the characters and I became more observant of them rather than the landscape. I noticed that she did a nod at one stage and that was a distraction it broke the sensation". *Study One, Participant #2/ comment made during the interview*

> "The one person was fantastic cause I identified with her. She came in first and then I lost her because I was exploring another space and I found her again later on and it was so delightful. I felt that the space needed populating. I identified very closely with her cause she was an aesthetic that I know. She was doing the same kind of wandering about that I would do If I were in that space. Doing nothing and feeling kind of relieved, that kind of thing". *Study Two, Participant #18/ comment made during the interview*

#	Evaluating Spatial Presence	Study One	Study Two
B36	I would have enjoyed more character action	Strongly Disagree: 24% Disagree: 20% Neutral: 24% Agree: 12% Strongly Agree: 16% Not applicable: 4%	Strongly Disagree: 4% Disagree: 24% Neutral: 36% Agree: 20% Strongly Agree: 16%
	Outcome:	**28% agree**	**36% agree**

Question B36 asked if participants *would have enjoyed more character action*. In study one 7/25 participants agreed and in study two 9/25 agreed, thus confirming that participants were relatively happy with the character action (B36: Study 1, 28%/Study 2, 36% Neutral). In the interview however, one participant expressed other ideas...

> "...but I wanted more from certain situations like I felt there was a level of engagement or interaction with the characters but because I could only give them more room, that was the only thing I could do. I wanted to be able to look at them more closely or tell them where to go...chase them or follow them somewhere".
>
> *Study Two, Participant #9/ comment made during the interview*

In fact, in study one, participant #10 wrote the following on her questionnaire (ITC-SOPI),

> "Characters – wanted them to be more static – loved Birdmann, perfect".

#	Evaluating Spatial Presence	Study One	Study Two
B34	I felt I was in the same space as the characters	Strongly Disagree: 8% Disagree: 28% Neutral: 12% Agree: 48% Strongly Agree: 4%	Strongly Disagree: 4% Disagree: 16% Neutral: 32% Agree: 32% Strongly Agree: 16%
	Outcome:	**52% agree**	**48% agree**

B34 asked if participants felt located in the same space as the characters. In study one, 13/25 (50 percent) agreed and in study two 12/25 (48 percent) agreed. This was a surprise to the findings as the result was not anticipated to be so high. When participants were asked if they felt *they were in the same space as the characters* approximately half of the participants agreed that they did despite the 2D technology display. This indicates that the that filmic techniques employed such as direct gaze and panorama were perhaps sufficient to break down the 'fourth wall' of the dramatic narrative. Participants' felt connected to the characters through the establishment of a sense of 'place'.

The comment below illustrates one participant's experience of Stage Two and the dynamic created by a characters appearance in the scene,

> "I felt like a bit of a voyeur so I thought I better move on and go to the next one (stage). It was a very intimate relationship that one on one so when I moved on there was a group of people and it was easier. I mean I'm not straight but I thought the voyeuristic element was... well there's a cultural fear about staring at women. I had no problem staring at the man, there was less of a cultural issue for me there. Funny". *Study Two, Participant 7/ comment made during the interview*

When video documentation of this participants experience is examined, it is clear that he participated in Stage Two for significantly less time than the other two stages. During his fourty minute interaction with *PEGASYS* he spent twenty five minutes of his time in Stage Three, ten minutes in Stage One and less than three minutes in Stage Two.

Conversations that took place during the interview process enabled participants to speak specifically about certain elements of their experiences of the visual media content (A), sound design (B), and of the interactive component (C). During the interview section A, participants were able to express very frankly how the presence of others (screen characters) made them feel.

> "It became more of a kind of performance when there was somebody in the scene. I was, you know with my acting training, I guess I'm aware that if I see somebody on the screen they're not there for no reason, they are there because some kind of narrative is being kind of suggested or inferred. So I took interest in them in terms of what they were doing. I was aware that in some cases they were kind of drawing my focus in a particular way through language or through particular journeys of narrative in a movement sense". *Study Two, Participant16/ comment made during the interview*

> "Sometimes I guess they were trying to be inconspicuously conspicuous so that I might not feel like I had to watch them and then I might feel free to go off and look at something else and so I kind of felt there was an intention of half detachment that is there as well. But I also took interest in some of the things they were doing to see what kind of decisions they were making in their space and on their journey. I mean sometimes you kind of feel like you are looking too intensely you don't want to be a voyeur so you cast your eyes away. You know I was aware of having to do that. When I say having to do that, you know just my own sense of what's appropriate, where to look. Birdmann crotch and the

> women's' legs... you tend to put yourself through a censoring process. But I kind of like, I like that demure kind of sensation as well, you can indulge in a little bit of peripheral joy and sensual experience and engaging with people which changes the physicality". *Study Two, Participant16/ comment made during the interview*

One participant objected very strongly to the company of men in the virtual place.

> "I got very cross. I really, I found myself reacting...it was ok when there were two woman on the rock but when the man turned up I thought what are you doing here? I got really quite...I really struggled from a reaction against there being men in that space. Really some how I felt that this was my space and I don't want anybody here certainly I didn't want a man around. So I went back into Stage One just where there was nobody just to chill out and then back into Stage Two cause I wanted to find the single woman. I looked at Stage Three again, there was you know, things had shifted and people were doing different things so there was ...I don't know I still didn't want them to be in that landscape. I would have loved to have been just either nobody or the single woman in that pool, that's what I really wanted."*Study Two, Participant 18/ comment made during the interview*

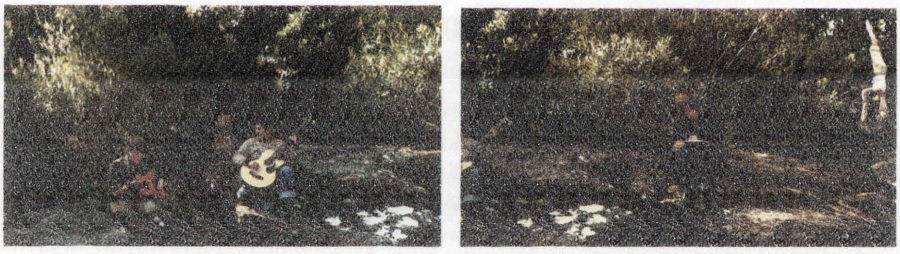

Figure 68. Cameras 4 and 5 of Stage Three

6.4.5 Evaluating the Use of Motion and Colour

Evaluating participants experiences of the use of colour and motion is now discussed. In study two, where participants navigated the media themselves by panning left and right using their gaze, they didn't mention anything during the interview about how the panning made them feel dizzy or that they had experienced 'a jerk when panning', as in study one. However, the questionnaire results indicate that a few people did experience negative effects due to system motion. In study two, two people agreed and one person strongly agreed that the experience *made them feel dizzy* at some point (B14: Study 1, (1/25), 4%/Study 2, (3/25), 12%). A sense of disorientation increased slightly as there was a 4 percent increase in the results of A2 when interactivity was introduced in study two (A2: Study 1, (5/25), 20%/Study 2 (6/25), 24%). Adding interactive motion did not alter participants' feeling nauseous as in both studies only one person indicated that they

did (B26: Study 1, (1/25), 4%/Study 2 (1/25), 4%). However, 4/25 people indicated in study 2 that they had a headache whereas in Study 1 nobody did (B27: Study 2,16%).

> "The imagery was really appealing; I really liked the movement and the variation. I really enjoyed watching it. I noticed that there was a sense that it wasn't quite real because it had a movement that didn't feel 100% natural but that was OK". *Study Two, Participant #9/ Comment made during the interview*

> "I liked particularly noticing the different light and shade. There is light in one particular spot, well its all those things that you notice and you start to look at and notice all of those little things". *Study Two, Participant #17/ Comment made during the interview*

> "I wasn't too upset by the shifts once I realized it was video, **I was just amazed that you'd even done it**, so I wasn't actually too concerned about the shifts in colour grading and the match..." *Study Two, Participant 24/ Comment made during the interview*

The use of colour in the video data was kept as natural as possible remembering that the visual media content was stitched together from fourteen FOV, seven of which were shot in real-time and the other seven shortly after, thus the lighting conditions fluctuated creating variation within the 'natural' environment (see Figure 2). Incidentally in study two only two participants out of twenty five expressed that they found the stitching to be distracting and commented on it during the interview,

> "I liked particularly noticing the different light and shade. There is light in one particular spot, well its all those things that you notice and you start to look at and notice all of those little things". *Study Two, Participant #17/ Comment made during the interview*

> "It seemed like to me it actually felt like it was lit in a different way, I know that's probably not what happened but it was drawing your attention around in different ways". *Study Two, Participant #9/ Comment made during the interview*

> "Especially with the woman who appeared it felt like she was...I really liked that effect, and I liked the effect of the different colours and the sense that... and I don't know it just worked, really worked". *Study Two, Participant #4/ Comment made during the interview*

> "I think because it was so nice being able to pan around and it was kind of interesting seeing the differences between the light and the shade. You could see that one was shot a little bit later and there were shadows there that weren't there before and then in one clip you know, there was wind and then there wasn't so much on the other side but that kind of added to the dynamic of it". *Study Two, Participant #17/ Comment made during the interview*

During the interview process participants were asked the following question (Section A_Q#1):

The content has sections that become 'out of kilta' to the rest of the footage, for example a nominal section will suddenly shake or pan ever so slightly, perhaps a rock moves or a tree is blown by the unforeseen wind. Did you notice these variations and if so how did they make you feel?

The folowing comment highlights a view that illustrates the nature of the media content in respect to the video stitching techniques employed.

> "I loved that aspect of it. It was kinda like a filmic cubism, I enjoyed the fact that there was time displacement, you could really work with that a lot more in terms of the aesthetic as well rather than having a naturalistic feel to it. You could really work with the aesthetic to make that time shift and you know that cubist movement of people through different phases. So that was kinda exciting, Shocking to start off with but I think that worked really well". *Study Two, Participant #7/ Comment made during the interview*

Incidentally in study two only two participants out of twenty five expressed that they found the stitching to be distracting and commented on it during the interview,

> "They detract from the ability to be able to immerse fully in the experience because they jolt and they jilt and you think it definitely needs to be more fluid and continuous in that respect". *Study Two, Participant #10/ Comment made during the interview*

Some participants were drawn to admire the content through careful consideration of how the content was composed:

> "I felt my attention was a little bit spilt because on the one hand I was actually really interested in the technique you were using and I was particularly interested in what looked like a display which was somewhere between film or video /

> animation. A couple of times, initially I was wondering if you had overlays that were sort of animating still parts of an image or whether it was filmed and treated in a particular way, so I was very interested in that. And then I was very interested in the stitching and it was at that point that I realized that you were actually using raw video, that you were actually matching together video which was really interesting. I thought oh gosh that's a whole other way of thinking about it and what that really gave me the impression of was, that I was in this sort of constantly moving...The sense of a 360 within a rectangle was very strong to me and so I didn't actually feel like I needed to go to the ends of the known universe in it. I didn't really need to know what's the top what's the bottom in a linear panoramic kind of way, so it gave me a very different take on it. And I wasn't too upset by the shifts once I realized it was video I was just amazed that you'd even done it, so I wasn't actually too concerned about the shifts in colour grading and the match but I think if you didn't know the technique that might be more disturbing". *Study Two, Participant #24/ Comment made during the interview*

6.4.6 Evaluating the Audio Components

The section goes on to evaluate the audio components in respect to both content (6.4.6.1) and form (6.4.6.2) through analysis of participants' experiences of the surround-sound system (6.4.6.2) and the use of headphones (6.4.6.3).

The sound was designed in accordance with the five steps embedded within the designed experience. 1) atmospheric sounds, 2) compositional music scores and 3) sounds dynamically generated through operation of the system and heard only by the wearer of the headphones. These three system features have been previously discussed in terms of their relationship to *The Creative Engagement Model* and participant's experiences of them.

Atmospheric sounds – attractors (for evaluation see 6.3.3)
Compositional music score – sustainers (for evaluation see 6.3.3)
Sounds dynamically generated – relaters (for evaluation see 6.3.3)

Participants reported through the interview sessions their experiences of the sound design. Overall the atmospheric sounds designed to work as *attractors*, did exactly that. Participants were very drawn to the natural surround-sound score that was designed to replicate the natural environment in 360 degrees. The music scores added to operate as

sustainers offered participants a fresh perspective on the same location, enabling the experience to change for them in a more creative and intimate way. Lastly the sounds that were dynamically generated and operated through an interactive component were considered mostly to be too erratic. Designed as *relaters* that assist the relationship between the participant and the system to grow fostering a continued interest in the work, these sound design elements proved to be too inconsistent and erratic to be effective system enhancing attributes. It maybe that the form of the interactivity hindered the ability of these sounds to work as designed. As we shall see results indicate that the 3 sound components as system design features (5.3.1.6 *Sound as a Design Feature*) contributed greatly towards heightening the experience of presence for participants.

6.4.6.1 Audio Systems

The sound outputs during the exhibition of *PEGASYS* (study two) facilitated two experiences for participants'. First, the external sounds, those heard in the exhibition space were constructed as a three-dimensional surround-sound environment thus creating a sense of spatial dynamism. Secondly, the participant wore headphones. These features are now discussed in respect to the form of the technology and how they enhanced the feeling of media presence for participants.

6.4.6.2 The Surround-Sound Environment

The questionnaire (ITC-SOPI) (B24) asked how participants experienced the sounds in the environment. As previously mentioned study one presented participants with a standard two speaker setup, with speakers located downstage in front of the visual media display. Study two implemented a surround-sound installation including five speakers positioned within the exhibition environment.

B24	I had a strong sense of sounds coming from different directions within the displayed environment	Strongly Disagree: 8% Disagree: 12% Neutral: 36% Agree: 28% Strongly Agree: 16%	Disagree: 8% Neutral: 20% Agree: 48% Strongly Agree: 20% Not applicable: 4%
	Outcome:	**44% agree**	**68% agree**

In study one 11/25 of participants agreed that they *had a strong sense of sounds coming from different directions within the displayed environment* (44 percent, B24, Study 1). In study two this increased to 17/25 indicating that the surround-sound environment with the remastered audio was indeed more immersive than the system and the sounds used in study one (68 percent, B24, Study 2).

In terms of relating sound to the form, study two reveals more closely the link between these human-computer relationships. In Stage One, atmospheric sounds played continuously in a loop with the visual media. In Stage Two a musical score was introduced along with the sounds of a girl singing and humming. The participant could not control the sound in either of these stages. In Stage Three, dynamically generated sounds were accessed by the participant via a target area or invisible icon which is embedded within the *PEGASYS* interface. These sounds could only be heard by the participant who was wearing headphones. The system played these audio clips sometimes at random and sometimes on demand. In order to activate them participants had to remember where the icon was and when to use it. In order to hear the sounds of the characters they were looking at they had to align the characters within the parameters of the invisible centre icon. For an example of this see, *PEGASYS* Drive/Folder 4_Evaluation/ *PEGASYS* in Beta_Space_Interface (01:08 Duration)

During the interview Section C, Interaction, the participants were asked if they felt they were able to switch the music on and off at will. Tables 36 and 37 illustrate some of the responses participants gave during their interviews.

C Q5	P#	**Study Two:** During the final stage were you able to switch the music on and off at will? **Negative Response**
	2	No, I didn't no. I didn't feel like that.
	15	No. I actually didn't. I was a bit surprised by...I felt that was something more to do with the artist, yeah something that the artist had more control over. I actually didn't pick up that I had any control over the sound.
	10	No. No I didn't. It was coming and going and I didn't know how.
	11	Umm Not really no. I found it a bit jarring sometimes when one clip would stop and another begins.
	18	No I had no idea I was activating the sound cues. That didn't twig.

Table 36. Interview. Section C. Question 5: Negative Responses

C Q5	P#	**Study Two:** During the final stage were you able to switch the music on and off at will? **Positive Response**
	17	Sometimes, it was very exciting
	22	I think I did when my gaze was resting

Table 37. Interview. Section C. Question 5: Positive Responses

Participants also had this to say on their experiences of the sound in relation to the system design,

> "Yeah, I liked it. I liked the sound, its nice to have a choice though, and a few times I actually did make the change on purpose and in other times it just happened, but that's all good you know". *Study Two, Participant #17/ comment made during the interview*

> "I liked the fact there were different types of music and trying to switch that on and off. I did in the part where Birdmann was talking and I was trying really hard

> to see if I could switch him on but I'm not sure whether you are able to or not". *Study Two, Participant #17/ comment made during the interview*

> "Oh the music was beautiful it was just a bit noticeable when the music stopped and a new track started, there might be a way you can sync them sonically but I'm not sure". *Study Two, Participant #7/ comment made during the interview*

> "I liked all the music. I sort of felt that I wanted the ... I didn't know where the music was coming from and sometimes one type of music left and I didn't know why it left". *Study Two, Participant #9/ comment made during the interview*

Many of the participants did not understand the relationship between their actions and the playback of audio clips, many had simply forgotten the instructions. The addition of a detailed sound score in Stage Three, that dynamically arranged sound clips in order that they could be activated depending upon where the participant was in respect to their location, enhanced the experience. However, as expressed above, many participants were unaware that they could implement audio changes, the dynamic quality of the art system appears to have detracted as well as enhanced participant's experiences of this aspect of the system design.

6.4.6.3 The Use of Headphones

When participants were asked during the interview about wearing headphones most people indicated that they did not mind with responses like:

> "I think it was better. It helped me to concentrate, not focus on the (external) surroundings". Study Two Participant #1 /Comment made during the interview

> "That was ok, got a little bit sore at the top of my head at one stage but I adjusted that and it was fine. It actually was nice because it kind of cut off the sounds that were happening outside as well which was really good". *Study Two, Participant #17 /Comment made during the interview*

Wearing headphones meant that participants were physically tied to the end of the extended headphone cable and some people found this a hindrance. It also proved to be another variable in configuring participants' full experience as occasionally the headphones would unplug from the computer terminal and require re-establishing. However, overall the wearing of headphones to enhance the experience was successful and highly recommended for noisy exhibition spaces.

> "Well look I love the sound. As I was saying, my attention was split in so many directions I didn't feel I got to attend to the sound as much as I would have liked. But I was really interested in how you've done the sound design because that's what I'm really immersed in with my own project. The fact that you've developed a sense of spatial dynamic in the sound I really liked. I was a bit thrown when I got to, I think Stage Three and there was no sound or maybe there was sound but I didn't hear it. Particularly because there were people playing instruments and stuff and I couldn't hear it. I was trying to remember if I was supposed to do something else to bring in the sound. I was very aware of the peripheral noise in the environment and I felt there was probably a likelihood of there being something there because so much of it, so many of the images related to sound". *Study Two, Participant #24/ Comment made during the interview*

6.5 Evaluating System Design Features – The Form

Section 6.5 considers the systems features in respect to the form of the technology. The systems form is considered in respect to the participant's experiences of it, namely; 6.5.1 *Evaluating the System Response Time*, 6.5.2 *Evaluating Eye-gaze Tracking as a Sensory Output*, 6.5.2.1 *The Viewing Distance*, 6.5.2.2 *The Obtrusiveness of the Technology*. 6.5.3 *Evaluating Participants' Experiences of Eye-gaze Tracking* concludes with a summary of eye-gaze control and its impact on participants'.

6.5.1 Evaluating the System Response Time

Eye-tracking as a form of interaction within the art system proved to be a creative tool for experiencing immersive engagement. A number of factors about the system response time can be identified through the evaluation of study two data. Generally speaking participants felt *drawn into the experience*, with 23/25 participants' in study two data indicating a strong response to the presence attribute of being '*drawn in*' to the experience (B1: Study 1, 80% / Study 2, 92%). In study one 14/25 agreed that *they felt involved,* in study two this increased to 18/25 (B2: Study 1, 56% / Study 2, 72%). This maybe due to the fact that many felt they were taking part in something as indicated by 19/25 of study two participants who felt that they weren't *just watching something* compared to 13/25 in study one (B12: Study 1, 52% / Study 2, 76%). Remembering that the system response time was deliberately slowed down inorder to create a stress free experience and force participants to engage with the media content not just experiment with the system's form it must be noted that this aspect of the design hindered some participants' experiences'. Some participants', especially those who had prior experience

of art systems and the concepts of immersion, had difficulties in experiencing the presence engagement sought by the artist.

Participants' experienced a presence-based engagement regardless of the fact the system did not consistently behave in a predictable reliable manner. This is where absence stepped in. 2.1.4.5 describes how presence and absence are both viewed as states of absorption, the former in relation to the state of 'flow' and the latter in respect to imagined situations and events. Where the art system form facilitated an experience of the sense of 'arrival' (being there), it also contributed towards the sense of 'departure' (a sense of not being there) or absence (Kim and Biocca, 1997). Some participants engaged with *PEGASYS* in a fluid playful manner, however, as previously mentioned, the system response time was implemented as a system feature, yet it was observed to hinder participants' experiences. What occurred then is absence, as the participant is trying to gain control and failing, they are drawn to engage with the media in a new way. There must be a willingness on the part of the participant to interact with *PEGASYS*, as if consciousness had snuck itself in as an art system design feature.

> "I have to say that I understood that I was having some influence on it and that maybe I could lead it to an extent but I would say using words, modality words like most or more or less it was mostly out of my control I felt. Occasionally I could see that I must have some influence but I wasn't sure exactly how". *Study Two, Participant 16/Comment made during the interview*

> "Well I mean for me the aesthetic in which your working is interesting and I think it works on three levels. I really found that sense of layering and the potential of moving inside that layering really interesting. My observations, having kind of put work into this space in the past and also trying to move panoramic compositions around, I find myself having faith in the cinema. No, not faith, feeling the same issues, is that I'd like that interaction, that panning, to be more responsive. I find it quite slow in that sense and so what occurs then is that the interaction is slow for me. I do think that to make someone immersed in something in an intimate way its got to be a very kind of clear response and I think at times that did occur. I got that sense you know but at other times it wasn't happening in that sense. So there were kind of inconsistencies and as soon as you get that kind of inconsistency that sense of embodiment is broken ...and then you have to remind yourself the relationship is another distant way of

looking at all of those things". *Study Two, Participant11 /Comment made during the interview*

The following comments were made by people who experienced the digital media content in study one and study two. It is possible that their experiences of the interactive system were hindered by having experienced the media as cut (and designed) by the artist and then exploring the system themselves:

"Response of system to my interaction was too slow to fully engage my attention". *Study Two, Participant #18/ note left on questionnaire*

"...there were times when I looked at something and nothing seemed to happen so I, I had thought beforehand that maybe there would be more response than that. But I had very limited knowledge of the technology. It just wasn't, didn't seem to me to be that much different"(compared to study one). *Study Two, Participant 6/Comment made during the interview*

The second comment is of particular interest as it gives the impression that despite the interaction occuring between the participant and the system (as observed in the video documentation), the participant was not very aware of her contribution in the two-way process. This indicates that she was involved in the interaction without feeling any particular effort on her behalf and therfore that the system responded to her needs unhesitatingly. In terms of the technology facilitating for participants an experience of a presence-based engagement, the questionnaire (ITC-SOPI) results assisted to more clearly define the role of the eye-tracking device as a tool for generating presence through interaction.

Data results indicate that some participants felt constrained by the form, some identified as feeling tired (B10: Study 1, (6/25), 24%/Study 2, (6/25), 24%) or felt that they had sustained eye-strain (B21: Study 1, (3/25) 12%/Study 2, (10/25) 40%). Comments were made about the suitability of the form and how multi-tasking is not yet an option, whereas others discussed their views on immersion and why the technology did not facilitate an immersive experience for them.

"I found it difficult to keep my gaze in the one place and I'll tell you what was frustrating was when I blinked it stopped, every time I blinked it stopped. It would pause it just for a second then it would pick up and go again, it didn't seem to be able to handle a blink even though your eyeball stayed there in the same

> place, when I blinked it stopped". *Study Two, Participant 10/ Comment made during the interview*

In study two participants could change the visual and aural media contents' delivery through creative exploration of the systems interface. They could make choices about where they wanted to be, what they wanted to watch and what they wanted to listen to, but in terms of the designed experience they were not able, in the artists view, to change the course of events. However, as 14/25 participants in study two indicated that they felt *they could change the course of events* then interactivity clearly enabled those participants' to feel more empowered, in control of the system and capable of controlling the course of events in an engaging creative experience (B33: Study 1, (3/25), 12%/Study 2, (14/25), 56%).

And finally in respect to the system response time, participation levels naturally excelerated through interaction as study one results indicate that 7/25 of participants *felt as though they were participating* whereas in study two this increased to 19/25 (B38: Study 1, 28%/Study 2, 76%). In study one, when participants were asked if they *felt that they could interact with the displayed environment* 7/25 agreed that they felt they could whereas in study two 22/25 participants' agreed that they felt they *could interact* with the system designed for the experience of a presence-based engagement (B4: Study 1, 28%/Study 2, 88%).

The *PEGASYS* drive Folder 4_ Chapter Six_Evaluation/ Demo#1_eye-tracking L&R.mov (01:17 Duration), contains a Quicktime video clip that demonstrates an an interaction occurring between a participant and the system. It is interesting because it demonstrates through observation that the process that took place within this relatively short space of time was both rewarding and challenging for the participant. The video documentation begins during a participant's engagement with Stage Two. The screen character is walking towards the left hand side of the image.

At 00:02 she disappears screen left, the participant simultaneously pans with their gaze, moving the media across to the left in order to keep up with the characters pace. At 00:09 the character again moves further left, off screen. Here the participant and the system take 6 seconds before the media begins to pan, 6 seconds is a long time when you know your missing out on the action. The participant then pans left for another 6 seconds before finding the character who has turned around and is now walking towards the right side of the screen. At 00:25 the character exists the screen on the right and the participant tries

for 15 seconds to activate the eye-tracking to pan the media right. At 00:40 the character returns walking across the landscape and directly exiting screen left. This time the participant is able to follow the character immediately and for an extended period of time, engaging with the system in a fluid, functional manner. What this demonstrates is that the system did not always behave in a predictable manner. The participant and the system form had to work together to navigate the systems media content, and occassionaly the two fall out of sync and the connection is broken.

As a design feature the systems response time appears to have been too slow for some participants to enjoy the experience fully. This is discussed in more detail when we look at how personality types and moods can affect a persons ability to experience art systems. As a design feature that enforced participants to engage and fully explore the media content, it worked well.

6.5.2 Evaluating Eye-Tracking as a Sensory Output

This section is concerned with evaluating the consistency of the sensory output in respect to the form of the system and its ability to assist in generating presence-based experiences for participants. The eye-tracking device as a sensory output is addressed here. Although the MyTobii User Manual (Version 2.4) states that freedom of head movement permits participants to move freely and behave in a natural way, the results of this study indicate that this was not true in all cases. In Section C: Interaction, the interviewed participants were asked: *did you find the eye-tracker easy or difficult to use as a navigation tool?* There were mixed responses. Some participant's commented on the physical challenges they underwent whilst using the system and made the following statements:

> "One of the things I did find was that I was a bit worried that if there was a person in the left or the right hand side of the screen that I wanted to watch, I was scared that it would move it on, and so I was sometimes consciously not directing my eyes directly at that person, because I didn't want it to move. But I wanted to watch them and then I kind of figured that if I moved it to the left or the right and centered them, I could watch them. (laughs) So its kinda like slowly learning how to control the situation, working out what works and what doesn't". *Study Two, Participant #17 / Comment made during the interview.*

> "Yeah, really good. Except I, you, get a bit lazy and your head moves and your unaware of the fact that you've moved outside of the gaze of the device, and all of a sudden nothings happening and then you think, oh I must have slouched or

rolled my head around. So maybe you need something like, clamped onto your head, so that the relativity, of your eyes to the sensor, is always retained". *Study Two, Participant #10 / Comment made during the interview.*

"Sometimes really easy and sometimes really difficult. I noticed that I was really conscious of not moving my head and I think I spent a bit of energy trying not to move my head, and sometimes I wasn't even sure if I was. I got to the point where I was focusing so hard that I thought that maybe I had moved my head, so that was a bit weird. It does take quite a lot of energy I think and you know a bit of practice. To start with I felt that I had it and then there were points where I lost it. I noticed that, I think in my excitement, my chin went up a little bit and I did move kind of forward or backwards or something slightly, which changed it". *Study Two, Participant #17 / Comment made during the interview*

"Well I think, I wrote in here in the last bit you know, I kind of surrendered to an experience, on a poetic level I think, do you know what I mean? There's like this conflict of feeling like your plugged in or strapped in or restrained and you can't kind of...you feel worried about scratching your nose. Silly I know, but you feel like your kind of attached to some technological device but ...**if you can kind of relax into it, you go into that world completely.** So I was able to let go and enjoy the experience and let it wash over me quite comfortably". Study Two, Participant #16 / Comment made during the interview

Clearly then there were mixed responses from participants, as people experience things differently but over all these comments reflect the participants experiences of using eye-tracking technology delivered in this form, as being challenging.

	Negative Effects	Study One	Study Two
B10	I felt tired	Strongly Disagree: 32% Disagree: 28% Neutral: 16% Agree: 12% Strongly Agree: 12%	Strongly Disagree: 32% Disagree: 36% Neutral: 8% Agree: 20% Strongly Agree: 4%
	Outcome:	**24% agree**	**24% agree**
B21	I felt I had eye strain	Strongly Disagree: 48% Disagree: 40% Agree: 8% Strongly Agree: 4%	Strongly Disagree: 24% Disagree: 20% Neutral: 16% Agree: 20% Strongly Agree: 20%
	Outcome:	**12% agree**	**40% agree**

The MyTobii User Manual (Version 2.4) states that long and accurate studies can be undertaken without fatigue and this seemed to be the case in this evaluation study. The results of B10 *I felt Tired*, were the same for both studies, however eye strain was

noticeably and understandably up from 3/25 (12 percent) in study one to 10/25 (40 percent) in study two.

In respect to the form of the technology providing an experience that facilitated a direct and responsive engagement participants had this to say when asked about how they felt about the interaction they were having with the technology:

> "I didn't have a desire to make it do stuff, as you say you are in effect making it do things by your gaze but it wasn't for me what the experience was all about at all. It was about being taken along". *Study Two, Participant #16 /Comment made during the interview*

> "Slightly clunky. A wee bit jerky. I mean straightforward. Quite tricky holding it still and being aware of the peripheral stuff going on. It was shifting at times when I just wanted it to stay still. It moved when I didn't want it to move simply because I was in a space I wanted to go around the space and of course that shifted it". *Study Two, Participant #24 /Comment made during the interview*

Another commented on how the interaction was for them, singular in purpose,

> "It was almost a demonstration to me how eye-tracking's not really a good way of interacting with things, not because of technical problems but because it just limits your ability to multi-task, like I wanted to keep scrolling but while looking at something else". *Study Two, Participant #11 /Comment made during the interview*

Study two, using the Tobii X120 eye-tracker and VOD system design, facilitated an interactive experience for participants' which by all accounts was deemed to be engaging, gained participants' attention and provided them with options for enhancing a slow thoughtful sensorial experience.

6.5.2.1 The Viewing Distance

Study 1_No interactivity	Study2_Interactivity
2 meters	1.6 meters

In study one the viewing distance was determined by the placement of the couch and no participants requested to move the couch to improve their experience. In study two the viewing distance was determined by the distance between the X120 eye-tracker and the

projected image on the screen as these dimensions had to be plotted into the trackers calibration process (1.6m). The participant was required to be between 60 and 70cms away from the tracker and the chair with wheels facilitated this.

Figure 69. View of the Participant and Observers Seating at Beta_Space

6.5.2.2 The Obtrusiveness of the Technology

In study one the technology was hidden from view in as much as the image was rear projected and the speakers were discrete. In study two the X120 and the headphones changed this scenario. The X120 was very obtrusive as it sat directly in front of the participant. If the configuration of the system was hindered in anyway then the X120 had the potential to block the image sightlines. During study two, when asked in interview why participant#11 found the X120 obtrusive, he replied:

> "...I think it had to do with the arrangement of the actual eye-tracker during calibration because the lower left icon during calibration was in the very corner but the lower right one was closer to the centre and the eye-tracker-thing was in the way so it almost caused a shift in focus and I was having trouble later looking at the icon". Study 2, Participant #11

This participant is right to comment on this aspect of the technology and interface connection. The participant was situated in the chair and positioned within the X120s view, sometimes this created a scenario where the participant could not see clearly all the screen. Attempts were made to adjust the outcomes when this situation arose but occassionaly views were obscured by the device. However, in most cases the physicality of the technology was acknowledged for what it was and no further discussion was entered into.

6.5.3 Evaluating Participants' Experiences of Eye-Tracking

The process undertaken throughout this research examines in what way the art system features contributed towards whatever features of a presence-based engagement the

participant was experiencing. Here we are particularly interested in what influences the eye-tracking technology had on the participant's experience of the art system.

> "If presence is not invoked appropriately, for example with poor or slow coupling between the body movement and display changes, and then it will detract from a sense of presence in a mediated environment" (Riva, 2004. p85).

The evaluation process of this study allows for analysis of Rivas statement by examining participants' experiences of an eye-tracking device (X120). Evaluation of participants' experiences of the system response time, were also examined through analysis of participants experiences of an eye-tracking device as a sensory output (6.5.2) and various factors relating to interactivity (6.5.2.1).

By incorporating the eye-tracking technology as a design feature, eye-gaze control was built into the system producing slow engaging experiences. This was effectively implemented as much as some participants could navigate the system reliably, some of the time. As the system is dynamic it is designed to behave randomly under certain circumstances, namely being dependant upon which stage you are in. If the response time had been faster then more participants would have enjoyed that aspect of it. However, if the system response time had been faster then some part of the designed experience would have been lost. As it was possible for participants to pan fairly quickly through the media content (see *PEGASYS* Drive/ Folder 5_ Folder 4_Evaluation/ Chapter Six_Evaluation/Demo#1- Demo#4), as many did, then those that focused on the response time and were distracted by it, may have simply moved to quickly through the designed experience to appreciate the systems purpose. The majority of participants 22/25 agreed they *could interact with the system* (B4: Study 1, 28%/Study 2, 88%) and 18/25 *felt involved* (B2: Study 1, 56% / Study 2, 72% agreed).

It appears that a majority of participants of study two did experience a presence-based engagement through the use of eye-tracking as a sensory output, regardless of the fact the system did not consistently behave in a predictable reliable manner. As previously mentioned the system response time was implemented as a system feature and was possibly more of a hindrance to the participants experience than anticipated. Issues of participant control and expectations played an important role in respect to interactivity and where the system had been designed to respond slowly this was perceived to be an error on behalf of the systems ability. Despite this immersion was possible as 23/25

participants of study two expressed during the interview and in questionnaire (ITC-SOPI) that they had a strong sense of involvement and felt themselves being 'drawn into the experience' (B1: Study 1, 80%/ Study 2, 92%) adequate signs that participants' experienced the sensation of presence engagement whilst interacting with the system.

During the interviews participants' repeatedly expressed their delight with interacting through their gaze. Nobody in the study had used the technology before and all were amazed by its potential and capabilities.

> "Like a form of visual poetry. At times I was able to feel part of it or in shared control but mostly I let it wash over me I think. Very tricky combination of sitting still – feeling a little strapped in but more or less a sense of 'letting go' was the joy of the experience". *Study Two. Participant 16.*

19/25 of participants agreed that they felt they weren't just watching something (B12: Study 1, 52%/Study 2, 76%) and felt as though they participating in the displayed environment (B38: Study 1, 28%/Study 2, 76%).

Eye-tracking technology had a significant impact on participants' experiences of *PEGASYS*. Participants could and did interact with the system through a series of repeated patterns or random movements. The choice was theirs. Participants experienced a new form of communication, they learnt how to navigate, control and interact with an audio-visual system through the use of their eye movements only. The participants indicated repeatedly that they enjoyed their interaction with the system as was indicated by the average duration time of participants, which was 35 minutes.

6.6 Evaluation of Personality Types and Moods

Section 6.6 *Evaluation of Personality Types and Moods* is divided into five sections. Its main aim is to alert the reader to the intricate nature of the experience of presence, to remind the reader that experiencing presence is not due soley to the system design features but requires that the participant enagages with and is absorbed by the interaction. Participants' personality type and mood affect the outcomes of these experiences and this section identifies some of the signifiers that exist to evaluate how these other factors influence the engagament. *Moods* (6.6.1) are addressed first followed by 6.6.2 *Attention as an Attribute of Engagement*. In this section a participant's ability to pay attention is evaluated and the use of a clinical model of attention proves to be a reliable data

evaluation method. The five sections address attention as focused, sustained, selective, alternating and divided.

Presence and Time Factors (6.6.3) include elements such as the participants levels of involvement (6.6.3.1), and their ability to concentrate (6.6.3.2). 6.6.4 the meaning the user gives to the stimuli addresses participants issues with controlling the system (6.6.5). As this section is concerned with participant's experiences of the interactive art system results from study two only are addressed within this section.

In order to evaluate the participant's experiences of an art system it is important to consider the personality types, traits and moods of the participant (Waterworth and Waterworth, 2006).

6.6.1 Moods

In respect to creating a low stress environment in which to test for presence attributes, when participants were asked if they found the experience relaxing or frustrating, a clear picture emerged. Participants generally reported feeling enagaged with the experience to the extent that whatever frustrations or stressfull situations arose, the positive outcomes exceeded them. "letting go' became part of the joy of the experience and as as one reported:

> "An incredible, exciting and moving experience unlike anything I have experienced before. It was relaxing and stimulating at the same time! Strange but wonderful. Study 2, Participant 11

For many participants the system *did* produce relaxing engagements, but some felt that they were tainted by what they perceived to be the systems inability to respond more quickly to their demands. As feelings associated with relaxation and frustration are indicative of mood then in the light of data gathered most participants were in receptive moods throughout their engagement. Additionally participants' were asked to indicate if they *responded emotionally* to the experience of the art system, 60 percent indicated that they did.

During the interview participants' expressed how they felt in respect to the meaning they gave to the stimuli or content. 80 percent *enjoyed themselves*, 68 percent agreed that *the content seemed believable to them* and 92 percent indicated that *the content appealed to them*. As we have seen participant's became very engrossed with the content and were drawn to different facets of it. Some reflected on the peaceful nature of the environment and how they appreciate places like Crystal Pool in real life scenarios, some commented

on the attraction they had with the engagement provided in Stage Two with a female character to interact with, others found her presence too voyeuristic. Many participants enjoyed the multiple narrative options in Stage Three. The use of sound was also noted for its ability to assist in drawing people into the experience and simulating an immersive engagement. Generally participants brought with them into the sessions their own prior memories and experiences of nature and dramatic encounters which assisted them to feel at ease and located in the digital environment.

When asked during the interview what participants remembered of their experience of Stage One, participants reflected;

> "...beautiful and I think really hugely added to the sense of peace and relaxation that you got while you are going through the journey". *Study Two, Participant #15/ comment made during the interview*

> "I found it very meditative and very reflective ok but I was also intrigued because I know a lot of the characters and that also engages at another layer. It's always intriguing to watch others in another context. But the whole setting itself it what really...I could...I could sit there for hours. I could be there for hours. And I can relate to that whole environment". *Study Two, Participant 7/ comment made during the interview*

> "Yes, parts of it were relaxing, parts of it I think I was trying really hard to get it to work, and trying hard not to move and I think that that I tend to hold everything from the shoulders up to the chin, I do this (demonstrates). But that's just me. But yes it was actually really nice, and I didn't mind that it wasn't working, it didn't frustrate me I just went oh well I just have to look at what's actually happening now rather than move it so...because you do tend to go oh this is really exciting I can move it with my eyes and you just want to keep moving around so when it wasn't working I actually... it didn't frustrate me at all it was actually, quite, it meant that I saw things that I might not have seen".
> *Study Two, Participant #17/ Comment made during the interview*

The above statements made by participants' indicates that the systems design features did meet their aims. The system was designed to slow people down and in doing so proposed that participants engage with the media content in a relaxed fashion rather than focus on the technology as an attribute for speedy exploitation. When participants were asked if they found the experience relaxing or frustrating a clear picture emerged. For many

participants the system did produce relaxing engagements that were not frustrating but they were tainted by the systems functionality. As the sensation of feeling relaxed or frustrated are identifiers of moods then in the light of this information we can identify that most participants were in receptive moods throughout their engagement.

P#	Section A: Q5: Study Two: Did you find the experience relaxing?
1	No.
2	No. It was a lot of work.
7	I found it very meditative and very reflective
9	Yeah, definelty.
10	It was relaxing, definitely relaxing. If your prepared to just take your time and don't think your just going to rush around there in 15 seconds or get this wilderness experience downloaded into you and then off you go.
15	I didn't get stressed because that environments such a relaxing environment
16	I enjoyed it as a tranquil experience as a relaxing experience I enjoyed it. Intellectually I enjoyed it.
17	Yes, parts of it were relaxing.
22	Yes.
18	Yes. ...it had that kind of ...relaxing nourishing component

Table 38. Interview. Section A. Question 5: Relaxing

P#	Section A: Q5: Study Two: Did you find the experience frustrating?
1	Umm, I don't think I was frustrated but I stopped before it got frustrating.
2	No. I wouldn't use that word.
8	It was painful and I think that's an important thing, you've got to get through that phase, go through the frustration, through all the personnel shit through all of that crap until you get to the stage of participating
9	Not frustrating
10	I found it difficult to keep my gaze in the one place and I'll tell you what was frustrating was when I blinked it stopped,
15	No, I wasn't frustrated but I just wondered whether, well I felt like I might have been missing out on something
15	I was just going back to enjoying where I was in the moment, which was a beautiful place to be, it was more, not frustration it was just more.. I don't know I just thought I can turn around and go back the other way
16	No. Maybe at some points I thought oh well what's next?
17	It didn't frustrate me at all it was actually, quite, it meant that I saw things that I might not have seen.
17	it didn't frustrate me I just went oh well I just have to look at what's actually happening now rather than move
18	No. Once I got the hang of how it worked
24	Well I didn't find it at all relaxing. I found it quite stressful. I didn't really find it frustrating I think my main response was that I was very interested in what you were doing

Table 39. Interview. Section A. Question 6: Frustrating

Table 38 outlines various responses from study two participants who were asked: *Did you find the experience relaxing?* Table 39 outlines various responses from study two participants who were asked: *Did you find the experience frustrating?* In light of responses given it is possible to deduce that a relaxing atmosphere was created and experienced by participants of *PEGASYS*.

6.6.2 Attention as an Attribute of Engagement

This research project identified participant's experiences of attention through the five different kinds of activities of growing difficulty as discussed in section 3.3.5 *Gaining Participants Attention.*

In order to gain and sustain the participant's engagement, the system design structure afforded deep psychological connections to be made between the participant and the art system. Both the carefully chosen media content and the unique eye-tracking device are important parts of the experience. As we have seen, both the form and the content of the system can be evaluated from the participant's perspective, through interview, questionnaire and other forms of documentation. Thus, it is possible to focus on *attention* as a factor of *engagemen*t if we use the *Clinical Model of Attention* to examine participant's experiences of the art system.

Focused Attention	The ability to respond discretely to specific visual, auditory or tactile stimuli.

In order to create an art system that is engaging and provides meaningful experiences, the participant's attention must first be attained. Attractors encourage participants to explore the system and intrigue them into engaging with the system (6.3.3). The audio-visual media content was designed to be the source of focused attention and hence the first attractor for participants. High-level presence requires a lot of attention (2.1.4.1). A system design feature implemented content that stimulates and interests a broad section of the general public as 23/25 of participants *found the content appealing* (92 percent, B32, Study 2). A natural habitat was chosen for its remote location and natural beauty. 16/25 of participants agreed that the *displayed environment seemed natural* (64 percent, B5, Study 2) and 17/25 agreed that *the content seemed believable to them* (68 percent, B11, Study 2).

Sustained Attention	The ability to maintain a consistent behavioral response during continuous and repetitive activity.

The form of the system includes the use of an eye-tracking device (X120). In order to operate the interface participants had to use this device as the sensor input to monitor their gaze. The system software developed to operate the X120 was designed to facilitate a slow response time between the participant and the system driven content. Thus participants were required to *maintain a consistent behavioral response during continuous and repetitive activity*. Sustaining participant's attention was achieved through the use of a non-traditional sensor apparatus that participants had to learn how to operate and then use to explore the interactive components of the art system. For more on the systems ability to sustain attention see 6.5 *The Art System Features – The Form.*

Selective Attention	The ability to maintain a behavioral or cognitive set in the face of distracting or competing stimuli. Therefore it incorporates the notion of "freedom from distractibility"

Study two took place in a busy noisy public exhibition environment where on average participants spent thirty five minutes experiencing and engaging with the art system. This in itself is a good indicator of participants levels of attention, state of immersion, interest and engagement, as the museum curator expressed that most exhibits generally maintain the attention of participants for approximately five minutes. One participant found the exhibition environment very stressful and commented during the interview on her response,

> "I was happy to leave it (the system) with unknown things and things not found cause I knew that there was something there. It was that balance between the stressful nature of the environment and my interest in it (the art system)".
>
> *Participant 24/ Comment made during interview.*

This participant's duration with the system was 20 minutes, half the average time. See *Distraction Factors* 6.7. Therefore, participants were able through the use of headphones, sound design, system form and content to incorporate the notion of "freedom from distractibility".

Alternating Attention	The ability of mental flexibility that allows individuals to shift their focus of attention and move between tasks having different cognitive requirements.

The system facilitates participant interaction through the implementation of three stages of interaction. Each stage provides a different experience for the participant. Stage One allowed for observation of a natural landscape providing opportunities for rest and relaxation; it provided not only entertaining experiences but also produced a new place for deep relaxation and personal reflection. Stage Two facilitated the exploration of the environment with a screen character who encourages the participant to use the interface to follow her around the environment sharing her experiences. Additional sound cues are embedded. For more on shifting between tasks see 6.3.3 and 6.4.4 *Narratives* and *Emotional Content*. Stage Three incorporates relaters by providing multi-narrative explorations and additional interactive components. In order to operate the visual media content participants have to pan with their eyes. By holding their gaze on invisible icons to activate the media, participants were shifting their focus of attention between action and non-action. The active role or task altered the visual contents of the system; the non-active role facilitated deep engagement with the media content. In practice, participants

had to learn how to operate the technology, remember what the system design features allowed them to do, and shift their attention between the system capabilities and their own desires.

Divided Attention	This is the highest level of attention and it refers to the ability to respond simultaneously to multiple tasks or multiple task demands.

The visual media comprises of 90 minutes of a stunning location, buried deep within Sydney's Royal National Park. The participant selects where they prefer to be and focuses their attention on whatever they can see takes their interest or holds their attention. In Stage Three the participant's attention becomes divided, as within any 90 degree point of view there are three characters on the screen. Each of these characters has their own sound track. In order to activate the sound track participants had to align the character roughly in the middle of the screen. They then had to hold their gaze on them for three to five seconds to activate the invisible sound clip attached to the code on the sequencer. As designed, the sound clips did not load in the player sequentially. The participants had to explore this option as a design feature. The aspect of creating multiple tasks that participants needed to respond to simultaneously, required a high level of attention as participants had to remember what the system capabilities were and then apply their own needs and requirements to operating the system. In study two 23/25 of participants felt themselves being *'drawn in'*, 22/25 of participants agreed that *they could interact* with the displayed environment and 10/25 of participants *felt as though they were participating*.

In respect to paying attention (participant's experiences were analysed in relation to the *Clinical Model of Attention* (Sohlberg and Mateer, 1989). Examples are given that highlight how the systems design features enhanced participants experiences of attention addressing; focus, sustainability, distracting factors or competing stimuli and alternating attention factors. Design features such as embedded relaters enhanced divided attention as they required participants to respond simultaneously to multiple tasks or demands. The model enabled us to see the degree to which participants were engaged with the art system and how their attention was held through the design features of the art system.

6.6.3 Presence and Time Factors

Participant's experience of time is a factor that can indicate if immersion was created and sustained throughout the experience. In study one 15/25 agreed to having *lost track of time* and in study two this increased to 21/25. As these results were up from 60 percent in study one we can attribute the increase to interactivity generated either by the form of the

technology or the unique experience of activating video-on-demand scenarios (B3: Study 1, 60% / Study 2, 84% agreed). Either way, in respect to Waterworth and Waterworths' Table: *Being-in-the-world: Presence and Time Perception* (Table1) is it apparent that most participants of *PEGASYS* experienced both a low working memory load and a high working memory load as aspects of 'solving a logical puzzle' (low presence/ fast time) and 'Daydreaming' (high presence/ slow time) were experienced.

	Time	**Study 2 – Interactivity -Agree**
B1	I felt myself being 'drawn in'	23/25, 92% agree
B2	I felt involved	18/25, 72% agree
B3	I lost track of time	21/25, 84% agree
B8	I enjoyed myself	20/25, 80% agree
B12	I felt I wasn't *just* watching something	19/25, 76% agree
B32	The content appealed to me	22/25, 88% agree
B33	I felt able to change the course of events	14/25, 56% agree
B38	I felt as though I was participating in the displayed environment	19/25, 76% agree

Table 40. Questionnaire Results and Time

The above table illustrates that 23/25 of participants felt themselves *being drawn in*, 18/25 *felt involved*, 21/25 *lost track of time*, 20/25 *enjoyed themselves*, 19/25 *felt that they weren't just watching something*, that 22/25 found the content appealing, 14/25 felt *able to change the course of events* and 19/25 felt that they *were participating in the displayed environment*. These results indicate that most participants experienced a high working memory load as time past quickly for them therefore experiencing high presence as indicated by the *Being-in-the-world: Presence and Time Perception* table.

Time is a construct which seems to pass faster when attention is focused, the results of the data analysis reveal that most participants were very attentive to the art system experience thus time past quickly for them. The other consideration is that the older one becomes the faster time passes, of the sixteen participants whose experience with the art system exceeded thirty minutes, twelve were over the age of forty years. And as we have seen on average participants spent thirty five minutes interacting with the system.

6.6.3.1 Involvement

In respect to the degree of involvement that participants experienced results indicate that most participants felt very involved whilst interacting with *PEGASYS*. 72 percent of participants indicated that they *felt involved* and 92 percent felt *themselves drawn in*. As concentration is likened to an attribute of attention we have seen that by addressing *The Clinical Model of Attention*, concentration was required by the participant in order for them to successfully interact with the art system.

	Involvement	Study Two
A1	I felt sad my experience was over	40% agree
A3	I had the sense that I had returned from a journey	88% agree
A4	I would have liked the experience to continue	52% agree
B1	I felt myself being 'drawn in'	23/25, 92% agree
B2	I felt involved	18/25, 72% agree
B4	I felt I could interact with the displayed environment	88% agree
B7	I felt that the characters could almost touch me	4/25, 16% agree
B8	I enjoyed myself	80% agree
B9	I felt I was visiting the places in the displayed environment	64% agree
B12	I felt I wasn't just watching something	76% agree
B13	I had the sensation that I moved in response to parts of the displayed environment	60% agree
B16	My experience was intense	52% agree
B17	I paid more attention to the displayed environment than I did to my own thoughts	84% agree
B30	I responded emotionally	60% agree
B31	I felt that all my senses were stimulated at the same time	44% agree
B34	I felt I was in the same space as the characters	48% agree

Table 41. Evaluating Involvement

As the system display was not 3D there was little chance of B7 (*I felt that the characters could almost touch me*) producing higher results.

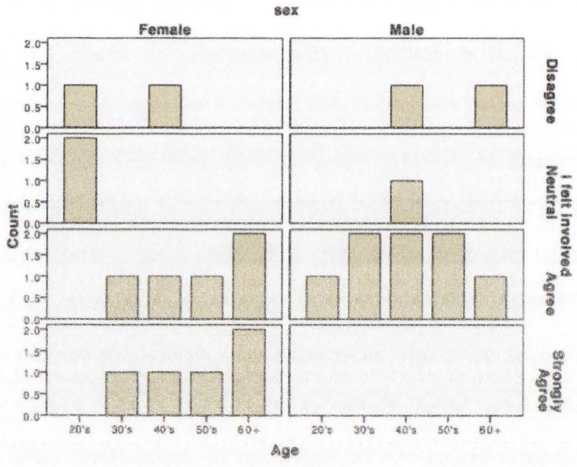

Table 42. Bar Chart of Question B2 Outcomes

The chart above in Table 42 illustrates that all the women in their 30's, 50's and 60's agreed or strongly agreed to *feeling involved* with the system and or the experience of the system. All three of the women in their 20's indicated that they did not feel involved as did three men. The woman in her 40's who indicated none involvement was participant #14 who as we shall see in the section on control (6.6.5) found the system very challenging to operate, the exhibition environment distracting and had her own personal expectations of the system through prior knowledge of the systems aims. However, most participants expressed an appreciation for the dynamism of the system and indicated that they felt involved both physically and mentally.

> "Look I just loved the drama of it and I think what's fantastic is that you have the dramatic element, that kind of aesthetic and emotional element to exhaust the technology which overtakes everything and this could be that the technology was the over riding issue here but the drama and the multiple narratives that were evolving and it was kind of...it was very exciting and I loved that, and that's what I really engaged with and I think it has huge potential". *Study Two, Participant #7/ comment made during the interview*

6.6.3.2 Concentration

Participants were required to concentrate to some degree to understand how the system would respond to their actions. Some people found this challenging, others had the system operating in a cohesive fashion fairly quickly. The degree of variation reflects how the personality types and moods of participants affect the degree of immersion with technology. As concentration could be likened to an attribute of attention we have seen that by addressing *The Clinical Model of Attention*, concentration was required by the participant in order for them to successfully interact with the art system (6.6.2). Participants were required to remember where the icons invisible interface were and what they do. Most participants successfully operated the system fairy quickly. Others required more assistance in understanding the relationship between their eye-gaze and controlling the system. When participants indicated that they were unable to complete a task, the channel was switched to change to an image of the *PEGASYS* interface (see Figure 60). Here they can clearly see on the display environment, the wire frames that indicate icons. The participant then has a fresh reference to work from and most of the time, the participant succeeds. This participant is referring to the icons which she can now see, as in the media view (*PEGASYS*) the icons are invisible.

> "What was good for me, was when it flipped back into the other screen (*PEGASYS* interface) so I could reestablish myself. I just went yeah ok, middle, side, and I noticed there were times when I was looking and looking at the left side and it just wouldn't work at all. So I thought ok, so obviously I am looking over there I'm not imagining that I'm looking at that spot".

As previously mentioned the system was designed to produce a slow engagement. Some people found this challenging, others relaxed but most enjoyed it. Some people did seem to find it more difficult to hold their gaze firmly on one spot. These people usually had a propensity for issues dealing with control and probably had to complete the calibration process a couple of times.

Another example of participant concentration is when the participant recalls their experience in a rich and attentive way. This signifiys that they have noticed in detail the media content, what was going on around them within the display environment experience.

> "The first stage is an incredibly relaxing experience so that was really nice for me because, you know, I live in the city and its been a really hectic week and I found that I was... my level of relaxation was really quite strong in that first stage, and in the second stage it was kind of amazing how I could interact with the young girl and sort of enjoy her play in that beautiful environment but then the third stage was just, it just seemed like these incredible unlimited possibilities were there in terms of interacting with people and kind of being curious about people and seeing what they were doing and seeing what they were up to, so, yeah, I liked all of it". *Study Two, Participant 15/ comment made during the interview*

6.6.4 The Meaning the User Gives to the Stimuli

23/25 of all participants in study two *vividly remembered some parts of the experience.*

	Personal Relevance	Study Two
A1	I felt sad my experience was over	**40% agree**
A4	I would have liked the experience to continue	**52% agree**
A5	I vividly remember some parts of the experience	**92% agree**
A6	I'd recommend the experience to my friends	**92% agree**
B1	I felt myself being 'drawn in'	**92% agree**
B2	I felt involved	**72% agree**
B8	I enjoyed myself	**80% agree**
B16	My experience was intense	**52% agree**
B30	I responded emotionally	**60% agree**
B32	The content appealed to me	**88% agree**

Table 43. Questionnaire Results and Personal Relevance

This maybe contributed to either the form or the content of the system. Table 43 illustrates how this percentage was drawn from the participants responses on the questionnaire.

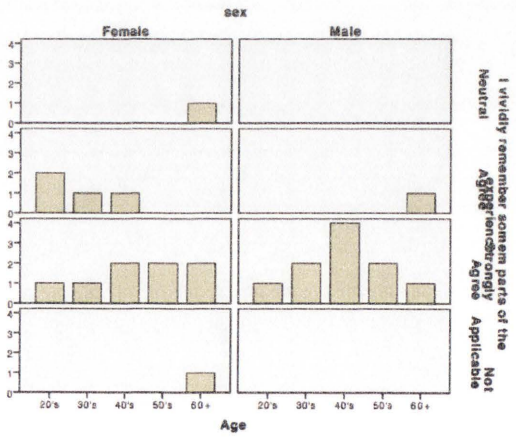

Table 44. Bar Chart of Question A5 Outcomes

In respect to B32 *the content appealed to me*, all the women expressed that they found the content appealing. Three men indicated that they were neutral (2) or not interested (1). In all 22/25 (88 percent) of study two participants enjoyed the content.

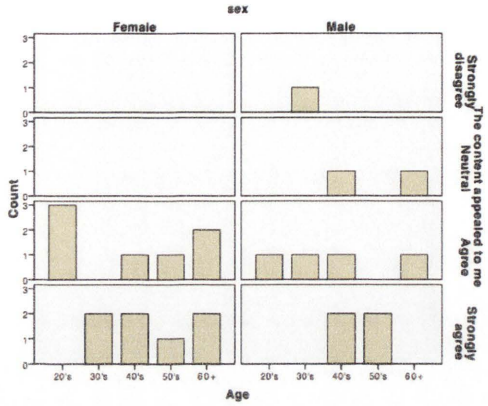

Table 45. Bar Chart of Question B32 Outcomes

"That's where the poetry comes in. For me it was very visual ...maybe it's the way I appreciate things too in my life, you know my interaction with nature and maybe a sensibility, you know I kinda like that idea, that things will just blow". *Study Two, Participant 16/ Comment made during the interview*

"The thing that I found disconcerting for me was because of...I've got two problems...I have a hearing problem so I didn't pick up much sound, I could actually hear through sensing so I missed that but what I did get was I felt it taught me a lot about me and how I interpret what I'm seeing and feeling so I was mainly accessing through visual and through memory, because for me it was so reflective. Particularly just engagement with experiences, with touch, the feel, smell, all of that, the sensual awareness of that whole setting, and the safety of that setting, the inclusion of the setting, the peacefulness". *Study Two, Participant 8/ Comment made during the interview*

"I'm a natural reclusive so therefore I would very much like to have stayed in the first stage, forever, that's my favorite. I liked the transition that you made on that first stage into the second with the illusionary referencing I really valued that because it allowed me to feel comfortable, it really did. The thing that I most engaged fully with was that association because I actually knew the characters (in Stage Three), it taught me a lot about me. It told me how much the familiararity of action, and association with areas of interest like the artists and the performers and the physicality of the water and the physicality of sound and all of those

things, that really fully engaged me". *Study Two, Participant #7/ Comment made during the interview*

"Became surprisingly antipathetic to the presence of men in the environment. Much preferred to watch the single girl in the landscape acting very much as I would in her place". *Study Two: Participant 4 / 15 minutes duration*

"I felt I was the director and had the control to zone in on the images that interested me. In Stage One I was excited when I found the stream that I could hear in the soundscape. In Stage Two I enjoyed following / chasing the girl around the space. In Stage Three I enjoyed watching certain characters and walking past others. E.g.- I watched the lady in red while I passed by the artist who was painting – almost as if I would in real life".
StudyTtwo, Participant 17/ Comment made on the questionnaire

6.6.5 Control

The interface was designed to provide a slow response between the participant and the system and some participants found this challenging. The interface had a built in lag, meaning that when a icon was activated through the eye-control device the system would not always respond automatically. This was implemented in order that participants did not spend their entire time zooming around the stages as if in a game (5.3.1.7). By extending the experience to one in which participants were forced to abandon any issues of control, the experience was thus altered for those participants who had trouble in doing so. Nevertheless control of the system was achieved and experienced by most participants as indicated by the comments below.

"I wasn't trying to control it. I kind of surrendered. I've never been interested in video gaming, its not my...I'm just not part of that generation really...I'm kinda post that generation you know I'm 46 so people 40 yrs and under tend to be really into it but I don't really like it that much so I didn't feel like I wanted to influence it too much. I wasn't aware that I could have such control but I didn't really care about that so much". *Study Two, Participant #16/ comment made during the interview*

"But there's a little bit of... you do feel like you wonder whether you are having any effect on it sometimes because I found that I wasn't able to identify patterns of what actually worked for me in controlling it. But I was aware that sometimes there might have been a possibility that my eyes might have been making

> panning or might have been involved with the change of images in some way but I wasn't quite sure I couldn't identify the patterns. I got a sense of if I panned right that the image on the far right of the screen would move over into the middle bit but I wasn't sure about that. Because it wasn't consistent. Different parts of the screen would respond in a particular way that was predictable. I could see that there was some...if I focused on something or if I saw something move and I focused on it sometimes that would kind of move, seemed to move into the middle but I wasn't aware that I was in control of that. I was detached from it. I felt like it...I wasn't aware of the fact that I was in some way a part of that. So my experience was completely unique, somebody else would come in and sit there and they would have a completely different experience? ...I found that, I found that I...there was such a delay and such a ...well for me I couldn't recognize the patterns so I didn't feel like I was in control of it, I just felt like I was floating through it". *Study Two, Participant #16/ Comment made during the interview*

Interactive control clearly aided the experience in terms of participation as 19/25 (76 percent) of participants in study two agreed that they *felt they were participating in the environment*. However, as indicated above, some participant's indicated that they did not fully understand the relationship between their actions and the response of the system, for example one participant had this to say on the subject:

> "So I would say that most of the time I wasn't in control. I wasn't consciously in control of how I could make it move right or focus or make it change. I wasn't conscious of that. Most of the time I wasn't conscious of that. You see I can understand what you mean when you say that I was actually doing stuff, but I wasn't aware of how the actions that I was performing had an influence on a particular detail". *Study Two, Participant #16/ Comment made during the interview*

Not all participants experienced the user interface as difficult to operate. Many people simply worked out what it could do and then enjoyed the system parameters;

> "In terms of being in control of that environment I absolutely felt in control 100% of the time". *Study Two, Participant #15/ comment made during the interview*

> "I think it's a pretty intuitive way of interacting because your just really interacting with ...if something catches your eye in the right then you look in the

right and it just so happens that you pan across the video so it's a pretty natural way to interact". *Study Two, Participant #22/ comment made during the interview*

Q	Control	Study Two
B1	I felt myself being 'drawn in'	**92% agree**
B4	I felt I could interact with the displayed environment	**88% agree**
B12	I felt I wasn't *just* watching something	**76% agree**
B17	I paid more attention to the displayed environment than I did to my own thoughts	**84% agree**
B24	I had a strong sense of sounds coming from different directions within the displayed environment	**68% agree**
B25	I felt surrounded by the displayed environment	**44% agree**
B35	I had the sensation that parts of the displayed environment (e.g., characters) were responding to me	**40% agree**
B36	I would have enjoyed more character action	**64 % disagree**

Table 46. Questionnaire Results and Control

In study two the eye-tracking device (X120) and system design facilitated an interactive experience for the participant.

22/25 of participants agreed that *they could interact with the displayed environment* (88 percent, B4, Study 2) but three people disagreed. So why was it that these participants felt they could not interact with the system? It is possible to analyze through the use of the questionnaire combined with the participant profile information (Table 33) and the participation information, Table 38, why these three people indicated that they could not interact with the system. Using a simple bar chart in SPSS the following results were graphed.

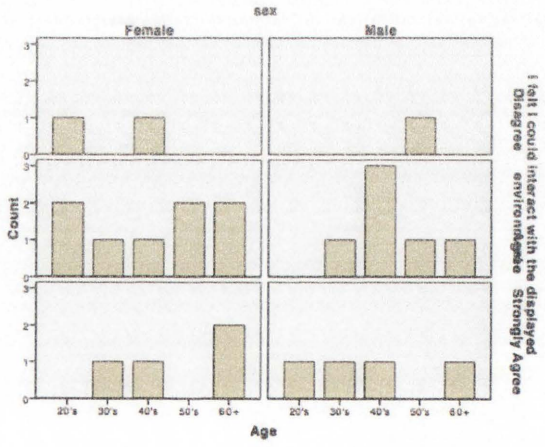

Table 47. Bar Chart of Question B4 Outcomes

By referring to hardcopies of the questionnaire results and transcriptions of the interviews it is possible to determine commonalties and disparate entities that may have affected their experience with the technology. The first participant indicated was female and in her 20's.

#	Sex	Age	Occupation	Time of Day	Duration
# 1	F	29 yrs	IT	11am	15 minutes

Participant #1 expressed very distinctly that the system was not operating for her as she expected it too. As she was the first participant the evaluator also expressed doubts about the quality of the experience. An assumption was made that the system was not operating, as it should. Maybe as a consequence of this the session was very short lasting only fifteen minutes.

> "I think it would be easy to manage but it was difficult because I had the feeling that it was not working. So it was difficult because I recognized that my right eye was working but I still wanted to go to the right hand side with the left eye, which doesn't work at all. For me it was difficult but I could imagine it would be easier if it was working properly". *Study Two, Participant #1/ comment made during the interview*

When watching playback of the interaction via the documented footage of the session we can observe that the participant is very eagerly trying to make the system do what she wants it to do. Having been told repeatedly that the system is designed for a slow engagement she appears to understands how the system works, and yet her body language indicates that she is frustrated by the pace and feels thwarted by the systems design. It becomes apparent that even though she is operating the system in order to make the media content pan to the left, this interactive element is not enough to sustain her interest. This young lady works in Information Technology and rated herself as having an intermediate knowledge of computers, however she has no prior experience with interactive art systems. Through observation of her session it is possible to determine a number of factors that relate to her experience of 'controlling' the system. Stage One is a 5 minute experience (a large number of people spent over 15 minutes in this stage alone), the participant spent 3:39 minutes in Stage One and then requested operator assistance after 15 seconds of trying to enter Stage Two. This participant was not in the least bit interested in holding her gaze and being still in the environment, she clearly wanted and expected a reaction for every moment of her engagement. Having determined that the system would not facilitate the panning to the right as designed, the participant choose to pan to the left as quickly as possible and even in Stage Two, when the character emerges, she still chooses to pan past her rather than watch her. Although the participant stops the interactivity of panning left by addressing the operator, she actually says, " I'm not doing that. I'm trying to go right". However, she is 'doing that' or moving the media and yet

will not acknowledge her part in the interaction hence her response to disagree when asked if she *could interact with the displayed environment.*

The system however proved to be working properly as Participant #2, who evaluated the system a few hours later, spent 55 minutes with it. When asked, *did you find the eye control easy or difficult to use as a navigation tool?* Participant #2 replied:

> "(It was) a bit tricky. It seemed to be sometimes intermittent. Sometimes it could do it, I don't know if, well that's what I was playing with, whether it was my ability to understand it and make it happen or whether it was... you see sometimes I thought I had just got it right and I could put it onto the icon and move it and I felt in control of it, and other times it seemed to go randomly to me. And I would purposely keep my eyes really still. That's why I was on there so long, cause I was trying all these different things". *Study Two, Participant #2/ comment made during the interview*

Participant #2 nevertheless indicated on her questionnaire that she strongly agreed that she could interact with the displayed environment. The next participant to state that they couldn't interact with the environment was a female in her 40's.

#	Sex	Age	Occupation	Time of Day	Duration
14	F	40 yrs	Artist	11:53am	22

Participant #14 is a female visual artist. During the interview this participant had a lot to say on the system design and interactive components of the system, for example:

> "I believe you've set it up for an ambient meditative, immersive experience and I'm saying you need to work with technologies that sync to allow you to do that. Because I know my eyes are activating the left and the right and the audio component in the first stage. I'm wanting to move around the space and I appreciate that it takes time and I need to focus on an area over and over but when it doesn't respond, for various reasons what ever they are whether I'm looking in the right place or not, it can read my eyes or not, and I try again and again, then it changes the experience because your trying to activate something. It changes from being immersed by the space to referring to the technology. So my comment or feedback is if that was smooth, slick stream if it responded every time even though it was slow and yes, you managed to activate it, then you would

> feel that you were actually involved with the space. But because, in my experience anyway, I didn't feel like I had that power and so I actually went where the space allowed me to go in a way". *Study Two, Participant #14/ comment made during the interview*

It is interesting to note that this participant was the first user tester for the day and observed as the operator set up the equipment, this gave her an opportunity to ask questions about the type of experience that the artist had designed, an opportunity that most participants did not have. She had travelled extensively to be there and was very familiar with the objectives of the project as she had spent a considerable amount of time with the composer. It was a Sunday and the Museum was busy hence atmospheric sounds were dominant. The participant is a performance artist and producer. She clearly had very strong opinions on what sort of immersive experience she expected to have. Her expectations were not met through the delivery of the systems ability to produce an interactive experience.

A close examination of her questionnaire indicates that although she indicated in question B4 that she disagreed and could not interact with the displayed environment, she also indicated that she **agreed** to (B1) *being drawn in*, (B3) *loosing track of time* and (B33) that she *was able to change the course of events*. Her final comment was:

> "I think it's really amazing; really I wouldn't take what I just said to heart. I mean I did feel labored by it, constrained by it, but I think that's just maybe my conceptions about what I'm experiencing". *Study Two, Participant #14/ comment made during the interview*

The third participant to express in the questionnaire that his experience of the system was not interactive was a male in his 50's.

#	Sex	Age	Occupation	Time of Day	Duration
# 12	M	52 yrs	Lecturer	1:40pm	16

Participant #12, like the one preceding, is an interactive art producer and therefore has had extensive experience of interactive art systems. His story is a good example of how people responded when the system didn't allow them to feel in control.

> "I didn't find that I had an immediate response from gaze, so I kind of detached myself from that and I didn't feel like I wanted to dwell and make things happen with my eyes. ... I felt like I was detached from...I didn't feel like I was wanting to be in control of it, I didn't. I was aware of a delay so I felt like I couldn't really

> predict how I could be in control totally, because it didn't seem to be consistent to me, the way that my eyes were engaging with it". *Study Two, Participant #12/ comment made during the interview*

Ironically for these participants, the whole premise of designing the system as such was to induce feelings of presence, and as interactivity on demand failed to meet their expectations another element of the system design took over. The necessity to slow down and enjoy the content was thus enforced when this participant had to let go of their controlling behavior.

> "I felt like I just kind of enjoyed it. I mean I just loved...I loved watching things like the wind blowing in the trees and the shadows, and I kinda dwell on those things you know, I really do, so I ...and when there's a character I watched the character to see what there up to and if I see a new character I'll ...you know I'd kind of look at them for a while and nothing would happen so I would maybe go back there".

Control as an issue or factor of characteristic temperament became problematic for some participants some of the time. In fact it would be fair to say that most participants, during the interview process, expressed some issues about wanting to have more control of the system. There were a lot of comments about methods for future improvement, which are discussed in section 7.4.4

As Table 57 illustrates this method of evaluating a participants experience enables us to see that the experience gained was driven by her expectations and inquiries of the system. Having understood how the system operates she then wants to direct it to accomplish more than it is programmed to do. Her expectations around its functionality changed once she grew accustomed to how it operated, she wanted more interactivity. This participant expressed that she was more driven by the screen characters, particularly in Stage Two, than by the naturalistic setting, created to enhance a peaceful engagement.

6.7 Distraction Factors

Previous research in presence indicates that there are a variety of possible consequences of different types of presence. These consequences include: increases or decreases in physiological arousal, feelings of self-motion (evection), motion sickness, enjoyment, empathy, learning, improved task performance and skill training, psychological de-sensitisation, connectedness (involvement, mutuality, engagement) with other people,

para-social relationships, a number of different emotional responses, persuasion and distorted memory and social judgments.In respect to this research a number of factors were investigated to determine what negative effects the participant experienced whilist using the art system. By comparing and contrasting differences and commonalities of an individual participant's personal factors we can see how the experiences of an art system differ and scrutinize the perceived factors impacting on participants responses. This section addresses the distraction factors associated with experiencing the system, it addresses the impact of the negative effects (6.7.1) associated with the system restrictions (6.7.2). 6.7.3 outlines difficulties related to the *Environmental Distraction Factors* including the exhibition lighting conditions (6.7.3.1) and the physical and psychological barriers (6.7.3.2).

Q	Distraction Factors	Study Two
A2	I felt disorientated	24% agree
B3	I lost track of time	84% agree
B8	I enjoyed myself	80% agree
B10	I felt tired	24% agree
B14	I felt dizzy	12% agree
B21	I felt I had eye strain	40% agree
B26	I felt nauseous	4% agree
B37	I felt I had a headache	16% agree

Table 58. Questionnaire Results and Distraction Factors

Data results indicate that some participants felt constrained by the form, some identified as feeling tired (B10: Study 1, (6/25), 24%/Study 2, (6/25), 24%) or felt that they had sustained eye-strain (B21: Study 1, (3/25) 12%/Study 2, (10/25) 40%).

6.7.1 Negative Effects

The questionnaire implimented into the two-part study addressed participants experiences of negative effects in the following questions: A2, B14, B10, B21, B26 and B37.

Q	Negative Effects	Study One	Study Two
A2	I felt disorientated	24% agree	24% agree
B10	I felt tired	24% agree	24% agree
B14	I felt dizzy	12% agree	12% agree
B21	I felt I had eye strain	12% agree	40% agree
B26	I felt nauseous	4% agree	4% agree
B37	I felt I had a headache	0% agree	16% agree

Table 59. Questionnaire Results and Negative Effects

Question A2 asked if participants felt disorientated, in both studies less than a quarter did. In study two, interactivity introduced the effect of a live panning motion however the figures only increased by 4 percent indicating that generally speaking it did not affect the orientation of participants. Furthermore, only 12 percent of study two participants indicated that the experience made them feel dizzy which was a slight increase from study one results of 4 percent or one person. For more on motion see section 6.4.5 *How*

the Use of Motion and Colour Affects the Participant. In both studies less than a quarter of participants indicated that they felt tired. Those participants who indicated that they did feel tired may have for any number of reasons. Examination of the participant statistics indicates that the most likely factor was due to the time of the day that the session took place. Sessions taking place during the mid afternoon seemed to induce this response more so than at other times.

10/25 (40 percent) of study two participants indicated that they experienced eyestrain. In both studies one person (4 percent) indicated that the system made them feel at times nauseous, and for question B37: *I felt I had a headache* 4/25 (16 percent) agreed in study two whereas 0 percent agreed in study one. Other factors also influenced participant's experiences of the art system. For example participant #8 had this to say of the negative effects,

> "I think you need to be very aware of the experiences that have happened prior to me and what we are bringing to it as well, and I came after, well I'd had a cup of coffee it probably would have been wise not to have had the coffee prior too...
> So it was the coffee, my technophobia and also the fact that I couldn't get comfortable because... I didn't want to make a mistake, I felt inhibited from my normal processes. So it's all about what the viewer is carrying, their own personnel baggage is also going to very much influence their perspective".
>
> *Study Two, Participant #8/ comment made during the interview*

To summarize, the negative effects experienced by participants in both studies were negligible. In study two where interactivity involved the participant using their eyes to navigate a slight increase was detected in respect to feeling dizzy and having a headache. Tiredness seemed to be more related to the time of day during which the evaluation process took place as after lunch people in both studies were more likely to express how tired they felt. The obvious negative effect was that of eye strain, although more people indicated that they experienced **no** eye strain in study two 11/25 the overall percentage of those that agreed increased from 12 percent in study one to 40 percent in study two (B21: Study 1, (3/25) 12%/Study 2, (10/25) 40%).

6.7.2 System Restrictions

PEGASYS was designed in order to produce a slow engagement. This was achieved by implementing code in the eye control software that activated the VOD after a certain time had expired. Various techniques were employed to create a dynamic effect, which in turn

assisted in the implementation of designing for creative engagement. Some participants found the system boundaries restricting which therefore impeded their experience of it, on the other hand others came to understand how the system operated and allowed themselves to engage at that level thereby assisting in the generation of the designed presence-based engagement. Those that felt restricted by the system became disgruntled, however it did not necessarily impede upon their overall enjoyment of the system itself as 20/25 agreed that *they had enjoyed themselves* (B8: Study 2. 80 percent).

> "Fascinating - the interaction between my eyes and the projected space was quite labored. I found myself wanting to move freely within the environment. To look left or right I looked for a prolonged time on both left and right and therefore the experience was tainted or overtaken by wanting to move. Consequently the immersive capacity of the install was interrupted. If the technology was slick stream within surround footage etc, I believe you would have a completely immersive experience where you could feel part of the space, involved and possibly in control". *Study 2: Participant # 14 / 22 minutes duration / Female*

> "The exposure calibration of stitched pieces of film was distracting. A sense of Presence that wasn't stimulated by 'human characters' would have been interesting. The music didn't seem diagetic or related to the scene I was viewing seemed more random. I liked the subtle lateral or horizontal slippages of some of the visual files". *Study 2: Participant # 21 / 25 minutes duration / Female*

> "I couldn't get to hear what Birdmann was saying and shortly after I felt a strong urge to exit the environment". *Study 2: Participant # 25 / 43 minutes duration / Male*

For an example of how sound effects the experience see *PEGASYS* Drive/ Folder 7_Examples of the New Work/3. Stage Three, Clip 3.mov and play without sound.

6.7.3 Environmental Distraction Factors

Beta_Space, the location of study two is situated in the middle of the *Cyberworlds Gallery* at the Powerhouse Museum and as such requires careful consideration for exhibition of the work. The external noise and lighting arrangements of the *Cyberworlds Gallery* have a tendency to filter into the exhibition space. When designing the art system in respect to previous research undertaken in presence generation it was apparent that these factors (lighting and sound in the exhibition environment) would need to be addressed. Therefore the sensory outputs were enhanced for study two. This was achieved

in a number of ways, namely attention to: sound outputs, lighting conditions and participant comfort.

Sound as a design feature and as an operable system was discussed previously in 5.3.1.6 and 6.4.6. During the interview process it became apparent that the location of the exhibition room within the context of a noisy museum greatly affected some people's experiences of the art system.

> "I'd probably have to eliminate a lot of the exterior noise and lights, I mean in this space its impossible but you know what I mean its like those questions are quite straightforward and I have to say no I didn't feel like that but its easy to see why I didn't feel like that (immersed)". *Study Two, Participant #14 / Comment made during the interview*

> "...and also I know now, the increasing awareness of how difficult it is for me to be in such an environment (gestures about) how this type of environment (Beta_Space) is an environment I'm quite alien too". *Study Two, Participant #8/ Comment made during the interview*

The exhibition space hindered some participants' whose ability to enjoy the experience was impeded by exterior sounds. Wearing headphones most certainly assisted participants to concentrate on the media content and form of the technology but the constant variations of noise within *CyberWorlds* Gallery did not assist in generating attributes of presence for participants. Also it is worth noting that the environment of study one, which was quiet and warm and self contained, seemed to encapsulate sensory sensations such as smell and room temperature. In essence the environment of study two had its advantages (prestige, accessibility, publicity, staff and technology) but had its disadvantages also.

6.7.3.1 The Lighting Conditions

The lighting conditions in study two varied depending upon participants' personal factors and their ability to operate the eye-tracking device. However, overall in the exhibition space a spotlight was positioned directly over the chair, smaller spots on the posters and low-level lighting around the operation desk. These conditions were not variable and as such remained constant. The spot above the chair assisted the participants with enough light for them to conduct the questionnaire from their seat (see Figure 72).

Figure 70. Example of the Exhibition Room Lighting Arrangement

The exhibition lighting outputs were consistent and reliable. The main consideration in terms of lighting arose when participants were encouraged to experiment with the use of an external lighting source. The external source was used as a fall back option when participants felt that they were unable to interact with the eye-tracking device and required additional assistance. This output was variable and although it assisted some participants to engage more fully with the system it also detracted a lot from both the media content (which became washed out under the additional lighting source) and from some peoples level of enjoyment of the system. The Figure 73 illustrates how the room looked without the use of additional lighting.

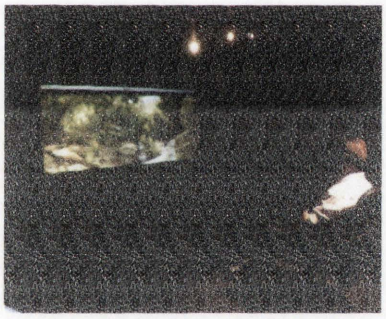

Figure 71. The Lighting Conditions in Beta_Space

The external light source became a useful tool when participants felt that they were not having any effect upon the interface. The additional light seemed to enable people to feel more in control of their experience, and yet at the same time it hindered the experience for them too.

> "I was very aware of the peripheral noise in the environment...I had a memory of a middle thing (icon) but I was finding it very hard on my eyes so I thought, no I'm just going to let go of trying to find things and just experience some gentle navigation". *Participant 24 comment made during the interview.*

Participants used the light in a number of ways; some held the light close to their eyes whist others kept it in their lap. Below are examples of how the external light was used by participants. Figures 74, 75, 76 illustrate how the standard lighting arrangement was altered with the addition of a hand held globe.

Figure 72. Example of Variable Lighting Conditions in Beta_Space

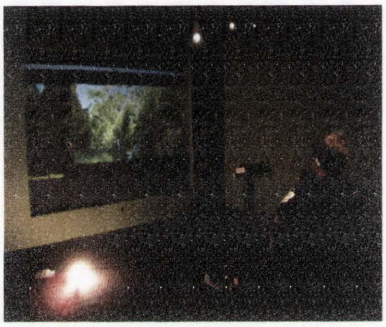

Figure 73. Example of Variable Lighting Conditions in Beta_Space

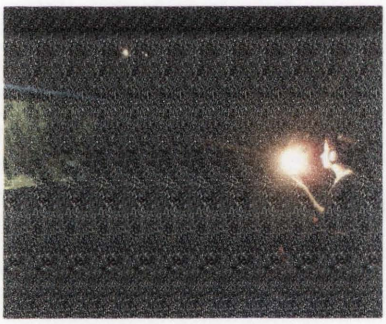

Figure 74. Example of Variable Lighting Conditions in Beta_Space

However, many participants did not require the additional lighting source at all, and as the light affected the image quality they were not encouraged to use it. Hence, the additional light source was only ever suggested to them when it became apparent that they required further assistance to operate the technology. Interestingly the X120 has an infrared camera and thus should be able to operate consistently in a dark environment, as many participants demonstrated. This barrier was psychological as well as physical.

6.7.3.2 Physical and Psychological Barriers

In respect to the visual and aural dimensionality of participants' experiences of the art system roughly half of all participants felt surrounded and immersed in the system.

The physical needs of each participant were met by providing them with a safe place to investigate *PEGASYS* with a comfortable chair within which to sit and a relaxed mental approach from the evaluator. Psychological barriers that the participant brought with them were observed and includes a number of items, each of which is listed below.

1) Recently drunk caffeine and energy drinks created within a number of participants' an expectation that the system would be fast and the interaction response time, immeadiate.

2) Bringing friends and relatives to experience the evaluation session was not advisable as participants expressed in each case, that they would have preferred to undergo the session alone because they felt pressured by company to finish when ideally they would have engaged with the system for longer.

3) Participant's wearing glasses indicated that they felt restricted and uneasy about the systems capabilities to operate as created, through their eye-glass.
4) Participants who had previously engaged with immersive environments expressed concern about the lack of immersive characteristics within *PEGASYS*. Participants' expectations exceeded the ability of the systems functionality.

6.8 Summary of Chapter Six

PEGASYS was designed to produce a creative engagement, gain the participants' attention, and present them with an opportunity to engage in a presence-based experience using cinematic techniques and eye-tracking technology.

Research question number one asked how previous research in presence can inform the design of an art system and was answered throughout the document starting with Chapter Two, Section 2.1 *Presence*. Here a review outlines the variable factors associated with the generation of, the experience of, and the evaluation of, presence. Chapter Three, section 3.2 *Investigating Presence* discusses methods previously implemented for gathering data about the experience of presence, and Chapter Five, section 5.3 *The Art System's Features* explores seven features designed to enhance the experience of presence, based on previous research into presence.

Research question number two is divided into two parts and asks in what way did the art systems features contribute towards the participant experience, in particular what

influence does eye-tracking technology have on the participants experience of this presence-generating art system? This was adressed in 6.4 Evaluating the system design features in respect to content and 6.5 Evaluating the system design features of form.

Research question number three inquired as to what factors influence an individuals' ability to experience a presence-generating art system, the conclusions of which are drawn together in section 6.6 evaluation of personality types and moods and 6.7 which investigates the distraction factors.

The next chapter identifies if the aims of the research were met and what the outcomes were of the evaluation of participants' experiences of *PEGASYS*: a Presence-Generating Art System.

Chapter Seven

> "For the great majority of mankind are satisfied with appearances, as though they were realities, and are often more influenced by the things that seem than by those that are".
>
> Niccolo Machiavelli

7 CONCLUSIONS

There were two objectives in this research project, both objectives were met through careful analysis and evaluation of data gathered through an extensive methodological practice-based research process. The research objectives are:

1) To advance understanding about interactive art systems that facilitate presence engagement.

2) To contribute new knowledge about human-computer interactions through the measurement and analysis of participants presence-based engagement.

The first research objective (1) is to advance understanding about interactive art systems that facilitate presence engagement. This was explored through the creation of the form and content attributes and the systems features for enhancing presence engagement within an art system and is examinined in respect to participants' reponses to the art system's features in 7.1. The section 7.2 *Did PEGASYS Generate Presence* concludes that yes, PEGASY immersed participants to the extent that many attributes associated with the experience of presence were engaged for them. The second research objective (2) sought to contribute new knowledge about human-computer interactions through the measurement and analysis of participants' presence-based engagement. This was achieved through evaluation of participants' experiences of the system and observations made of those experiences. 7.3 *Summary of Research Outcomes* examines the information gathered during the process of the two-part study, pertaining specifically to what extent eye-tracking technology played in the role of the participants experience of presence.

This research process also facilitated the objectives by developing a concept for measuring participants experiences of presence in low stress environments. Using the information retrieved from the studies it is possible to advance understanding about participants' experience of presence when using *PEGASYS*, a system designed to induce a low stress experience (7.3.1). 7.3.2 looks at whether designed interactivity assisted in

sustaining participant's experiences of presence engagement through the use of interactive narratives. Results determined that Stage Two of the interactive experience was more engaging than the others. Why? 7.3.3. Explains the outcomes of evaluating participants' inner presence experiences and 7.3.4 discusses how adding interactivity to the experience of PEGASYS enabled participants' to experience more presence-based elements. Section 7.5 *Future Work* considers the outcomes and proposes what could/should/would happen next in respect to future work undertaken to enhance the experience of *PEGASYS* for participants and share it with the rest of the world.

7.1 The Art System's Design Features

Table 64 outlines the art systems features. The first column identifies the number allocated to the feature. The design feature is then listed. The type of presence that the feature relates most directly to, with respect to Media Presence and Inner Presence (specifically, does the feature relate to the physiological or psychological aspects of experiencing presence) is then tabulated. Many of the features relate to both types of presence engagement. Column four lists the related information located elsewhere in the document in order that the reader may quickly reference the information if they so desire.

#	Design Feature	Type of Presence	Related Information Located Elsewhere in this Document
1	Designing for Creative Engagement	Media Presence Inner Presence	**2.1.4.1** Presence Engagement **2.2** Models For Creative Engagement **5.3.1.1** Engagement as a Design Feature **6.3** Evaluating the Engagement Models **6.4.1** Evaluating Engagement as a Design Feature **7.2** Did PEGASY Generate Presence?
2	The Sensation of Spatial Presence	Inner Presence	**2.1.4.2** Spatial Presence **5.3.1.2** Designing for the Sensation of Spatial Presence **6.4.2** Evaluating Spatial Presence **7.1.1.2** Was Spatial Presence Experienced?
3	The Experience of Ecological Validity	Media Presence Inner Presence	**2.1.4.3** Sensory Presence **5.3.1.3** Creating Ecological Validity **6.4.3** Evaluating Ecological Validity (Sensory Presence)
4	The Use of Interactive Narratives	Inner Presence	**2.1.6.3** Participant: as a Component of Inner Presence **3.5.1** Measuring Content **5.3.1.4** The Use of Narratives **6.3.3** Evaluating the Three Stages of Interaction **6.4.4** Evaluating Narratives and Emotional Content **7.3.2** Outcome of the Interactive Narratives
5	The Use of Colour and Motion	Media Presence Inner Presence	**5.3.1.5** The Use of Colour and Motion **6.4.5** Evaluating the Use of Motion and Colour
6	Audio	Media Presence Inner Presence	**5.3.1.6** Sound as a Design Feature **5.4.2.4** Sound Media **6.4.6** Evaluating the Audio **6.4.6.1** Audio Systems **6.4.6.2** The Surround-Sound Environment **6.4.6.3** The Use of Headphones
7	The Art System Response Time	Media Presence Inner Presence	**2.1.6.1** Form: as a Component of Media Presence **3.5.3** The Degree of Immersion **5.3.1.7** The Form of the System **6.5** Evaluating System Design Features **6.5.2** Evaluating Eye-Tracking as a sensorial…

Table 64. The Systems Seven Features

7.2 Did *PEGAYS* Generate Presence?

The art system *PEGASY* provides progressive experiences that enhance and utilise engagement as a design feature. In respect to the art system facilitating attributes associated with presence engagement it appears that the system was very successful. The outcomes of evaluating participant's experiences based on their comments and the results of the questionnaire (ITC-SOPI) indicate that a majority of the participants were very engaged and encountered elements of presence such as a sense of transportation and co-presence whilst using the art system. Engagement as an attribute of presence was experienced by participants of both studies at relatively high levels. In respect to attention, engagement and interactivity, in study two, 76 percent *felt they weren't just watching something* and 88 percent of participants agreed that *they could interact with the displayed environment*. Participant's experiences of spatial presence was measured through their experiences of pictorial realism and spatial depth. Participants of both studies were found to encounter few sensations of spatial presence with low results in respect to creating a fully immersive environment.

Although the art system features did not include the standard technological mechanisms for generating attributes of spatial presence; namely that the system is not a fully immersive visual environment, is absent of haptics, and the visuals are video-based rather than CGI, it was interesting to note that spatial presence was however, still experienced by some participants. By examining the participant's responses to the ITC_SOPI questionnaire it was possible to conclude that some aspects of spatial presence was experienced by some of the participants during their engagement with *PEGASYS*.
60 percent of participants experienced the sensation that *they moved in response to* parts of the displayed environment, which is associated with experience of spatial presence. Participants were asked asked if they *felt that they had visited the place* in the displayed environment. In study one (with no interactivity) 68 percent agreed and in study two 64 percent agreed indicating that adding interactivity had little bearing on this outcome. In study one 36 percent of participants agreed to sensing that the room temperature had changed and 24 percent agreed in study two. Approximately a quarter of all participants indicated that they could almost smell different features of the displayed environment and the figures more than doubled in agreement from study one (20 percent) to study two (44 percent) when asked if they felt that all their senses were stimulated at the same time. Overall participants generally indicated that they felt empowered and in control of the

system in respect to changing the course of events (56 percent) and participating in the displayed environment (76 percent).

Generally people expressed enjoyment at the use of colour and motion as art system features. In the interview many people expressed their fascination and interest in how colour and motion interplayed with the experiences they were having whist interacting with *PEGASYS*. The artists perceived stitching hindrances revealed themselves to be assets in respect to participant experiences of them, with only one person in study two expressing any doubts about them. Generally participants experienced the use of colour and motion as implemented into the design features as *fascinating, interesting and eminently watchable*. The use of motion in study two, whereby the participant orchestrates the system to pan left and right, had only slightly more participants experiencing side effects in respect to feeling dizzy and disorientated than the media in study one. This implies that interactivity combined with issues of participant control produces a more immersive environment than the more traditional aspect of simply viewing content, as was the arrangement in study one. As 88 percent of study two participants experiencing the system did not feel dizzy these design features were received favorably and enthusiastically by most participants, see 6.7 *Distraction Factors*.

In general it appears that the image size (1.8 x 2.4m) was satisfactory although more people in study two commented on this during the interview, expressing how they would have appreciated a larger screen area (36 percent). It could be proposed that participants of study two felt less surrounded by the display environment than study one as a result of the added interactivity. The interactive component enabled participants to traverse the landscape in a panning motion left and right. It therefore seems logical that if the screen extended to cover the surrounding walls then the experience would be more immersive. As this was not the case full 360degree immersion was not possible, and not desired for this stage of the research.

Features designed to enhance the audio experience included atmospheric sounds, music, voice and sound effects. Some of these sounds were embedded within the media and others were designed to be retrieved as interactive components. Overall participants expressed their delight in discovering the sounds and listening to them within the context of the displayed environment. As immersion is a key quality in respect to generating presence then the audio system set up for study two was more effective then the audio system set up for study one. During the interview process participants were asked if they

were able to switch the music on and off in Stage Three. Many of the participants did not realize that this was possible, which was possibly a result of being given too much information during the calibration process. The feature enabling the system to dynamically play a sound clip in relation to the image on screen, was generally identified as an asset in the participants' experience, although this did create unstable scenarios (whereby for example, the duo playing guitar, cannot be heard, or Birdmann was out of sync).During the interview process positive comments were made about the use of sounds as a system feature to enhance the experience of presence engagement. The implementation of sound cues as attractors, sustainers and relaters increased the possibilities for engagement complimented the exhibition environment through a surround-sound score with an additional engagement on offer to the wearer of the headphones. Headphones greatly assisted in participant's experiences of the engagement. Participants expressed how the headphones assisted to immerse them in the audio-visual experience, sonically removing them further from the exhibition environment in which they sat.

The three part audio system set up worked well for most participants. The atmospheric sounds of the location could be heard in the space constantly, musical elements wafted in and out at the discretion of the operator and the participant experienced, through the use of headphones, an intimate unique dynamically generated sound score that as a system feature was under valued and under utilized by participants. The implementation of two audio systems as features programmed to enhance participant's experiences of immersion worked very well. As expressed by previous researchers into presence (Begault, 1994) sound plays a key role in creating immersive environments. The immersive qualities produced by implementing three audio systems for sound playback facilitated experiences that were akin to 'reality' through ecological validity and participant involvement. Questionnaire (ITC-SOPI) results indicate that the surround-sound score implemented in study two was clearly effective in assisting in producing an immersive environment, as 68 percent of participants indicated that they had a strong *sense of sounds coming from different directions within the displayed environment*.

The technological form of eye-tracking technology used in the system design could have been more effectively implemented. If the response time had been faster then more participants would have enjoyed that aspect of it. However, if the system response time had been faster then some part of the designed experience may have been lost. As it was possible for participants to pan fairly quickly through the media content, as many did,

then those that focused on the response time and were distracted by it, may have simply moved too quickly through the designed experience to appreciate the systems purpose. The majority of the 25 participants (88 percent) agreed they *could interact with the system*, 72 percent *felt involved* and 92 percent *felt themselves drawn in*. Interestingly, it appears that a majority of participants of study two did experience a presence-based engagement regardless of the fact that the system did not consistently behave in a predictable reliable manner.

7.3 Summary of Research Outcomes

The art system design considered a number of factors. First, key presence factors were identified and extrapolated upon in Chapter Two. This revealed that the main contributing elements for system design consisted of or were determined by the form of the technology, the content of the system and amongst other things, the participants' ability to suspend disbelief and engage with the system in a way that replicates the experiences of everyday life. These three key factors, form, content and participant were considered in respect to what is known about how presence is experienced. This PBR process then set out to discover if the attributes of eye-tracking technology could in fact enhance or detract from participants' experiences of presence within an art system.

Results of the two-part study indicate that eye-tracking technology can enhance the sensory experience of presence within art systems. If art systems are designed to adhere to the structures of creative engagement and they provide participants with interactive options such as; the facility to engage in creative narrative exploration and the ability to seek, discover and enjoy hidden embedded activities, then a heightened experience is produced facilitating a presence-based engagement. Most importantly, the art system must be engaging enough, such as in the ways described above, to gain the participants attention and sustain their interest. It is the participants' willingness to interact that enables the relationship between the computer-based system and the participant to generate attributes of presence engagement.

The work aimed to produce new understandings about best practice for designing interactive experiences for participant's to experience a presence-based engagement. It did this by evaluating participants' experiences of an art system in respect to the systems seven features which adhered to previous research in presence. These features were, designing for creative engagement, the sensation of spatial presence, the experience of ecological validity, the use of narratives, the use of colour and motion, audio and the system response time. The participant's ability to experience this art system was addressed by examining issues of personality types and moods in respect to factors of; attention, time, involvement, concentration and the meaning the user gives to the stimuli.

The research project facilitated sharing of knowledge about the experience of designing art system features that enhance a presence-based computer mediated experience, through a real-time video networked system, using an eye-tracking device. These features are

discussed in respect to the role they play in the experience of presence and immersive interactivity in section 6.5 *Evaluating System Design Features- The Form.*
Other research outcomes are discussed in respect to; generating and measuring presence in low stress environments (7.3.1), outcomes of the interactive narratives (7.3.2), outcomes of measuring inner presence attributes (7.3.3) and 7.3.4 Outcomes of Adding Interactivity.

7.3.1 Experiencing Presence in a Low Stress Environment

The first section of Chapter Six addressed the participants experience, evaluation and outcomes of the art systems features, designed to enhance the experience of a presence-based engagement. In respect to media presence and media content, section 6.6 examined with particular interest as to whether it is possible to generate and measure presence in less intense environments.

> "Most experiments into presence are based around media content that aims to induce fear or produce stress. This has been gauged to be the standard as participants are more likely to respond dramatically under such circumstances" (Insko, 2003. p17).

The concept of *PEGASYS* was created during the process of engaging two models into the systems design. *The Model of Engagement* (Bilda et al, 2008) proposes interaction modes and phases and the *Creative Engagement Model* (Edmonds et al, 2006) employs the use of attractors, sustainers and relaters. Three stages of engagement were implemented into the art systems design as prescribed by these models for designing interactive art systems. Designing to include these features within the context of creating a soothing calming experience required that the audio and visual media content of *PEGASYS* reflected an image which both soothed and engaged the participant.

A two-part study evaluated participants' experiences of *PEGASYS* and its features. The designed experience was found to produce relaxing and thought provoking engagements in which participants felt comfortable (see 6.6.1 *Moods*). 80 percent of participants of study two *enjoyed their interaction,* 84 percent *lost track of time*, and 92 percent felt themselves being *'drawn in'*. As presence-based engagement did take place for most people at some stage then it is possible to deduce that relaxing and calming environments are equally good environments in which to gauge the measurement of presence–based experiences.

> "It was relaxing, definitely relaxing. If your prepared to just take your time and don't think your just going to rush around there in 15 seconds or get this wilderness experience downloaded into you and then off you go. I think you've got to sit there and immerse yourself in it. *Study Two, Participant 10/ Comment made during the interview*

The statement below indicates that the features did meet the artists aims by producing a system that encouraged participants to slow down and 'smell the roses', to relax. It also indicates that the act of paying attention for extended periods was at times taxing on the participant but that they adapted to let the system interact with them which in turn facilitated outcomes relating to the aims and objectives of the research project.

> "Yes, parts of it were relaxing, parts of it I think, I was trying really hard to get it to work, and trying hard not to move, and I think that I tend to hold everything from the shoulders up to the chin, I do this (demonstrates). But that's just me. But yes, it was actually really nice, and I didn't mind that it wasn't working. It didn't frustrate me. I just went oh well I just have to look at what's actually happening now rather than move it so...because you do tend to go, oh this is really exciting I can move it with my eyes and you just want to keep moving around so when it wasn't working, I actually... it didn't frustrate me at all, it was actually, quite, it meant that I saw things that I might not have seen". *Study Two, Participant 17/ Comment made during the interview*

The system was designed to slow people down and in doing so proposed that they engage with the media content in a relaxed fashion rather than focus on the technology as an attribute for speedy exploitation. This is discussed in section **6.7**. This was perceived by many participants to be a design flaw; they consistently blamed the system for not doing what they wanted it to do. Despite this all but one of the twenty five participants of study two grew in confidence with respect to their interactions with the system.

> "I had the intellectual desire to want to quickly 'flash back' at first but became patient in the program to meander backwards and forwards. Found the colors, tonality, light, both reflective, associational and stimulating. Thanks for a fascinating and exciting experience". *Study Two, Participant 8/ Comment left on the questionnaire*

From an observational viewpoint, there were many participants' who were at first very impatient in their actions and demanding in their quest for control of the system, of their experience. The system was very capable of responding, in a fluid and intuitive manner. A good third of participants were able to pan left and right at will, with variation in speed of panning. These participants generally moved through the location from slow into fast mode, sometimes panning for prolonged periods, say to cover the full 360 degrees (there are examples of this interaction occuring located on the *PEGASYS* Drive Folder 4_Evaluation/ Chapter Six_Evaluation/ Demos.

When participants were asked if they found the experience relaxing or frustrating, a clear picture emerged. Participants generally reported feeling enagaged with the experience to the extent that whatever frustrations or stress full situations they may have encountered, the positive outcomes exceeded them. Participant 16 of study two had this to say,

> "Like a form of visual poetry. At times I was able to feel part of it or in shared control but mostly I let it wash over me I think. Very tricky combination of sitting still – feeling a little strapped in but more or less a sense of 'letting go' was the joy of the experience".

Or as Participant 15 put it,

> "An incredible, exciting and moving experience unlike anything I have experienced before. It was relaxing and stimulating at the same time! Strange but wonderful.

For many participants the system *did* produce relaxing engagements that were not frustrating, but some felt that they were tainted by what they perceived to be the systems inability to respond more quickly to their demands. As relaxation and frustration are identifiers of moods then in the light of data gathered we can identify that most participants were in receptive moods, throughout their engagement. Additionally question B30 asked participants to indicate if they *responded emotionally* to the experience of the art system, 60 percent of participants indicated that they did. Thus a relaxing atmosphere was generated and experienced, in keeping with the projects objectives.

7.3.2 Outcomes of the Interactive Narratives

In respect to the art system features and designing for three stages of interaction it is apparent that most participants preferred engaging with Stage Two. By applying *The Model Of Engagement* (Bilda et al, 2008) and *The Creative Engagement Model*

(Edmonds et al. 2006) to the design of the art system a number of variables were considered in designing experiences for enhanced participant engagement. As we have seen Stage One utilised attractors to draw the participant into engaging with the system. The main idea being that the media content would encourage curiosity and assist in gaining the focused attention of the participant. As Riva states,

> "To design for maximal presence is to create stories we can inhabit as fully as possible. These stories are located in immersive environments and elicit embodied, unselfconscious and engaged participation from all three layers of self " (Riva, 2004. p. 417).

During the interview participants who expressed that they were natural reclusives indicated that they found Stage One the most attractive. These participants indicated that they enjoyed the natural surroundings with the atmospheric sounds and no music. However, more participants expressed a deep connection with Stage Two. These people found the addition of a character within the space a far more engaging experience. In this stage sustainers were added in the form of music, singing and an interactive component that encouraged participants to engage with the environment through the screen character. These attributes sustained participant's attention. Furthermore, participants were able to enter this stage and if they felt so inclined, avoid the character but enjoy the music and the singing within the context of the natural environment.

People expressed how they found that Stage Two gave them something interesting to do and added layers of meaning. They indicated that they enjoyed the addition of something dynamic in the environment and felt that the addition of a character enhanced intimacy. Many commented on the relationship they experienced with the character and how they identified with her. Two men commented on the voyeuristic aspect of watching her within the space and felt inhibited by her presence. Many people indicated that Stage Two was technologically the most challenging as in order to watch the screen character progress through the landscape participants were forced to activate the eye control interface in such a way as to pan left and right according to her movements within the environment.

One participant expressed how he didn't have a favorite stage, explaining that he would engage with different stages depending upon his mood:

> "It's hard to say, they are each unique in their own way, it would depend upon what I'm looking for from the experience which stage appealed to me at that time. Today I was in a curious mood so I guess the third one appeals to me the most, but if I wanted to relax id stay in the first. If I was anywhere in between, the second I think. I felt that depending upon my mood I would have a different preference".

Another participant expressed how the space became hers and how other people, particularly men, affected her relationship with that space;

> "In Stage Three I got very cross. I found myself reacting, it was ok when there were two women on the rock but when a man turned up I thought what are you doing here. And I felt quiet a strong reaction towards there being men in that space. Somehow it became my space and I didn't want anybody here. Certainly not a man around".

Participant's experiences of social realism and presence attributes were tested through the design features implemented through the use of narratives and emotional content. Issues pertaining to the separation and experience of the self are enhanced if 'other people' or avatars are involved in the virtual experience (Heeter, 1992). Mutual understanding and awareness, intimacy and immediacy, behavioral engagement, sensory awareness of the embodied other, sense of access to intelligence and salience of the interpersonal relationship are all factors influencing the experience of *'being together with another'* (Biocca et al., 2001) pp 462-465.

The system features incorporated three stages each with its own narrative style. The first stage drew the participant into a relationship with the natural content of the environment implementing playback of atmospheric sounds. This stage was enjoyed by participants who indicated that the harmony and tranquility found in that space was restful and evocative of times spent in similar real environments.

In Stage Two, the wandering girl presents a new dynamic. The subjective camera techniques such as direct address both assisted in gaining and holding the participants interest and detracted from the experience depending upon who was asked. Nevertheless, as Stage Two implemented subjective camera techniques as a design feature within the media component, and it was the most popular choice of the three stages, then a claim is made that as a design feature it enhanced the potential for a presence-based engagament.

When asked to comment on the three stages in respect to having a favourite stage, participant number two answered;

> "The middle stage I think. The first stage is kind of interesting but when you compare it (stage two) to the other things it gave you some kind of interactive thing to do and it added a layer. I'm really interested in layers, yes, and the third one seemed to have too many disparate things which kind annoyed me a bit but interested me, I was interested". Study Two, Participant 2/ Comment made during the interview

Stage Three was designed to included relaters that enhanced the experience for participants by providing them with any number of possible narratives to engage with. Their attention became divided between what they could see and what they could do in terms of interactivity. The general consensus of Stage Three was that it successfully provided multi-option choices so that people enjoyed and engaged with the multi-narrative options. Participants expressed their delight at the progression from an unpopulated landscape to one containing many people and many enjoyed the musical cues that were embedded within the media. The hidden sound clips were not accessed as frequently by participants as the artist had hoped but as we have seen many participants were unaware of this system feature and the control they exerted over it. Stage Three presents twelve screen characters who are all enjoying the environment in their own way. During the interview process participants expressed their delight with watching the characters in turn, choosing to dwell on the characters who interested them the most. The multi narrative option, as a system feature was, according to the participants, very successful in gaining and maintaining their interest and attention. The subjective camera techniques employed created an intimacy that some participants, particularly men, found awkward. The presence of others within the screen space was identified as having positive outcomes. Those participants who prefer solitude returned to Stage One, where there are no other people. Over all the embedded characters were found to be engaging and enhanced participants experiences of the engagement.

In respect to experiencing the effects of social realism within the art systems design nearly half of all participants expressed that they felt they were in the same space as the characters. In study two, which included interactivity, 40 percent of participants agreed that they had the sensation that parts of the displayed environment (e.g., characters) were responding to them and just over a quarter of all participants expressed that they would have enjoyed more character action, basically confirming that the character action as

designed was sufficient for the experience they were undergoing. Most participants expressed that they enjoyed Stage Two the most. It contains one character who dominates the narrative, weaving between the panoramic video clips. Study results confirm that the emotional dialogue and built in narratives enhanced that level of the experience of the art system for many participants as did the guided interaction designed into the experience of Stage Two.

7.3.3 Outcomes of Inner Presence Attributes

Inner Presence is stimulated through a multitude of variables. Participant attention was gauged through the meaning the participant gave to the stimuli; how negative effects affected the participant; their general level of interest and therefore willingness to concentrate. The physical factors include but are not limited to; environmental distraction factors, involvement, physical and psychological barriers and the interplay of senses and the nervous system. What follows is a summary of the main factors influencing an individual's ability to experience the pyschological aspects of a presence-generating art system. These factors are: their ability to pay attention, their ability to loose track of time, their degree of involvement and concentration, the meaning they give to the stimuli, their mood, and issues related to controlling behavior.

In respect to attention, a participant's experience was analyzed in relation to the *Clinical Model of Attention*. Examples are given that highlight how the systems seven features enhanced participants experiences of attention. The features combine to create a sense of focus through sustainable form and content delivery. They assist participants in overcoming distraction factors and provide creative engagement with alternating attention factors. These factors were applied through system design, to adhear to the reccomendations of the *Model of Engagement*'s theory of modes and phases, with the *Creative Engagement Model's* use of attractors, sustainers and relaters (2.2). Design features such as embedded relaters enhanced 'divided' attention as they required participants to respond simultaneously to multiple tasks or demands. The model enables us to see the degree to which participants were engaged with the art system, and how their attention was held through the features designed for the art system.

Participant's experiences of time displacement are a major factor in evaluating the quality of the presence experience. In the questionnaire applied in this study (ITC-SOPI), question B3 addressed the issue of time. In study two, which included interactivity, 84 percent of 25 people agreed that they *lost track of time*, 48 percent of those strongly

agreeing. 21 out of 25 participants in study two, lost track of time simply because the experience they were having was deeply engrossing them, immersing them. In respect to participants level of involvement, 72 percent of participants indicated that they felt involved and 92 percent *felt themselves drawn in* which is an indicator of the phenomenon of presence. 76 percent felt that they *weren't just watching something*. 56 percent of participants felt *able to change the course of events*, and 76 percent felt that *they were participating* in the displayed environment.

As concentration could be likened to an attribute of attention, we recall *The Clinical Model of Attention* outlining how it requires a degree of concentration by the participant in order for them to successfully interact with the art system. During the interview, participants expressed how they felt in respect to the meaning they gave to the stimuli or content. 80 percent of participants *enjoyed themselves*, 68 percent agreed that the *content seemed believable to them* and 92 percent indicated that *the content appealed to them*.

For many participants the system produced relaxing creative engagements where the system responded in synchronization to the participant's demands. During the interview process participants expressed ideas about wanting to have more control of the system but they also expressed how refreshed they felt, how they had enjoyed the experience, and how they found the experience to be relaxing rather than frustrating. Regardless of his or her level of ability, everyone wanted to experience more options and participate in more creative interactive engagements.

7.3.4 Outcomes of Adding Interactivity

The two-part study included an investigation into whether interactivity played a role in generating presence engagement for participants of *PEGASYS*. As part of the evaluation process an interview was conducted with each participant and a questionnaire (ITC_SOPI) was completed. The study concluded that the introduction of interactivity facilitated prolonged engagements for participants who determined their own session duration and were found to be more engaged than participants of study one.

In terms of the technology facilitating for participants an experience of presence, the questionnaire (ITC-SOPI) results assisted to more clearly define the role of interaction. Outcomes based on high percentages indicate that participant's experiences of presence attributes were enhanced through implementation of interactivity into the system form. In study one 80 percent of participants felt themselves being *'drawn in'*, 24 percent found that the *content seemed believable* to them and 76 percent would *recommend the*

experience to their friends. In study two 92 percent of participants felt themselves being *'drawn in'* an increase of 12% from study one. 68 percent found that the *content seemed believable* to them, an increase of 44% from study one. 92 percent would *recommend the experience* to their friends, an increase of 16%. Results indicate that adding interactivity to the experience of *PEGASYS* increased participants sense of immersion as in study one 60 percent agreed to have *lost track of time*, and in study two this increased to 84 percent. Question B16 asked if participant's experiences had *been intense*. Interactivity increased the degree of intensity experienced with results moving from 40 percent in study one to 52 percent in study two. The system was designed to be stress free and as such, not intense. Evaluation of the system indicates that the systems features encouraged the attributes of peacefulness, relaxation and playful exploration which interactivity enabled. As more than half of the participants in study two (56 percent) *felt they could change the course of events*, then interactivity clearly enabled participants to feel more empowered and in control of the system than in study one containing no interactivity, when 12 percent agreed. In study one, when participants were asked if they *felt that they could interact* with the displayed environment 28 percent agreed that they felt they could, this is an unknown factor and no further data analysis can identify why this was the case. In terms of the form assisting in presence-generating attributes as experienced by study two participants, when asked if they felt that they could interact with the displayed environment 88 percent agreed that they could, up by sixty percent. Interactivity clearly aided the experience in terms of participation as 76 percent of participants in study two agreed that they *felt they were participating in the environment* compared to 28 percent in study one.

In the context of spatial presence and interactivity the majority of the participants of study two did indeed experience the sensation *that they moved in response to parts of the displayed* environment (B13) as 60 percent agreed with 20 percent remaining neutral. Clearly form assisted to improve these scores in study two as study one results, were reduced to 44 percent. Spatial presence in respect to participation and /or interactivity (the form) was considered by participants to be effective and was measurable, but produced deeply immersive engagements for only a few of the participants. Participants were asked if they *felt that all their senses were stimulated at the same time*. This question relates to the human senses that engagement stimulates and is interesting in as much as 20 percent of study one participants agreed and 44 percent of study two participants agreed. Therefore interactivity clearly played a role in manifesting sensory attributes of presence.

In study two 64 percent of participants agreed that the *displayed environment seemed natural*, 36 percent strongly agreeing. As these figures were up substantially from study one (48 percent) there are a number of conclusions to be drawn from this. Firstly, that interaction designed as a mechanism for delivering video-on-demand scenarios assisted in creating a more natural experience than the simple act of looking and watching media pass by as implemented in study one. Secondly, that the delivery of the content, in other words the form, allowed participants to spend greater periods of time within chosen locations within the landscape, thus it maybe that participants spent more time in sections of the media that were more 'natural' than others. And thirdly, the sound score for study two was significantly enhanced from the study one experience.

Enjoyment as a form of engagement is related to the experience of presence. As the results of both studies were high, 84 percent in study one and 80 percent in study two agreed to enjoying themselves, it is difficult to ascertain whether interactivity played a role in sustaining the sensation of enjoyment, or if the visual media content alone sustained the enjoyment.

Results therefore indicate that adding interactivity to the system design facilitated much stronger presence-based reactions from participants. Attributes of presence as indicated by previous researchers, namely; time factors, enjoyment, intensity, control and the form of the system, were clearly evident in the evaluation of the participant's experiences of, engagement, spatial presence, sensory presence and ecological validity.

7.4.5 Outstanding Research Questions

This research project examined how participants experienced a presence-generating art system; designed to adhere to previous research in presence, and following the design principles of two creative engagement models. Several key outstanding research questions remain. These are:

1. Eye-tracking provides a form for interaction that enables many attributes of presence to emerge, for example; the form of the technology enhances the experience by providing a unique engaging interaction that requires the participant to pay attention, concentrate on the system operation instructions and be involved in the process in a willing manner. The ultimate goal of these efforts aim to produce a link between human and machine through a user interface that passes information so naturally between participant and computer that the participant experiences a complete sense of presence within the remote location.

With *PEGASYS* this degree of immersion was experienced by participants' at some time during their evaluated session. How is it possible to extend upon the limitations of eye-tracking technology to enhance the degree of immersion within presence-generating art systems? Is it possible to link multiple eye-tracking devices and media content in order to create a full 360 degree immersive environment?

2. This research examined how eye-tracking facilitates an interaction between the participant and the content and form of the art system. *PEGASYS* was designed to produce stress free engagement (as it turns out, the most stressful aspect of the experience was the system response time). How does the experience change when the form remains the same but the content is a computer generated one? A virtual landscape designed to contain the sensorial attributes ascribed to the generation of presence.

3. Participants expressed during the interview a variety of examples on how to increase the interactive elements of the system. For example, many of the participants' articulated that they desired a system function that facilitated a zoom into, and hence out from, various elements of the visual media, adding interactivity. Yet it became apparent that some participants very quickly became absorbed in the exchange and forgot various interactive elements that were available to them. How then do we design art systems containing cinematic narratives (provided through a variety of interactive elements for creative engagement), and not overload the participant with information nor clutter the interface with instructions?

7.5 Future Work

Post-doc research may continue with the addition of evaluating participants with severe disabilities, that they too may experience a designed engagement that able bodied participants enjoyed. *PEGASYS* could be used to evaluate experiences of accessing video-on-demand scenarios with people who have severe physical disabilities like Cerebral Palsy. It is anticipated by the artist that those participants who are physically strapped into their wheelchairs may find *PEGASYS* all the more engaging as some participants from study two expressed concern about the inflexibility of interacting with a stationary eye-tracker.

So far *PEGASYS* has been produced and exhibited on one wall of a digital display environment with embedded interactive components, made accesible through the use of eye-tracking technology. However, the media content clips of *PEGASYS* (of which there are three stages each containing four clips, equaling twelve clips) maybe applied for inclusion within the creation of any number of digitised environments; curated to suit a gallery space or exhibition environment.

The transference of the media experience created, as the media moves from one screen format (private screenings within a studio environment) to another (public screenings) does not reduce its value, it just changes its audience and orientation, the context and use remain the same. The same narratives exist within the media content (which is set) with or without interactivity. It is the form of the system that changes its appearance. It is our relationship with that form, the delivery mode that allows us to navigate the narratives that invite playful interactivity. *PEGASYS* media clips can be viewed in a number of orientations, however each time it will be the participant who moves to interact with the media.

Scenario 1: Positioning the HDV *PEGASYS* clips on four large-scale screens suspended to form a square in the air at head height. Low level lighting, surround sound, soft L shape bench in the middle. Each clip runs in sync with the other three and the participant is located within the centre.

Scenario 2: Four screens placed in a row might each run a clip in sync and thus the participants interactivity and relationship changes from being pro active (as with eye-tracking) to spectator status, where they pace alongside the media and sit back at times and watch the action unfold.

APPENDICES

Ethics

Creativity and Cognition Studios currently employ an ethics status with the University of Technology, Sydney (UTS) that was established in February 2004 and is regularly modified for current and future use (last modification 2009). The UTS Human Research Ethics Committee has approved generic clearance to CCS researchers in order that research conducted within the studio is of a consistent standard. Ethics approval for individual projects is sought through CCS by lodging an application to the studio and defending publicly the projects intentions and methods used for conducting the

experiments. Therefore ethics approval was sought for this project through the CCS ethics cover in the method prescribed by CCS.

Ethics Application One: *The Element of Luck_* Public exhibition and questionnaire. *20/06/06_*

Ethics Application Two: *The Inneriorama Project* – Location Shoot One. *Crystal Pool. 1/07/08_*

Ethics Application Three: *The PEGASYS Project* – Preliminary User Testing at CCS. April-May 2009_ UTS HREC REF NO 0902 2006-304P

Ethics Application Four: *The PEGASYS Project – User testing at Beta_Space, Powerhouse Museum Sydney. 1/11/09_*

This research used non-invasive technologies. Experimentation of the art system was only conducted with adult participants in a manner prescribed by the methods that are covered under the ethics approval for CCS. All Participants signed a consent form and received printed information about the nature of the study (see *PEGASYS* external hard drive_Folder 10_Ethics applications for *PEGASYS*).

References for the PEGASYS External Drive

The external hard drive accompanying this thesis contains a number of items that assist the reader in their understanding of the artist, the art system and the participants' experiences of the art system.

The folders progress from 1–7 in much the same way the thesis does; namely progressing from foundation to experiments to new work through to evaluation. There are nine appendices, an application through which to view and interact with the media and three examples of the 12 finished HDV films created for *PEGASYS*. The media files contained on the *PEGASYS* Drive are formatted for use in a Macintosh operating system, OX10 is recommended. QuickTime movie files can be opened by simply dragging them onto the QuickTime icon on your desktop. Still images can be opened in Preview or an alternative picture viewer. Other media items that require an application to open are discussed in detail below.

Folder 1_SM_Foundation contains a number of items that introduce the artist and work done to date. A short film produced for Creativity and Cognition Studios in 2006, *CCS_Profile_sarahmoss.mov* has a duration of 03.06 minutes and explores future work proposals through investigation of previous work undertaken. The *dvshowreel.mp4* has a

duration of 3.46 minutes and illustrates the type of multimedia work undertaken by the artist in the previous 10 years. Finally the folder titled, *sarahmoss.com.au* contains a website database with 54 pages. Within the website are 58 videos and 168 images still images, with hyperlinks joining artists with artistic endeavors created over the previous 10 years.

Folder 2_SM_Experiments contains four items. *Experiment 1.mov* has a duration of 01:25 minutes. In this film a beach is documented and edited back to create an impression of the levels of interaction as proposed within early adaptations of the art system. Likewise *Experiment 2.mov* with a duration of 02:02 minutes utilizes a musical score underpinning the action in respect to the use of Baroque music created to induce a relaxed state of mind (see 5.4.2.4 for more on interplay of sound elements). *Test_Panoramic#1.jpg* illustrates a panoramic image shot in still frames when experimentation with the media was taking place. Finally '*The Element of 'Luck*' (a FLASH Application requiring FLASH Media Player to operate) provides an interactive experience of the pilot study conducted in 2006 researching the experience of presence.

Folder 3_*PEGASYS*_New Work holds a variety of media types illustrating various aspects of the new work. The movie file Beta_Space_Pegasys.mov has a duration of 2:57 minutes as is made from still shots taken of *PEGASYS* at Beta_Space the exhibition environment. The folder titled, *PEGASYS_* Still Frames contains three folders each with examples of the three stages as captured by the cameras on the live shoot. These images remind the reader that the creation of editing PEGASYS was very involved. These still images demonstrate the scale of each field of view (FOV) and also the varying lighting conditions that changed throughout the course of the day. The folder Stage One_Examples of still frames contains four images; Camera 1.jpg, Camera 5.jpg, Camera 8.jpg, Camera 11.jpg and one movie with a duration of 1:09 minutes containing all the FOV shot for use in Stage One, Stage One_14 cameras FOV.mov. The folder titled, Stage Two_Examples of Still Frames contains four images of the camera's FOV used in Stage Two: Camera 1.jpg, Camera 6.jpg, Camera 7.jpg, Camera 12.jpg. The folder, Stage Three_examples of still frames likewise contains four still images namely; Camera 2.jpg, Camera 4.jpg, Camera 9.jpg, Camera 12.jpg and one film file with a duration of 00:59 minutes that uses each of the 14 cameras FOV in still frames; Stage Three_14 cameras FOV.mov.

A video shot to capture the essence of *PEGASYS* at Beta_Space is titled; *PEGASYS*_DVD_5mins (04:51 Duration). This film is created from video documentation of participants experiencing *PEGASYS* during the evaluation sessions. The voice over conveys participant's expressions of their interactions with the system. This short film was created to play during a presentation at the X/Media/Lab Global Media Cultures held at Sydney Opera House November 27th-29th 2009.

The *PEGASYS*_Production folder contains three short films (all QuickTime video files) and a folder containing .Wav sound files. 'Crystal Pool'.mov (04:39 duration) documents the landscape on the day of the film shoot. It includes the installation of the camera shelf, the placement of the screen characters within the landscape and displays the beautiful habitat of 'Crystal Pool', a location buried deep within Sydney's Royal National Park. The Camera Shelf.mov (01.11 duration) is a series of still shots that illustrate the camera shelf in detail. The Visual Reference Guides (VRG).mov with a duration of 01:37 shows examples of the early stages of PEGASYS, illustrating the editing environment and the processes involved in editing large media files using two large display screens. Finally the folder called PEGASYS_Sound Files contains another folder titled; www.marianthe loucataris.com, which houses the musical scores used in *PEGASYS*.

Folder 4_*PEGASYS*_Evaluation includes a folder called *Chapter Six_Evaluation*. Within this folder lie four demonstrations of participants using *PEGASYS* during an evaluation session. *Demo#1_eye-tracking L&R.mov* has a duration of 01:17 minutes, *Demo#2_Stage Three.mov* has a duration of 01:56 minutes, *Demo#3_Participant #1.mov* has a duration of 04:46, and *Demo#4_Participant#.mov* has a duration of 06:15 minutes. A film called *The Callibration Process.mov* (29:08 duration) takes the viewer through one participants experience of using *PEGASYS* in Beta_Space. This documentation is actually of the artist's father interacting with *PEGASYS*, hence apologies are offered for the brisk manner in which the session was conducted (the father was being typically stubborn and the daughter not very understanding). Next, the film called *PEGASYS in Beta_Space_Interface* (01:08 duration) illustrates with an example of how the *PEGASYS* interface controls the media according to the demands of the participant. The *PEGASYS_Evaluation Film for Study one* (08:22 duration) is an example of the film used in Study one. It is important to differentiate between the media components and type of engagement encountered by participants of Study one which watching this film will illustrate. And finally, the film *PEGASYS_Interface.mov* with a duration of 00:29 demonstrates how the eye-tracking technology and the *PEGASYS* interface communicate.

Folder 5_PEGASYS_APPENDICES contains nine appendices which are all PDF's. Appendix One presents the interview questions & answers. Appendix Two outlines the participants' comments written on the questionnaires. Appendix Three discusses the exhibition venue and publicity material generated for exhibiting *PEGASYS*. Appendix Four contains the questionnaire and the results of both studies. Appendix Five contains the data collected from the participant profile forms. Appendix Six contains a list of the system operations and instructions for conducting the evaluation sessions as outlined in the methodological approach. Appendix Seven discusses the system technical specifications.

Appendix Eight contains the academic papers written in the previous three years in respect to researching and experimenting with the concepts that configure to resemble a presence-based engagement. The papers are; *The Reflective Practitioner: In Creation of a Presence-based Experience* (Engage, 2006); *The Reflective Practitioner: In Creation of PEGASYS* (OZCHI, 2008) and *PEGASYS: An Interactive Panoramic Cinematic Presence-Generating Art System* (ISEA, 2009).

Appendix Nine contains information about the *PEGASYS* film shoot addressing the location, the casting call and the shooting schedule.

Folder 6_*PEGASYS* Application contains all the media files required to preview the system in an interactive format. Other media clips on this drive illustrate how the eye-tracking device facilitated an interactive experience for participants. This folder contains an application specifically devised in order to demonstrate the visual media contents and create a visual display that imitates the form of the system. To preview the media follow the instructions below:

- Double click on the pegasys_app
- Extend the image until it fills the screen while at the same time retaining the black letterbox effect around the image.
- Use the position tool bar to navigate either left or right in 360 degrees.
- Use the stage tool to move from one stage into another.
- It is recommended that you stop and start the media using the icons on the left hand side of the application, when you move between stages, especially Stage Two. This refreshes the video clips assisting to keep them in sync.

The footage should run in real time but this will depend upon your playback system. The running numbers located in the bottom left hand side of the screen, increase with

computer power, RAM. The higher the number the swifter the image update rate. For a non interactive example of how the screen character passes through the independent video footage captured from different sources and merges into clips, see *PEGASYS* Drive/Folder 7_SM _ *PEGASYS* / Examples of the New Work/ Stage Two, Clip 2.mov (Duration 07:51).

Please note audio is not included within this version of the application. For a fuller experience it is advisable to open in QuickTime and play the following sound files: **s1.wav** (10:15 Duration) for Stage's One and Three, and **s2.wav** (09:33 Duration) for playback in Stage Two. They are located on: *PEGASYS* Drive/Folder 3_SM_ New Work /*PEGASYS*_Sound files/www.Marianthe Loucataris.com/ s1.wav/ s2.wav

Load the remaining wav. files into iTunes and play simultaneously (be your own DJ) when in Stage Three.

PEGASYS plays music on demand in Stage Three. It is possible, when connected to the eye-tracking device, to activate a centre interface icon that changes the musical score according to the positioning of each screen character, upon the screen. Each screen character has to be within the parameters set within the interface icon, which is invisible upon the digital screen environment. The participant activates sound clips that were chosen / created, for that characters narrative. There are 14 characters in Stage Three. For an example of how one character, the Birdmann, interacts in Stage Three, see *PEGASYS* Drive/Folder 7_SM _ *PEGASYS* / Examples of the New Work/ Stage Three, Clip 3.mov (Duration 10:10).

Folder 7_*PEGASYS* / Examples of the New Work contains three full length video files that demonstrate the quality and visual depth of each of the 12 original media files developed for use in *PEGASYS*.
PEGASYS_Stage One, Clip 1.mov has a duration of 05:15 minutes.
PEGASYS_Stage Two, Clip 2.mov has a duration of 07:51 minutes and
PEGASYS_Stage Three, Clip 3.mov has a duration of 10:10 minutes.

Each of these three media files can be opened by drag and dropping them into a QuickTime Application, preferably 7.6.2 or higher. The audio plays in stereo. The larger the digital display screen, the more immersive the experience. Be sure to maintain the aspect ratio to see full screen image.

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