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Emotion and Presence in Virtual Reality

a novel enactive approach

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Emotion and Presence in Virtual Reality: a novel enactive approach

By

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Abstract

Virtual Reality (VR) use emotion based based therapies to alieviate anxiety, stress, and depression and for gaming involves excitement and enjoyment. Key to these experiences are the feeling of being there (spatial presence) and being with others (Social Presence) within VR.

This thesis addresses: What are people's lived experiences of emotion, especially gratitude, and presence within VR environments? This thesis views people as inhabiting a world experienced as meaningful and interpreted as they live it. Secondarily, the thesis relates these experiences to theories of how emotion, especially gratitude, and presence and how may be explained by the enactive approach, including an enactive approach to presence (EAP) developed in this thesis. There is little research clarifying how emotion related to presence in virtual environments and none specific to gratitude. This triggered the primary research question.

The enactive approach adopts a unified approach between mind, body and environment and emphasises that dynamic interactions between these are purposeful such that presence and emotion emerge as forms of meaning or sense-making. Qualitative Interpretive Phenomenological Analysis (IPA) is used to examine this lived experience. Gratitude was induced in a helping scenario. IPA captured the experience of unfolding emotional episodes and presence over time. Questionnaires provide additional evidence easing comparison with quantitative studies. The findings were recast via an enactive lens and compared with existing research relating emotion to presence.

Eight themes were identified: purpose and intentionality; curiosity, exploration and evaluation; orientation of emotion: its nature and intentionality; unfolding presence episodes; weirdness and dissonance; role of the avatar; gratitude: other,benefit, help, and culture and foreknowledge. The first three are closely linked. Gratitude boosted positive feelings towards others and increased social presence even where the helping avatar's humanity was doubted. For spatial presence, emotion needed to be orientated towards the physical environment for increased spatial presence or social interactions for increased social presence. A novel view of social presence dependent upon dynamic coupling, including dissonant connectedness of emotions, which may enhance or reduce social presence.

The thesis highlights first the strength of examining presence from the psychological perspective. Psychologists and VR designers need to consider not only actions, emotion as independent storylines but also the role of intentionality both within the virtual environment but also external to it. It highlights considering the interactions as a whole experience and consideration in terms of the coupling between individuals and environment in general and how designers should design for these. Such an approach paves the way for an improved therapeutic use of gratitude and empathetic VR to improve mental wellbeing, stimulate VR collaboration, and further social cognition research.

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Chapter 1 Introduction

This chapter introduces the research study in its context and explains its scope and limitations. It sets out the objectives, research questions and explains the factors which influenced the decision to explore this subject using these questions. It outlines the methodological approach and the theoretical basis for the study and sets out an overview of the contribution made by this thesis to the body of knowledge. The chapter concludes by giving an overview of each chapter of the thesis.

1.1 Overview

This thesis is divided into four elements: the development of a new approach, known as the enactive approach to presence (EAP); the development of a research platform to investigate the relationship between emotion, gratitude and presence; a qualitative study into the lived experience of peoples' emotions, including gratitude, and presence when socially interacting within a virtual environment; discussion of the results from an enactive perspective and an evaluation (in the discussion section) of the developed EAP. The enactive approach is where meaning emerges from purposeful, self-sustaining actions of embodied organisms dynamically interacting with their environment. The EAP was developed in order to explain how emotion, including gratitude, and presence may be related together which needed an EAP that aligns with pre-existing enactive approaches to emotion (Colombetti, 2014a; Colombetti & Thompson, 2008). The thesis draws upon idiographic, hermeneutic and phenomenological traditions along with critical realism. This approach aims to generate new insight and inform theory rather than identify causation and statistical generalisability. The evaluation of the EAP, therefore, focuses upon its worth as a guiding framework of interpretation, explanatory power and the extent to which it generates new insight.

This thesis draws throughout from works published by the researcher. More detail and an outline of the EAP model and approach has been published as a peer reviewed chapter . This has been cited by Jelić, De Matteis and Vecchiato (2016), Nuel, Fayant and Alexopoulas (2019) and led to a number of communications between the researcher and Giuseppe Riva, a leading researcher into presence. A contributor statement ensures that the originality of the thesis contribution is not compromised (a copy is included in Appendix C).

1.2 The Context

To an information-rich generation brought up with the Internet and social media, using technology to access education, employment and entertainment, such as gaming, has become second nature. Virtual Worlds (such as Second Life, developed in 2003) have matured and there is increasing use of Virtual Reality (VR), particularly through the use of immersive 3D headsets, such as the Oculus Rift. Goldman Sachs predicts that by 2025 the global market for immersive

technologies will be $95billion (Mateos-Garcia, Stathoulopoulos, & Thomas, 2018, p. 10). The UK government has identified the immersive sector, including virtual reality, as a young and rapidly developing sector (Mateos-Garcia et al., 2018). Microsoft adoption term mixed reality emphasises that the boundaries between technology and computing and normal life are blurring. This study similarly sits at the boundaries between psychology, technology, computing and human nature in the natural world. The use of immersive technologies is cross-sector with "almost two-thirds also identified other 'non-creative' sectors". Training, education, health and tourism are mentioned most often (Mateos-Garcia et al., 2018, p. 23).

The focus of this thesis is upon the psychological aspects of human nature, in particular feelings of emotion, especially gratitude (an empathic emotion), and the feelings of presence. It therefore adopts a human centred approach to computing, from the perspective of the computer scientist, which involves "embedding the cultural and social contexts as well as personal factors such as emotion, attitude, and attention. This requires considering work in fields such as neuroscience, psychology, cognitive science, and others". (Jaimes, Gatica-Perez, Sebe, & Huang, 2007).

Studying the emotions of the humans behind the avatars and the interactions between avatars in a virtual world is useful for examining human behaviour. This research used OpenSimulator (Open Sim), an open source multi-platform, multi-user 3D application server, to create a simulated virtual environment similar in appearance and functionality to Second Life. It also made use of Oculus Rift headsets for some participants. In the light of the context described, a study which makes use of technology (the Open Sim Virtual World) and Virtual Reality (use of Oculus Rift headsets) and links these with psychology and emotion, in order to provide greater understanding of human behaviour and emotions, is likely to be of contemporary significance and value.

1.3 The Problem

Emotion is a fundamental attribute of the human experience. Designers of virtual reality games, whether for pleasure or serious objectives utilise the affective nature of people and other uses include helping people with emotional disorders such as post-traumatic stress disorders (Gamito et al., 2007). Immersion and presence are widely considered desirable characteristics in virtual reality and game design. However, a provisional review of the literature suggested that there was relatively little clarifying how emotion related to virtual environments and the quantitative evidence did not provide the rich contextual evidence needed to understand the factors in the interactions. In particular Gratitude, as an empathetic emotion, has potential for exploitation in virtual reality which can be "a tool for empathy and cognitive enhancement" (Hall & Takahashi, 2017, p. 3). It has been associated with improving mental wellbeing (Emmons, 2008; Toepfer, Cichy, & Peters, 2012; Watkins, Woodward, Stone, & Kolts, 2003). However, there has been no research into gratitude's relationship with presence nor into emotion and presence from an

enactive perspective. Fisher (2017) argues that one of the key aims of VR Designers is to engender an "emotionally charged interpretation of life" (p. 233). This triggered the research aim: *to provide a fresh insight into the experience of emotion within virtual reality environments.*

1.3.1 The Research Questions

In order to address the initial research aim three objectives were set: to clarify what is an emotion (Sections 2.1 and 2.2); narrow down the scope of the aim (Sections 2.3 and 2.4) and examine what prior studies suggested was the experience of emotion within virtual reality environments (Section 2.5). These were developed in a manner that identified gaps in the current understanding of the issues. These objectives enabled the specific research questions to be addressed and hence were an appropriate way of doing so; in this case utilising a qualitative rather than quantitative experimental approach.

Clarifying what an emotion is involved understanding the implicit and explicit underpinning assumptions including differing views over dualism: the distinction between mind and body or object and subject. This thesis makes explicit its approach: a non-dualist approach. This led to adopting an enactive approach to emotion and an epistemological approach that understands people as experiencing life as a world of meaning formed from their experience as living beings. This making sense of the world (sense-making) by their lived experience led to the research paradigm adopted in this thesis. Narrowing the scope for emotion led to an emphasis upon gratitude and for virtual environments focused upon the feeling of being there spatially and with others (spatial and social presence). There was no existing enactive approach to presence and this was therefore devised in this thesis to enable emotion and presence to be related together based upon a coherent, enactive, perspective.

This thesis adopts a non-dualist and enactive approach based upon theoretical, philosophical and empirical grounds and on novel grounds after accepting that the enactive account was sufficiently plausible yet for presence was missing, to be worthy of further examination.

This led to three further objectives:
1) To understand the 'lived' experience of emotion and presence within virtual reality
2) To understand how the lived experience of emotion and presence as revealed within this study were related to each other as suggested by prior quantitative empirical studies.
3) To develop a novel theoretical enactive approach to presence to enable the experience of emotion and presence to be related together from an enactive perspective.

The thesis now consisted of two areas: first, a bottom up approach aimed at understanding the participants' experience, driven by the empirical findings, secondly, theory driven aspects

utilising a high level theoretically derived enactive approach to presence, and prior theories of how emotion and presence were related used to interpret the empirical findings

The first of the above objectives led to the primary research question:

- What are people's lived experiences of emotion, especially gratitude, and presence within virtual reality environments?

This primary research question is addressed first as it provides the empirical evidence used by the secondary research questions.

The second of the above objectives led to the secondary research question 1:

- What is the relationship between emotion, especially gratitude, and presence?

The third of the above objectives led to the secondary research question 2:

- To what extent can accounts of the lived experiences of emotion, especially gratitude, and presence within virtual reality environments be explained using an enactive approach?

The findings of the primary research question addressed using Interpretive Phenomenological Analysis are presented in Chapter 5, along with the studies used to pilot and develop the research environment with the theoretically derived enactive approach to presence addressed within Chapter 6 using an abductive approach. The theoretically derived EAP needed is developed first and presented in Chapter 3. Chapter 4 explains more fully the study design and methodology.

1.3.2 Scope of the Study

The research examines the relationship between benefit induced gratitude and spatial presence in a 3D virtual world between pairs of people interacting as avatars. No other specific emotions are targeted. The focus is upon the psychological aspects rather than the technological aspects and the recalled lived experience. The study is constrained by the particular environment developed, however, having some participants use virtual reality headsets, and some helped and some not, provides for some variation. Whilst this study utilises the enactive approach which is involves brain-body-world coupled as one system it focuses upon the body-world relationship. This places a constraint on fully validating the EAP hence the focus is upon explanatory power of the EAP. In view of the size of the group, it is not claimed that the findings of this study identify every variation, or the prevalence of the features identified. It does not aim to generalise over a wider population but rather to inform theory.

1.4 The Contribution of this Study

This section highlights the key contributions made by this thesis. These are discussed in more detail in Chapter 7 which examines the theoretical development, research findings, and draws conclusions. Contributions arise from two areas, the development of a novel EAP and the findings examined through an enactive lens. As a qualitative study the aim is to inform theory rather than provide statistical generalisations across a population.

1.4.1 The Theoretical Body of Knowledge

The IPA study identified eight super-ordinate themes that address the primary research question: Purpose and Intentionality; Curiosity, Exploration and Evaluation; Orientation of Emotion: its nature and intentionality; Unfolding presence episodes; Weirdness and Dissonance; Role of the Avatar; Gratitude: Other, benefit, help; Culture and foreknowledge which were examined. These were then interpreted using the enactive approach, using the EAP, to provide insightful explanations of the IPA derived themes in this study.

In summary, the contribution made by this study to the body of knowledge is that the study:

- emphasises social presence (and spatial presence) as an unfolding dynamic episode, using the EAP it suggests that there can be a dynamic self-destructive process such that can be associated with increased social presence and coupling, however this can generate emotions with dissonant-coupling (such as social anxiety when meeting) leading to break down of coupling and social presence.

- Provides evidence of a relationship between emotion (specifically gratitude) and presence, leading to the corroboration of aspects of existing research from a novel perspective of analysing individual data points rather than data trends

- Suggests a very close relationship between emotion, intentionality (personal, interpersonal and trans-personal) and agency (curiosity, exploration and evaluation) for both social and spatial presence, with agency frequently, but not always, associated with increased spatial presence.

- Extended existing gratitude induction to virtual environments and found that increased gratitude can be associated with increased social presence but doubts over the humanisation of the avatar may reduce this

- Extended prior results that gratitude helps boost positive and appreciative feelings towards others to include existence even where there is doubt over whether the avatar is a real person

- Confirmed prior results regarding the role of traits such as visual and spatial imagination and perceptions, strengths and attention, but the enactive approach suggests a different interpretation rejecting current presence theories emphasis upon an internal mental model

This study creates new understandings by:
- Extending existing studies to the social emotion gratitude in order to explain the relationship between presence and emotions.
- Providing explanations (from an enactive perspective) of the relationship between emotion and presence
- Evaluating the significance of the novel enactive approach to presence developed for this study.

1.4.2 Ways of Gaining New Understanding

This thesis contributes two novel ways of gaining understanding:
- A novel EAP is developed (see Chapter 3) to enable constructs related to presence to be interpreted from an enactive perspective.
- A novel use of IPA in VR and presence research is employed. This has enabled a greater insight into the dynamic and lived experience of aspects of presence and emotion than quantitative empirical studies alone.

The value of the EAP has been recognised by researchers adopting the enactive approach within VR who commented on the published version (Willans, Rivers, & Ekaterina Prasolova-Førland, 2015) as a "potentially fruitful direction for theoretical conception of presence and emotion for VR on the basis of the enactive approach" in an area that has received "little to no attention" (Jelić et al., 2016).

The review of the literature of presence research and IPA revealed that using IPA in VR and presence research is new.

1.4.3 Impact

The practical social and economic impact of this research is upon designers of virtual reality experiences whether for psychology, therapy, gaming or immersive journalism. Some of the social and economic benefits identified lie the areas of health; collaboration; empathy machine development; collaborative activities; general VR development and research contribution. These include:

- Provides a synthesis of how emotion interacts with presence in virtual environments

- Illustrated a virtual gratitude simulation that may be used to help improve gratitude influenced wellbeing
- Suggests that designers and developers need to consider the types and orientation of emotion not just the intensity of emotion along with the potential coupling involved
- Improves awareness of the balance between reliance upon technical solutions, such as headsets, and possibility of using less technically immersive environments provided, if the scenario is sufficiently emotional
- Emphasises the integral nature of emotion in presence and that social emotions are focused upon social presence; other emotions focus upon spatial presence
- The enactive approach suggests that virtual reality designers need to emphasise considering the whole dynamic interactions between self and avatars in a dynamic interaction with the environment whilst designing a virtual environment
- Lays a foundation to enable enactive research into feelings such as depression and presence.

1.5 Key Terminology

In this thesis the terms 'virtual world' and 'virtual environment' are used interchangeably, as generic terms to mean computer-generated simulated environments accessible by multiple users who use avatars to move around, participate in activities and communicate with others.

The term 'avatar' is used to mean a computer-generated graphical representation of the user, which enables them to act and interact within the virtual environment.

The term emotion is considered to encompass a wider range of affective states such as empathy, gratitude and boredom than the biologically innate basic emotions (originally identified six discrete basic emotions, namely happiness, sadness, fear, surprise, anger and disgust) (Ekman, Sorenson, & Friesen, 1969). It precludes the feeling of presence itself except where explicitly stated. Fuller explanations of emotion are given in Sections 2.2 and 2.3.

Gratitude in this thesis focuses upon benefit-induced aspects of gratitude defined as: " *the positive emotion one feels when another person has intentionally given, or attempted to give, one something of value"* (McCullough, Kilpatrick, Emmons, & Larson, 2001; McCullough & Tsang, 2004). Research into aspects of gratitude such as being grateful for life is outside of the scope of this thesis. Fuller explanations of gratitude are given in Section 2.4.

Critical realism is the research paradigm adopted, which holds that knowledge is interpreted within its historical and cultural context, based upon our experience of events that are real and independent of the mind but cannot be observed directly(Bhaskar, 1997/1975). For social

research especially, such as in this thesis, it highlights limitations rendering reliance hypothetico-deductive techniques inappropriate. (Danermark, Ekstrom, Jakobsen, Karlsson, & Bhaskar, 1997/2005).

The enactive approach adopted in this thesis draws upon that proposed by Varela et al. (1993) as opposed to enactive models of perception theory which are focused upon perception as a way of action (Noë, 2004) or more radical enactive approaches focused more upon the reject of cognitive representation (Hutto, 2005). The enactive approach adopts a unified approach between mind, body and environment and emphasises that dynamic interactions and associated actions are purposeful and from which experiences such as presence and emotion emerge as forms of meaning. Colombetti and Thompson (2008) express this as:

> according to the enactive approach, the human mind is embodied in our entire organism and embedded in the world, and not reducible to structures inside the head. Meaning and experience is created by, or enacted though, the conscious reciprocal interaction of the brain, the body and the world. *(2008, p. 56)*

This meaning (as sense-making) derives from autopoietic (self-creating and maintaining) organisms that act purposefully in a manner that maintains them can be as emotion. Emotion and Cognition are both forms of sense-making and cognition and combined together.

Presence and immersion are commonly confused in the context of virtual worlds. In this thesis, the research involves two specific forms of presence: spatial presence, the "feeling of being there", in a spatial location whilst social presence is the "feeling of being with another". Immersion in contrast focuses upon feeling deeply involved and engrossed within the virtual environment. This thesis focuses upon presence within a virtual environment rather than the natural world and will state where this varies. Presence is regarded as a psychological experience and not an attribute of technology or media. Fuller explanations of presence are given in Sections 2.4 and 5.4.4.

The enactive approach to presence, a novel development in this thesis, which utilises the enactive approach includes two aspects, the spatial and social which are defined below.

Spatial Presence, as developed in Chapter 3 of this thesis, is defined as:

> *The felt experience of being there emerging from the purposeful, self-sustaining, actions (enaction) in a dynamic interaction between an autonomous embodied (natural and synthetic together) organism and its environment (natural and synthetic).*

Social presence, as developed in Chapter 3 of this thesis, is defined as:

> *The felt experience of being with other social agents emerging from the*
> *purposeful, self-sustaining, actions (enaction) in a dynamic interaction between*
> *autonomous, embodied (natural and synthetic together) social agents and their*
> *environment (natural and synthetic).*

1.6 Outline of the Theoretical Basis

This section sets out the rationale for this thesis including the enactive approach to emotion. The key theoretical themes explored in this study and the principal texts drawn on include:

1. The Enactive approach to presence adopted draws upon the approach of Colombetti and Thompson (Colombetti, 2014b; Colombetti & Thompson, 2008) in an enactive approach to emotion.

2. Emotion arises from interactions as a form of meaning. Thus, emotion is a form of cognition. As our physical self-interaction with the environment provides meaning, it is from our experience as living beings that meaning arises (Colombetti, 2014b; Colombetti & Thompson, 2008; Varela, Rosch, & Thompson, 1991/1993).

3. Presence (the feeling of being somewhere) is located around where self is being; the approach of Riva et al. (2004) to presence emphasises self. The world, to us, is as we experience it in our interactions and how we may interact; the atoms, molecules and objects in themselves are just atoms, molecules and objects. Thus, our world is located around ourselves in time in terms of our lived experience and how we may interact with it. This leads to our sense of where our being is (presence) based around self.

4. Slaby's (2013) enactive approach to intentionality (also potentially related to presence and emotion) relates to the impact upon self-conception; emotions have an intentionality such that to care about someone has an intentionality towards acting to help them (depending upon the context). Presence, as action, and the intimate link between intention and action may relate to emotion and presence.

5. The suitability of the critical realist approach (Bhaskar, 1978; Danermark et al., 1997/2005; Mingers, 1995) in the research design is argued for from autopoietic principles at the heart of enactivism.

The analysis of the literature revealed that the underpinning assumptions of both emotion and presence could be understood in terms of dualism and phenomenological approaches. This led to

identifying specific gaps in emotion-presence literature and the lack of and need for an enactive approach to presence (EAP), which is to be evaluated (this is developed further in chapter 3).

By highlighting the underpinning assumptions, such as meaning-creation and epistemological/ontological issues, the groundwork was made for a link to the study design approach in chapter 4.

Clarifying the enactive approach in chapter 2, and in more detail in chapter 3 (developing the enactive approach to presence) prepared the analytic window through which the research data was analysed.

The key theoretical bases for this thesis are discussed in more detail in Chapter 2.

1.7 Outline of the Research Design

This study adopted an intensive, context sensitive approach drawing upon idiographic, hermeneutic and phenomenological approach, in line with the critical realist epistemological and ontological position used (Bhaskar, 1989), rather than an extensive statistical experiment. This was preceded by a development phase. Over 55 participants were involved in total. The aim of the main research design was to understand the lived experience of emotion, gratitude and presence in virtual reality. This addressed the primary research question and provided the empirical data to analyse though an enactive lens. Participants were given a virtual activity (pushing boxes or buttons, purportedly in an exercise for an experiment involving two participants) to complete and using the ruse that the activity involved two participants, enabled a confederate to help the participants complete the task in order to induce gratitude (as benefit-induced-gratitude). The contexts varied in terms of gratitude (helped and not helped) and in two levels of presence (lower and higher) using a laptop and VR headset. In practice, the use of technology such as a laptop "low presence" was not fully reflected in the results (see Section 7.3).

Interpretive Phenomenological Analysis (IPA) was the methodology adopted along with associated methods suggested by Smith et al. (2009) which focus upon the conscious lived experience as interpreted by the participants. It aims to focus upon coherent philosophical underpinnings with the enactive approach by choosing critical realism and IPA at both the meta-theory of knowledge creation and the methodological levels respectively. This study, focused upon IPA, is a primarily qualitative study but the idiographic use of questionnaires at the level of the individual is used to enable ready comparison with empirical approaches. The interviews of 8 participants out of 14 passed a quality threshold needed for IPA and were used in the main study. Prior to the main study, pilots were carried out to develop the virtual environment, questionnaires and interview protocols. The research design also included evaluation of the EAP.

The methodology and methods used in this research are discussed in detail in Chapter 4 (Study Design).

1.8 Overview of the Thesis

This thesis is divided into 7 chapters: Introduction, Literature review, A novel enactive approach to presence, Research design, Feedback and analysis, The enactive lens and discussion, and the conclusions. How these relate (excluding the introduction and conclusions) are shown in Figure 1-1. These are described as follows:

Chapter 1 – Introduction

This chapter introduces the research study in its context and explains its scope and limitations. It sets out the research questions and explains the factors, which influenced the decision to explore this subject using these questions. It outlines the research design and the theoretical basis for the study and sets out the particular contribution made by this thesis to the body of knowledge. It concludes by giving an overview of each chapter of the thesis.

Chapter 2 – Literature Review

This chapter critiques and presents a synthesis of emotion theories, including gratitude and presence theories and the extant literature in the relationship between the two. Amongst the critiques it identifies that for both emotion and presence theories a major area of criticism and debate common to both was that of dualism, the divide between mind-world, nature-nurture or approaches involving the simulation of world in the mind. The resulting stance in this thesis is the adoption of the enactive approach (unity between mind-body-world). The chapter reveals that whilst there was an enactive approach to emotion there was no enactive approach to presence. The chapter further identified that there was little research into the relationship between gratitude and presence. These identified gaps in current knowledge are highlighted in darker pink in Figure 1.1. From this chapter the research questions were derived.

Chapter 3 – A novel enactive approach to presence

This chapter presents one of the contributions of this thesis, a novel enactive approach to presence, developed in response to the need to fill the gap identified in Chapter 2. This enables the emotion and presence findings to be evaluated from an enactive perspective and the approach itself is evaluated in Chapter 6.

Chapter 4 – Research Design

This chapter presents the rationale and justification for the approach, methodology and the methods for collecting and analysing data chosen. It explains the approach; the methodology IPA and associated methods to collect and analyse the data in order to answer the research questions. IPA is consistent with the assumptions underpinning the enactive approach.

Chapter 5 – Results and Analysis

This chapter presents and analyses the data collected both from the studies used to develop the research platform and the main study answering the primary research question. In line with the IPA methodology the emphasis is upon each participant's interpretation with an increase in the researcher interpretation in selecting the themes. These themes then inform the discussion in the next chapter.

Chapter 6 – Enactive Lens and Discussion

This chapter discusses the themes and findings identified using IPA (directly addressing the primary research question) and evaluates the EAP. The findings from chapter 5 are re-contextualised though an enactive lens and leads to an evaluation of the explanatory value of the enactive approach to presence (Secondary RQ2). How these experiences of emotion, especially gratitude and presence address their relationship (Secondary RQ1).

Chapter 7 – Conclusions

This final chapter evaluates the significance of the findings and key issues and implications that emerge. It also includes an evaluation of the research design, the study limitations, areas for further research and a reflection upon carrying out this research.
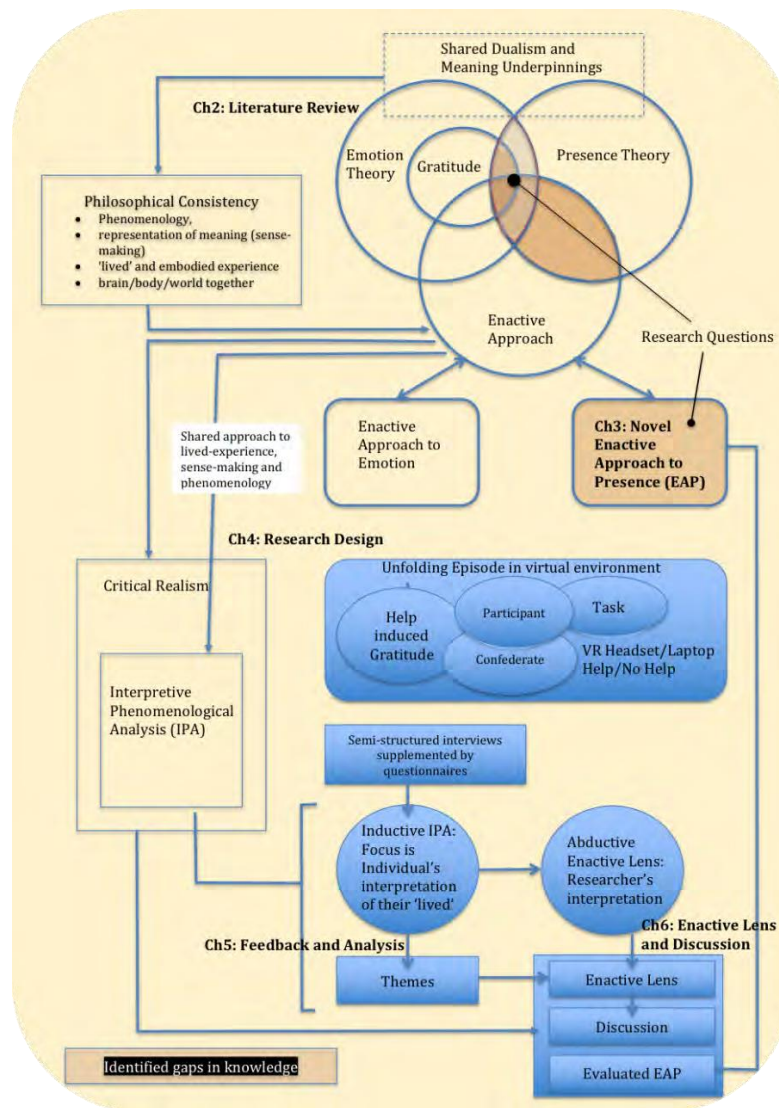
Figure 1-1: Thesis Structure

1.9 Summary

This chapter has explored the context for and significance of this study. It has given details of the research and its scope and limitations. It has set out the primary research question, two secondary research questions and outlined the theoretical underpinning of this study and the methodology and methods. It has given an overview of each chapter of the thesis. Chapter two identifies and reviews the principal underlying theoretical basis for this thesis.

Chapter 2 Literature Review

This Chapter provides a review of literature focused upon emotion theory, later scoped to focus on gratitude, presence, and prior studies into the relationship between emotion and presence. The chapter clarifies and justifies why this doctoral research developed an enactive approach to presence (EAP) (see Chapter 3).

The motivation is driven by identifying that a key assumption in emotion and presence theories is dualism. An overview of key emotion theories identifies concerns over dualism and how non-dualist approaches provides the motivation for adopting an enactive approach to emotion. A similar overview of presence theory identified that the same debate exists for presence theory, yet there is no enactive approach to presence.

The literature review considers prior research of the relationship between emotion and presence also adopted dualist assumptions. This meant prior research into the relationship between emotion and presence adopted a dualist stance. In order to understand the experience of emotion and presence from a non-dualist approach, using the enactive approach, required the development of a novel enactive approach to presence so ensuring an alignment of emotion and presence theories from an enactive perspective. The enactive approach is a non-dualist approach, where humans dwell in a world of meaning formed by their purposeful bodily actions dynamically interacting with the environment. This brings together the mind-brain-body-world, emotion and cognition so addressing dualism concerns.

Understanding, the debate over dualism (examples include the divide between biology and society, cognition and emotion, mind and brain, and the body and the environment) has important implications for how we understand the world around us affecting the theories explaining the psychology of emotion and presence. Dualism concerns are classically associated with views such as those of Descartes (1649/1911), who considered the body and mind associated with emotion and cognition as distinct, with a separation between object and subject such as the external world and internal mind. Problems with dualism have been argued by philosophers critical of dualism, based upon phenomenological tradition. Merleau-Ponty (1945/1962; 1967) is explicitly included in the writings of Varela et al. (1991/1993) whilst non-dualist interpretations of Husserl (Husserl, 1931/1964; 1936/1970; 1900/2001; 1901/2001) are utilised by Thompson (2007) in the enactive approach. The implications of dualism are recognised by many emotion theorists with most current emotion theories are becoming more integrationist (Barrett, 2012; Damasio, 1994/2006; Prinz, 2004a; White, 2000) and are addressing dualism issues, but these are only partially addressed other than in the enactive approach to emotion (EAE) (Colombetti, 2014a; Colombetti & Thompson, 2008; Hutto, 2017). Dualism remains an active area of debate to which this thesis can contribute.
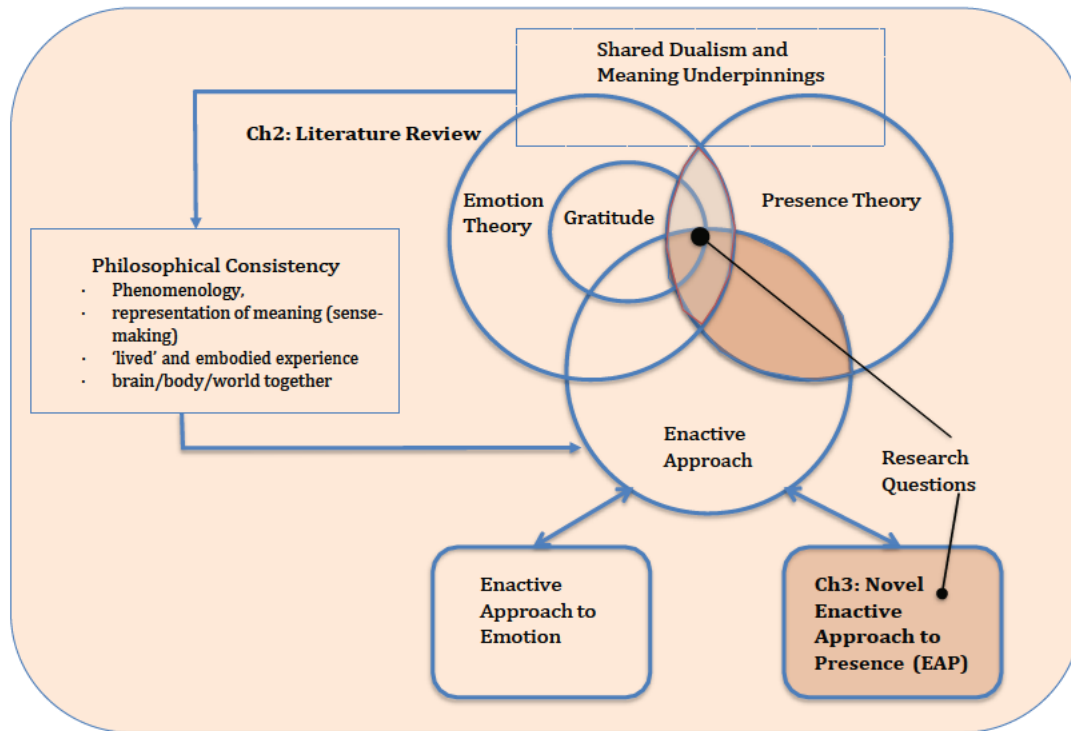
Figure 2-1: Areas of theory and gaps in current literature

This review examines literature and prior studies regarding the relationship between emotion, including social emotions, and presence which is an under researched area; no studies into the relationship between gratitude and presence were identified. Empirical studies into virtual or synthetic environments have investigated presence (the feeling of being there), social presence (the feeling of being with others) and emotion and suggest that there is a statistical correlation between spatial presence and emotion, especially anxiety or fear (Baños et al., 2008; Bouchard, St-Jacques, Robillard, & Renaud, 2008; Meehan, Insko, Whitton, & Brooks, 2002; Riva et al., 2007a). Bouchard et al. (2011) found that stronger emotions in emotionally charged discussions contribute to a stronger feeling of self-reported presence. Whilst, in a two dimensional, as opposed to three-dimensional environment, this suggests that social exchanges may increase the sense of presence too. This social exchange is of particular interest to this thesis' focus upon the social emotion gratitude. It also became apparent that there is difficulty in identifying the causation of any relationship between emotion and presence.

This chapter discusses and evaluates the literature upon emotion in Section 2.1, the enactive approach to emotion in Section 2.2, and gratitude in Section 2.3. The approaches to presence, both spatial and social, are presented in Section 2.4 and prior studies into emotion and presence in section 2.5. The areas covered and gaps identified in the literature, are illustrated in Figure 2.1.

2.1 What is emotion?

In seeking to understand the relationship between emotion and presence it was considered important to understand what emotion is. This section presents and examines emotion theory and the principal critiques of it, especially the criticisms relating to dualism, formation of meaning and embodiment. Dualism, formation of meaning and embodiment are identified in this thesis as key commonalities linking approaches to presence and emotion theory.

The examination of emotion is dealt with broadly in chronological order of the key theoretical approaches and has therefore been split into two sub-sections as follows: From Dualist Embodiment to Disembodiment (Section 2.1.1) and Narrowing Down Dualism: Embodied Internal Representation (Section 2.1.2). Emotion theories were mainly split between those which are biologically based theories of emotion and those which are socially constructed theories of emotion (Ratner, 2000; Parkinson, Fischer, & Manstead, 2005). Such approaches fail to appreciate the roles of the social, as well as the biological, aspects of emotion. This is analogous to nature (biologically) versus nurture (social) debates in psychology. Most current emotion theories try to integrate these aspects now, to varying degrees.

There are some hybrid theories that have tried to connect these two aspects by using approaches such as splitting emotions into two kinds: 'basic emotions' (originally happiness, sadness, fear, surprise, anger and disgust) and higher emotions. The latter are considered to be more socially influenced, in order to account for the great range of human emotions. This thesis agrees with White's (2000, p. 31) view that there is an "overly dichotomous separation of emotion and culture, as well as a more fundamental opposition of nature and culture". The form of dualism between mind and body is heavily critiqued in current approaches to emotion (Barrett, Mesquita, Ochsner, & Gross, 2007; Damasio, 1994; Prinz, 2004b) but a dualism between cognition internal to the body (including the brain) and the external world, is maintained. Amongst the most critical of such divides, regarded as unwarranted, are proponents of the enactive approach to emotion (Colombetti & Thompson, 2008; Hutto, 2012a; Slaby, 2013). Enactive theorists of emotion emphasise the importance of mind, brain, body and world (including social aspects) taken together on emotion theory, which has been extended to presence theory in this thesis.

This thesis supports and adopts the enactive approach, which overcomes the dualist divides of other theories of emotion, including the divide between internal cognition and the external environment. The following section presents emotion theory and the critique. Common themes identified were criticisms relating to dualism, formation of meaning and embodiment.

2.1.1 Dualist Embodiment to Disembodiment

This section considers the dualist underpinnings (the divide between two fundamental aspects such as mind from the brain, brain from the body, body from the world external environment) and establishment of the role of body (embodiment) in emotion theory. It focuses upon theories of emotion from the time of Descartes (1649/1911) (who epitomises 'Cartesian' dualism and embodied approaches to emotion) to cognitive appraisal approaches, where emotions are regarded as disembodied cognitive thought.

DESCARTES

Descartes (1649/1911) called emotion 'the passions' and his approach epitomises 'Cartesian' dualism, with its separation of cognitive thought from emotion, the mind from the body and the mind from the external environment. For Descartes, the passions are considered to be only related to external situations and:

> *have a cognitive content, in virtue of which it motivates the will to fix attention*
> *on an object or to approach and avoid or to maintain or the abandon an object*
> *(as wonder does), or to approach or avoid or to maintain or abandon the object*
> *(as do desire, love and joy, and hatred and sadness)* (Hatfield, 2007, p. 426).

Descartes (cited in Zipoli Caiani, 2011, p. 167) in clarifying the concept of the disembodied mind, did however emphasize that "one is not merely present in my body as a sailor in a ship" but as "very closely joined and, as it were, intermingled with it, so that I and the body form a unity." This emphasizes two aspects: the separation of the 'I', or mind, from the body (dualism) and an essential interdependence between body and mind. This dualism in criticised by philosophers such as Heidegger (1927/1962) who located 'being' as intrinsically within culture, and therefore not separate from the wider world. Criticism of Descartes is later reflected in a number of approaches to emotion, such as those of Damasio (1994), Griffiths and Scarantino (2005) and the enactive approach to presence (EAP) (Colombetti & Thompson, 2008) and presence theory (Zahorik & Jenison, 1998; Riva, 2006) discussed in Section 2.4.

EVOLUTIONARY AND BIOLOGICAL APPROACH OF JAMES AND LANGE

Variations upon the James-Lange (James, 1884; Lange, 1885/1922), approach are important to many current emotion theories such as psychologically constructed approaches or the approaches of Prinz (2004a) and Damasio (1994) (discussed in Section 2.1.2 the latter whose theory is utilised in the presence theory of Riva et al. (2004)) . In contrast to Descartes, James and Lange (James, 1884; Lange, 1885/1922), asserted that overt responses and bodily changes associated with an emotion precede the conscious feelings accompanying them. James (1884) argued that we are "afraid because we tremble" (James, 1884, p. 190), "the bodily changes follow directly the PERCEPTION of the exciting fact", and that "our feeling of the same changes as they

occur IS the emotion (sic)" (James, 1884, p. 190). James (1884) suggested that, when emotion is removed, a "cold and neutral state of intellectual perception is all that remains" (p. 193). To this extent, James has still separated cognition from emotion, the objective from the subjective. This separation is at odds with the EAE where cognition and emotion are both seen as forms of meaning.

Descartes (1649/1911) regarded emotions as embodied. James (1884) distinguishes between, innate, evolutionarily 'original' emotions and developed emotions. Original emotions are based upon instinctive responses. Developed emotions involve cognition in triggering and modulating; developed emotions having consciously learnt from the original emotions. Feeling is seen as a sensory perception, or the imagining of a sensory object (including environmental circumstances). Hatfield (2007, p. 20) considers that "James excludes cognitive and motivational content from the emotions." This builds upon a Darwinian view of adaptive of instinctive behaviour (as having evolved over time) and fits into the themes of both biologically and evolutionary based theories of emotion. Hatfield (2007, p. 22) considered this approach to be Cartesian in its invocation of bodily mechanisms, but to be anti-Cartesian in its rejection of cognitive or motivational aspects. The view of two categories of emotion, original and developed, has similarities with the views of basic emotions or evolutionary older emotions, although the basic emotion approach discards learned, developed emotions as emotions.

BASIC EMOTION THEORY (BET)

Basic Emotion Theory (BET) focuses upon biologically innate basic emotions (originally identified six discrete basic emotions, namely happiness, sadness, fear, surprise, anger and disgust) (Ekman, Sorenson, & Friesen, 1969). BET is one of the most widely used approaches to emotion especially within computer science (Scherer, 2009a). In contrast to the enactive approach adopted in this thesis, BET is highly dualist, arguably placing undue emphasis upon the biological aspects and neglecting the social or wider world aspects. BET, which rejects the concept of gratitude as an emotion, viewed in this thesis as an emotion, and classes it as an 'other affective phenomenon'.

Basic emotions are driven by 'affect programs', a metaphor for biologically innate schemas that trigger the basic emotions. These affect programs may trigger and cause emotion. They rely upon 'circuits' in the brain and involve 'automatic appraising', hence may involve either a very fast sequence of emotions or a blend of emotions. The learnt element opens up the possible application of causal appraisals theories, with which BET is compatible (Moors, 2014), which involve a potential separation of cognitive thought, mind and brain. This is a dualist divide between brain and the external environment, with meaning being generated within the brain in a similar way to that involved in appraisal theory.

The basic emotions of BET are frequently associated with images of facial expressions based upon Eckman's original studies that were used to identify all the basic emotions (P. Ekman, 1993; Gutiérrez-Maldonado, Rus-Calafell, & González-Conde, 2014; Nasoz & Lisetti, 2006; Zhang, Wu, Meng, & Cai, 2007). Ekman and Cordaro (2011) have since greatly expanded the original list of Eckman's (Ekman et al., 1969) six basic emotions (happiness, sadness, fear, surprise, anger and disgust) to seventeen basic emotions, by creating two families of themes: seven basic emotions associated with contempt and ten basic emotions associated with enjoyment : sensory pleasures, Amusement, Relief, Excitement, Wonder, Ecstasy, Naches, Fiero (Naches and Fiero can be considered the single emotion pride), Schadenfreude (pleasure at an enemy's suffering) and rejoicing are expected by Ekman and Cordaro (2011) to follow. Gratitude, examined in this thesis, is considered a social emotion (Bartlett & DeSteno, 2006; Fredrickson, 2004; M. E. McCullough, Kilpatrick, Emmons, & Larson, 2001), yet the inclusion of the social emotion, Schadenfreude, suggests that social emotions can be included in BET.

This thesis argues that BET assumes that all emotions must be universal to qualify as an emotion, which excludes non-universal emotions by definition, despite the fact that these engender feelings that are experienced by individuals. This thesis argues that a lack of universal expressions is an arbitrary exclusion criterion within BET which is based upon the false premise that true emotions should be universal; hence, it wrongly rejects other conceptualisations of emotion, by definition. Nevertheless, this thesis also supports Colombetti's (2014a) assertion that there is some evidence for being able to identify emotions based upon bodily autonomic activity, as argued for by BET theorists.

SOCIALLY CONSTRUCTED APPRAISALS

Socially constructed theories of emotion argue that biology has little role in emotion. Ratner (2000) emphasises that it is cultural-psychology that determines emotion and that "biology contributes little if anything", to the specifics of emotion (p. 25). He points to the role of culture with western feelings of guilt associated with the introduction of Christianity to Africa. He does recognise a role for the cortex but only to the extent that the cortex and mind produce emotions though representations of social concepts. Similarly, Averill (1980) emphasises that an emotion is a social role involving causal appraisals, examined next. These highlights two dualisms, a separation of the social and embodied and emphasising brain-bound cognition of social constructs separate from the physical world. The social and embodied aspects of dualism are addressed by the Embodied, Damasios and especially Psychological Constructionist approaches (see Section 2.1.2).

Further social emotional frameworks are incorporated into enactive approaches (see Section 2.2.2) that avoid dualism concerns.

Meaning and the associated mind/brain/body/world divide remain problematic within appraisal theory. All appraisal theories emphasise the importance of the situation where emotion develops. Moors (2014) discusses appraisal theories as falling into two approaches: causal appraisal and constitutive appraisal approaches. Causal appraisal models focus on perceiving a situation, evaluating it, which then causes emotional feelings, associated physiological changes and actions. (Moors, 2014) suggests that most of the appraisal theories evaluate stimuli for goal relevance (relevance of a person's goals), goal congruence (congruence with a person's goals), and expectation, whether the person caused the stimulus (agency) and is able to control the stimulus (control). Constitutive approaches focus more upon the components and situations associated with emotions, rather than with a trigger mechanism of emotion. This thesis is critical of both in that they maintain a problematic dualist divide. Many constitutive approaches include emotion emerging from its components and some (e.g. Sherer (2009b)) include the role of dynamical system theory (Section 2.1.2). The emergent nature of meaning and dynamical system theory are important aspects of the enactive approach to emotion (Section 2.2) and presence developed in this thesis (Chapter 3).

In causal appraisal theory, Arnold (1960) proposed that emotions are determined by an internal, disembodied, cognitive, appraisal and evaluation of an event from which the relevant emotion is triggered. Lazarus (1984) focused upon disembodied cognitive appraisal as a judgment of what were perceived as 'core themes' to provide the meaning or gist of the emotion. These can be mediated by the 'affect programs' of BET discussed above (Moors, 2014). In rejecting external behaviour, this approach returned to the concept of the 'internal mind' like Descartes (1649/1911), but unlike Descartes rejected an embodied aspect to emotion. Thus, it is even more dualist than Descartes. One significant aspect of cognitive appraisal theory is the idea of emotions as coping potential, and the link with actions or action-potential (action readiness) as proposed by (Frijda, 1986).

Constitutive approaches to emotion include those of researchers such as Clore and Ortney (1987; 2013) and Scherer (2009b)). Clore and Ortney (2013) focus upon the situation and argue that emotions can be more readily distinguishable by the situations. They emphasise that emotions emerge from psychologically significant situations represented in multiple modes more or less at the same time. Clore and Ortney (2013) argue that it is not that emotions are situated, but that "emotions are embodied, enacted experienced representations of situations". It is from the structure that comprises emotions that emotion emerges. Hence, they focus more upon the structure and the components of emotion, rather than on linear causation. This view of emergence from structure as opposed to linear causal paths is similar to the emergent nature of emotion and meaning from the enactive approach endorsed by this thesis. However, unlike the enactive approach, they are partly in our minds where there are 'as-if-world'" (a simulated world

as-if real). This emphasises a dualism between mind and world. This role of 'as-if' mental worlds is one of the prime areas of disagreement between appraisal theory and the enactive approach.

Appraisal theories have developed since their emergence in the 1960's and are considered in both section 2.1.1 and Section 2.1.2. As the early causal appraisal approaches are disembodied and cognitive, constitutive emotions can be highly embodied and may include the component dynamical model of Scherer (2009b), discussed at the end of Section 2.1.2. Scherer's (2009b) approach shares much with the Dynamical Systems Theory. This is an underpinning theory of Colombetti's (2014a) enactive approach to emotion and the enactive approach to presence which are developed and explored in more depth, in terms of their application for the research in this thesis, in Chapter 3.

2.1.2 Narrowing Down Dualism: Embodied Internal Representation

Following the extreme dualism of cognitive appraisal and the objective/subjective divide of behaviourism, views intending to reduce these were adopted within emotion research. Theories were adopted that regarded emotion and cognition as working together. Theories that aimed to bring together the mind and body were developed, including those of the 'neo-Jamsian' proponent, Damasio (1994). Damasio defines emotions as "a collection of changes in body and brain states triggered by a dedicated brain system that responds to specific contents of one's perceptions, actual or recalled, relative to a particular object or event" (Bechara & Damasio, 2005, p. 339) and distinguishes these from felt feelings which are the conscious experience of the emotions. Prinz (2004a, 2004b), like Damasio (1994), also focused upon closing the gap between mind and embodiment, and bridged the gap between biologically determined basic emotions proposed by Eckman et al.(1969); theories of BET and cultural approaches to emotion that tend to eschew the role of embodiment and biology. Despite this rejection of a divide between nature and nurture, mind and brain or even brain and body, and acknowledging the importance of the external situation, there remains the dualist concept of internal evaluation and an embodied internal representation of meaning rejected by enactive approaches.

EMBODIED APPRAISAL THEORY

Embodied appraisal theory (EAT), as proposed by Prinz (2004a), is a neo-Jamsian theory (that argues emotions derive from bodily behaviour: 'I tremble; therefore I fear', and links both high level 'cognitive' emotion and low level basic emotions (e.g. guilt and fear respectively) into one general model of emotion. It aims to overcome the dualism between mind and body and biological and socially constructed approaches. Prinz (2004a) argues that emotion involves the perception of bodily effects. This perception represents core relational themes (the general gist

of an emotion such as guilt or fear) as suggested by Lazarus (R. S Lazarus, 1984; 1991). Prinz's model distinguishes the emotion from the elicitors of emotion e.g. judgments (conscious or unconscious), other perceptions and ultimately the external environment. In this theory, basic emotions are calibrated by judgments to provide high-level emotion based upon representations that can trigger the same or similar patterns of bodily response to a basic emotion e.g. a calibration 'file' for jealousy contains representations to track infidelity. This could calibrate an emotion such as anger. These judgements can be criticised, however, as still, in effect, being mental appraisals by enactive proponents (Colombetti, 2014a; Hutto, 2012b) and Willans (2012) (Paper in Appendix B).

Figure 2-2: Simplified Overview of Embodied Appraisal Model based upon figure 4.3
(Prinz, 2004a, p. 99)

DAMASIO (SOMATIC MARKER THEORY)

Damasio's (1999) self-presence framework used in this thesis builds upon his theory of emotions. "An *emotion* is defined as a collection of changes in body and brain states triggered by a dedicated brain system that responds to specific contents of one's perceptions, actual or recalled, relative to a particular object or event" (Bechara & Damasio, 2005, p. 339). However, Damasio (1996) divides emotion into background, primary, and secondary emotions.

Background emotions are the oldest low-level unconscious emotions guiding movements to an area that controls its internal environment e.g. temperature control. Primary emotions are the kind of 'innate' emotions, such as fear, that require no conscious thought. Secondary emotions include social emotions such as guilt. These are based upon somatic markers (mental representations in the somatosensory system including representation of the external world 'as-if' real) with experiments showing damage to the autonomic nervous system inhibiting the

response to emotional stimuli (Damasio, Everitt, & Bishop, 1996). This use of 'as-if' mental representations of the world is still a dualist division between the (mind-brain) and the external world. For secondary emotions Damasio (1999) requires complex cognition, with top-down adjustment cognitive thought from more recently evolved, higher areas in the cortex. This has revived the dualist divide between cognition and emotion. So, whilst emphasizing the essential need of emotion for reason, he has retained the view of Descartes (1649/1911), that bodily-based emotion and cognition are intermingled to form a unity. This contrasts with the non-dualist enactive approach where emotion and cognition are both regarded as forms of sense-making or meaning.

He relates this division to the proto-self, core-self and autobiographical self-associated (requiring top-down cognitive thought and high level understanding of their past history) with the oldest, in evolutionary terms, to the newest parts of the brain; a relationship that aligns with the approach to presence, taken by Riva et al. (2004) (see Section 2.4.3).

Critics such as Colombetti (2014a) argue that this approach is flawed in five ways:

1. Emotion and Cognition between older and newer parts of the brain, in evolutionary terms, are not as separate as Damasio suggests
2. Internal representations of emotions as 'somatic markers' and 'as if body loops' maintains a dualist stance, which approach is felt to be inappropriate
3. There is little evidence for 'as if body loops' and 'somatic markers'
4. Damasio's approach does not reflect the fact that there is a split between top-level (requiring cognitive thought) and low-level (innate unconscious emotions)

PSYCHOLOGICAL CONSTRUCTIVISM & CORE AFFECT

Barrett (2012)and Russell (2003) narrowed down dualist approaches and emphasised the need to avoid biology-social dualism so incorporating the embodied aspects. They emphasise that emotion (as feeling) emerges from conceptual acts of categorising a core affect (feeling of pleasure and how active the response is). Russell (2003) proposes that, at the centre of all emotions, moods and other affective states, lies a core affect embracing intensity of activity and levels pleasure (negative to positive). Unlike emotion, this is not directed at an object but may become so, through attribution. The role of core affect has been utilised primarily in affective science, but also in presence theory (Riva et al., 2004).

Barrett's (2012) approach to psychological constructivism is expressed in her Conceptual Act Theory (CAT). In this she states that:

> *an emotion is an intention that is enacted when embodied conceptual knowledge is brought on line to shape the perception of a physical state, binding that physical state to an event in the world (so that it becomes something more than a mere physical sensation) (Barrett, 2012, p. 419).*

Barrett (2014) argues that emotions are "acts of meaning making" and an intention. This has similarities and a focus upon purposeful sense-making from the enactive approach and similarities with Riva and Mantovani's (2014) definition of spatial presence as the "successful enaction of an intentional act" discussed in Section 2.4. The emotion emerges when we "conceptualise an instance of affective feeling" in a manner similar to humans conceptualising a distinction between a weed and a flower (an example of categorical knowledge) which is objectively a plant. It is the affective feeling as 'core affect' that she sees as innate yet distinct from emotions. Like Damasio (1994; 2005) she does not, in principle, distinguish between the mind-brain or brain-body dualism. This knowledge, she argues, is gained from prior experience via sensory and motor neurones but goes beyond the brain, as the motor and sensory signals influence bodily activations. The representation is that this knowledge involves the whole body (detected and monitored by the interoceptive system) and is embodied within the body. This creation of knowledge 'reaches forward' (known as intentionality) in that it shapes future actions and experiences.

Barrett (2014) argues that the act of seeing, or feeling, or thinking is at once a perception, an emotion, and a cognition as for the enactive approach. This approach to intentionality and the role of the interoceptive system shares much with Riva's (2011) approach to presence, discussed in Section 2.4.3. Barrett (2015) takes this further and provides neurological evidence (Barrett & Simmons, 2015), suggested as analogous to Bayesian theory, where new information from bottom up sensory or bodily theory is compared with top-down prior predictions (or beliefs) about the world based utilising embodied prior knowledge to update an inference from the senses and actions about the world. This knowledge and prediction are updated as new experiences are gained. Thus, the evaluation is within the brain-body separate from the environment. The main criticism of this from the enactive approach is that this appraisal is still an internal – external divide even if the linkage with the external world and the act of perceiving are now closely linked. The key here is where the meaning derives from and is represented, as the internal Bayesian appraisal or, as for the enactive approach, the purposeful enaction between the brain, body and environment.

The emergent nature and component is highlighted by Scherer's (2009a) Component Process Model (CPM) of emotion. Scherer (2009a) draws upon Dynamic Systems Theory (DST) (see Section 2.2) a significant component of the enactive approach. Dynamic Systems Theory is a key part of enactive approach to emotion and the enactive approach to presence, developed within this thesis, drawing upon the enactive approach of Varella et al. (1991).

An important difference between the James-Lange (Lange & James, 1922) and the constructivist approach is that the feeling aspect of emotion is considered to be a component of emotion along with the appraisal results, tendency to particular actions, physiological changes and bodily motor expressions. Appraisal involves the organism carrying out checks of the stimulus, as stimulus evaluation checks (SECS) focusing on four aspects: relevance (does this affect me or my social group), implications (to wellbeing and goals), ability to cope and normative significance (effect upon self, social norms and values). These checks are carried out sequentially. Together these appraisal evaluations form a pattern of synchronisation of the results that determine the nature of the emotion episode. As an organism, we are predisposed to be biased towards some appraisal evaluations. These predominant appraisal evaluations form more typical emotions (as emotion episodes), which Scherer (1987) terms modal emotions. The affective feeling of emotion is considered a consciously felt component that feeds into processes controlling the regulation of emotions not the emotion itself.

The dynamical approach draws upon work by Tschacher and Haken (2007) and Lewis (2005) and their views of self-causation to self-organising systems. This entrainment of different subsystems, coupled with various physiological conditions, leads to a pattern of synchronisation, in the same way that two clock pendulums on the same wall tend to synchronise with one another. Attractors act to make some synchronised modes more stable than others. These stable 'attractor basins' form states of the emotions. When the appraisal results drive the attractor, states lead to these attractors diminishing in force; therefore the emotional episode concludes. Notably, Scherer (2009a) does not regard the categorisation and labelling of emotions as developing in this way. This dynamical approach is consistent with the enactive approach to emotion and presence. However, as Colombetti (2014a) states, "It appears more natural, that is, more in line with principles of biological organisation, to allow the organism to generate emotional episodes without the pervasive guidance and control of an army of appraisal checks" (p. 270). In this thesis, the enactive approach to presence derives from the self-organising biological structure that self-creates and self-sustains (F. J. Varela, Maturana, & Uribe, 1974; Maturana, 1980) (see Chapter 3).

Section 2.1 has highlighted the varying dualist approaches to emotion and the extent to which the dualist issues have been addressed. It examined the limits and degree to which these approaches address dualism concerns and identifies where this has not been done. Section 2.2 introduces the

enactive approach to emotion to address dualism. Whilst many approaches do reduce dualist divides between mind and brain, brain and body, and body and world, all maintain an element of dualism, especially that aspect which regards an internal cognitive mental process. Dynamical approach's (see Section 2.1.2) have introduced concepts of emergent emotion from structure and the use of Dynamical Systems Theory (DST), including the importance of the situation and non-linear causal mechanisms. There is disagreement with the enactive approach over the role and representation of meaning within the brain and body. From the enactive perspective, arguments for non-brain-bound representationalism are proposed. The inability to address dualist concerns motivates the adoption of the enactive approach to emotion, examined in more detail in the next section.

2.2 Enactive Approach to Emotion

This section introduces the Enactive Approach to Emotion (EAE) in line with the views of Colombetti and Thompson (2008) and Varella et al. (1991/1993). This follows the criticism of emotion theories that view cognition as being within the mind, separate from the environment, which disregard emotion as a form of cognition (Colombetti & Thompson, 2008; F. J. Varela et al., 1991/1993) examined in Section 2.1 above. An outline of this enactive approach (Section 2.2.1), its applicability to emotional episodes (Section 2.2.2) and how these emotional episodes are scaffolded (Section 2.2.2) are presented. This section uses as its basis the published worked by Willans et al. (2015) drawn from this thesis in Appendix B.

The enactive approach described is linked to phenomenological philosophy following the views of Husserl, Merleau-Ponty and Heidegger (Heidegger, 1926/1962; Husserl, 1936/1970; Merleau-Ponty, 1945/1962) especially when focused upon humans. Husserl (1936/1970) and Merleau-Ponty (1945/1962) are explicitly included in the writings of Varela et al. (1991/1993). As human beings, we experience life as meaningful in relation to our surroundings. Merleau-Ponty (1945/1962) emphasized that we, as embodied beings, experience the world though our motor-sensory interactions, and that the locus of this meaningful experience is the embodied self. Husserl (1936/1970) was critical of the classic 'postpositivist' scientific approaches where objective cognition was divided from the world and subjective experience, and placed cognition as the human experience in a lived body, relative to the surrounding world. In synthetic environments, this begs the question of where the locus and body are, as our natural body cannot enter a synthetic environment, yet we experience the world as living humans.

The enactive approach, adopted in this thesis, involves, in part, autonomous embodied organisms whose dynamic interactions with their environment forms meaning. A key facet of this approach is that meaning, including emotions, is understood as inherently meaningful, brought forth through the interaction between people and their environment (including other people).

Colombetti and Thompson(2008) in discussing the EAE summarise the enactive approach thus:

> according to the enactive approach, the human mind is embodied in our
> entire organism and embedded in the world, and not reducible to structures
> inside the head. Meaning and experience is created by, or enacted though, the
> conscious reciprocal interaction of the brain, the body and the world. *(p. 56)*

The EAE regards emotion as experience and meaning emerging in a dynamic interaction between peoples' brains, bodies, and surrounding world though enaction. Hutto (2012b), from a radical enactive perspective, rejects all "talk of contents and meanings at the level of basic responding" and suggests an alternative, "Truly" EAE, by modifying Prinz's (2004a) embodied appraisal theory (see Section 2.1.3) so that, rather than the emotions representing the situations, he argues that "we are set up to set off by core relational themes by responding to these in ways that implicate experiences of bodily feeling" (p179). Colombetti's (2014a) EAE is adopted in this thesis because it extends from explaining purpose, meaning and self-causation from the biological origin to complex social interactions, that other approaches do not. It is, arguably, consistent with empirical research such as dynamical systems theory, emergence (Thelen, 1996; Tschacher & Haken, 2007) and current studies in brain dynamics (Freeman, 2013) whilst addressing the dualist concerns of emotion. It is considered "an extension of general systems theory" (Torrance & Froese, 2011, p. 14) and hence it is applicable across differing domains e.g. emotion and presence theory, focused upon in this thesis.

2.2.1 Enactive Approach

This section describes the general enactive approach in order to understand the EAE, and the enactive approach to presence (EAP), developed in this thesis. The enactive approach adopted in this thesis draws upon that proposed by Varela et al. (1991/1993) as opposed to enactive models of perception theory, which are focused upon perception as a way of action (Noë, 2004), or more radical enactive approaches focused more upon the rejection of cognitive representation (Hutto, 2005).

Self-Constituting Autonomous Organisms: Enactment and Bringing Forth Meaning

In the enactive approach, embodied living organisms create and maintain their own existence as stable autonomous units and adapt to their external environment. They do this by taking the necessary actions acted out (enacted) needed to sustain this existence; for example, getting dressed in order to prevent freezing to death or turning up the heating (Di Paolo, 2005; Di Paolo, Rohde, & De Jaegher, 2010). These actions enable such systems to maintain their internal normal state such as the normal range of body temperature they need. This enaction is therefore inherently purposeful and, hence, meaning or sense-making emerges from these actions within

their own domains of meaning (cognitive domain). The range of meaningful acts for adult humans are vastly more sophisticated than that for single cell organisms.

Figure 2-3: The autonomous system self-constitutes and identity, which is conserved during dynamic, structural coupling with its environments (full arrows); adaption of the coupling are dotted arrows. (Copyright 2010 Di Paolo. Licensed under Creative Commons Attribution 3.0 Unported [http://creativecommons.org/licences/by/3.0]

The organism's actions are relative between the organism itself and its environment; this is not a simple response to a static environment but a dynamic reciprocal interaction between the actions and the environment, causing changes to each. This link is so integral as to be structurally as well as dynamically coupled; change either one and the relationship between organism and environment is altered (see Figure 2-3), remove one and the relationship does not exist. However, the existence of the relationship is continuously enacted by the organism itself. Taking an action is embodied, thus cognition, as sense-making and meaning, is integral with embodiment. Thus, the world is meaningful for the organism through its experience. Emotion is as much sense-making as classic cognition and is thus part of the enactive view of cognition. This brings together cognition, embodiment and its external environment, involved with the organism's inherent experience as a living being.

COMPLEX SELF CONSTITUTING AUTONOMOUS ORGANISMS

Ongoing self-constitution of autonomous organisms that self-organize can form a stable single such organism, consisting of other autonomous systems that together self-sustain as a single, collective unit. A visual example is that of the development of humans after conception. The individual cells are autonomous systems within the domain of a cell, purposely enacting in order to sustain and constitute themselves. They are dynamically coupled to the surrounding environment within the womb and fallopian tube and interact together though the environment. (see Figure 2-4).

Figure 2-4: The relationship between two adaptive autonomous organisms sharing the same environment: the manner in which one agent's movements affect the environment can result in changes to sensory stimulation for the other agent, and vice versa, creating the basis for a multiagent recursive interaction (Copyright 2010 E. Di Paolo. Licensed under Creative Commons Attribution 3.0 Unported [http://creativecommons.org/licences/by/3.0])

There comes a point where the integration between cells, and later groups of cells, is not just via the environment, but they become dynamically coupled to each other (see Figure 2-5). They are still interacting purposefully with one another and, from their actions, emerges meaning, as for the simpler organisms, but the cognitive domain is relevant to this stage of development. The now organizationally closed system is itself an autonomous organism interacting with the external environment.

*Figure 2-5: Schematic of a multi-agent system. **It is possible that when two adaptive agents who share an environment begin to engage in mutual sensorimotor coupling, their activities become entwined in such a manner that their mutual interaction results in an interaction process; characterized by an autonomous organization, i.e. an emergent structure in its own right. (Copyright 2010 E. Di Paolo. Licensed under Creative Commons Attribution 3.0 Unported [http://creativecommons.org/licences/by/3.0]).***

As this happens, the formation of the organs and systems of the mature human body come together over time to form an increasingly stable human organism (see Figure 2-6). From the enactive perspective, this coming together is an emergent aspect of self-organizing autonomous systems that constitute, and later maintain, themselves.

Figure 2-6: Based upon C.H. Waddington's classic epigenetic landscape as illustrated in Pujadas and Feinberg (2012, fig. 2). Stability of the developing tissue types increases with time illustrated by the path of a ball. (Copyright Elsevier 2012, Reprinted under http://www.elsevier.com/open-access/userlicense/1.0/.)

SOCIALLY INTERACTING SELF CONSTITUTING AUTONOMOUS ORGANISMS

This approach to self-organizing systems can be extended to social interactions involving several people (Di Paolo et al., 2010; Froese, Paolo, & Ezequiel, 2011). This is relevant to this thesis as social presence (see Section 2.4) and social emotions, such as benefit-induced gratitude (see Section 2.3) involve social interactions. The social aspect extends meaning as sense-making by an individual, to sense-making between interacting agents, participatory sense-making, (as illustrated in Figure 2-4). Even closer coupling (as in Figure 2-5) leads to the emergence of a multi-agent system as an autonomous structure itself (Di Paolo et al., 2010).

Barandiarian and Moreno (2006, 2008) argue that the ability to adapt and regulate coupling provides a flexibility that breaks away from dependency upon monitoring the internal aspects of the body, but that flexibility is needed to enable the type of interactions within neurological networks that permit abstract thought. Just as the structural coupling is adapted and regulated in the example of the individual cell (see Figure 2-3), so the social coupling is regulated by the individuals involved. A distinction, however, is that both individuals are able to exist as autonomous individuals (unlike organs of the body), hence the existence of the social relationship is, in itself, continuously enacted by both organisms and ultimately broken by either, at the end of the relationship.

This section has highlighted the emergent nature of self-constituting autonomous systems from the single cell; interacting cells to clusters of cells forming stable organs to produce a complex organism such as a human being with a nervous system. It highlighted how this can be extended to introduce participatory sense-making when individuals couple, and hence tend to synchronise e.g. walking in step. The enactive approach to social interactions is relevant to understanding the relationships between individuals interacting with virtual worlds, and social presence, the study of which is presented in this thesis.

2.2.2 Emotional Episodes

This section discusses the place and approach to emotion episodes adopted in this thesis. The next section builds upon the general approach to emotion and focuses upon gratitude, in particular.

In the EAE, emotion arises out of the intimate dynamic interaction between an autonomous living system acting out (enacting) its actions, in order to adapt and sustain itself, and its environment. The EAE considers emotions as emerging within emotional episodes where these interactions occur.

SCAFFOLDING THE ENVIRONMENT

Griffiths and Scarantino (2005) developed a situated framework for emotion which includes 'cultural scaffolding' by the environment. This scaffolding covered diachronic aspects such as biological development, developing social skills and those synchronous aspects used within specific episodes involving the unfolding of an emotional performance, known as an emotional episode. This framework focused upon the social aspect of emotion, regarding emotions as 'largely social' (Griffiths & Scarantino, 2005, p. 446). This approach draws upon transactional models of emotion, where emotion is generated though transactions between people (Parkinson, 1995; Parkinson et al., 2005). It builds upon the framework for emotion devised by Markus and Kitayama (1994) and refined by Parkinson et al. (2005), following ethnographic research into emotion. Griffiths and Scarantino (2005) regard emotion as "a form of skilful engagement with the social environment" (Griffiths & Scarantino, 2005, p. 437) that can be interpreted as purposeful enaction with the social environment. This thesis endorses the opinion of Jan Slaby (2013), that the enactive perspective highlights the view that emotion is situated in the social context and embraces the Griffiths and Scarantino (2005) framework. Colombetti and Krueger (2015), from an enactive perspective, adopt a similar approach to scaffolding, arguing that Sterelny (2010) can expand upon the situated approach of Griffiths and Scarantino (2005). The scaffolding involves reciprocal coupling and is not a static structure to be observed and internally conceptualized.

DYNAMICAL PATTERNS

This thesis suggests that the dynamic reciprocal coupling of cultural scaffolding can be understood as dynamical patterns applicable to emotional episodes (Colombetti, 2014a). Colombetti (2014), building on approaches by Lewis (2000, 2005), proposes that emotional episodes are best seen as dynamical patterns of brain and bodily events or "'self-organizing patterns' using DST" (p. 53). This is consistent with the concept of autonomy, where organisms sustain themselves by ongoing dynamic interactions with the environment. In DST, the range of all possible states of a system at any point in time may be represented geometrically by a "state

space." Changes between states (trajectories) can be represented as a topology to form relatively stable basins or valleys of attraction (attractors) with ridges where they diverge (repellors). A visual illustration of topological space is given in Figure 2-7, relating to increasing stability of behavioural development in time.

Figure 2-7: Visual depiction of behavioural development as a series of evolving and dissolving attractors of different stability with time. It represents a model of spaces and basins of attraction similar to Figure 2.6, showing the increasing stability in aspects of behavioural development rather than physical development. (Copyright John Wiley & Sons, Inc.; Thelen & Smith, 2007, Fig. 6.8. Reprinted with Permission)

Behaviours can be related to actions and the brain and bodily states relevant to emotion. Thelen and Smith (2007) compare Figure 2-7 with a version of Waddington's epigenetic landscape (1957) in Figure 2.6 to illustrate how dynamical systems demonstrate similar characteristics of stability to the development of a human organism (described in this thesis in terms of the enactive approach). Various parameters, including control parameters (relatively unaffected by the system), influence, but do not cause, this range of possible states. This is because these attractors and repellors change over time, for example, as an emotional episode develops. Dynamical systems can couple and reciprocally influence and constrain one another, such as where they synchronize via mutual influence or adapt to the action of the other (known as entrainment). Colombetti (2014a) suggests that emotional episodes "recruit or entrain various processes (neural, muscular, autonomic, etc.)" (p. 69). This acts upon constraints among muscles,

self-organisation and plasticity of the brain structures and dynamical aspects of social relations. Consistent with Froese at al. (2011) emphasis upon social coupling between multi-agents and their synchronisation. Colombetti (2014a) argues "We can talk of emotion forms instantiated by two (or more) agents together in their coupling, with attractors that pull all organisms simultaneously into a specific interactive pattern" (p. 70). Such emotion forms would be consistent with concepts of participatory-sense making (Di Paolo et al., 2010) or social cognition (Froese et al., 2011)(See Section 2.2.2) from an enactive perspective.

This thesis argues that the control parameters, and even some attractors and repellors, can be mapped to the cultural scaffolding framework. Colombetti (2014) contrasts emotions with moods, primarily in terms of the length of the episode, and regards emotions to be of short duration and normally focused upon an object. She argues that moods can also be seen as such dynamical patterns but are longer lasting. Moods can influence emotion; for example, when you are depressed, you are less likely also to be joyous. The moods affect the state space of the organism by shifting the attractors and repellors, so pulling brain and bodily processes towards particular emotions, over that of others.

2.3   Gratitude: narrowing the scope of emotion

The scope of all emotions is very broad, this is narrowed by focusing around a single emotion relevant to virtual reality, in this case gratitude and those emotions that arose in its study. Gratitude is adopted because a gap in the literature has been identified which suggests that there is little or no prior research into gratitude and presence. In addition, a prior study involving a scenario for triggering gratitude (Bartlett & DeSteno, 2006) exists which is suitable to be adapted for virtual reality research within a short unfolding emotional episode. Finally, due to its relevance as an empathetic emotion, to exploit in virtual reality, it is "a tool for empathy and cognitive enhancement" (Hall & Takahashi, 2017, p. 3).

Sections 2.2 and 2.3 presented an overview of emotion, criticised in terms of dualism, leading to the adoption of the enactive approach in this thesis, which addresses these criticisms. This section examines the literature on gratitude. In order to understand how gratitude relates to a generalised enactive approach to emotion, this section aims to examine: first, the scope of gratitude (Section 2.3.1) from narrow intrapersonal approaches to broad transpersonal approaches; secondly, the specific benefit-triggered gratitude (triggered by being helped) examined in this thesis (Section 2.3.2) and, finally, how gratitude relates to the enactive approach adopted in this thesis (Section 2.3.3).

2.3.1 The Scope of Gratitude

There are two broad categories of gratitude: a narrow benefit-induced category and a broader category of general gratitude (Hlava, Elfers, & Offringa, 2014; Lambert, Graham, & Fincham, 2009; Steindl-Rast, 2004). This research focuses upon the narrow benefit-induced aspects of gratitude defined as: " *the positive emotion one feels when another person has intentionally given, or attempted to give, one something of value"* (M. E. McCullough et al., 2001; M. E. McCullough & Tsang, 2004). However, it is acknowledged that this approach focuses upon just one aspect of gratitude and that gratitude may involve more than just giving something of value.

Hlava, Elfers and Reid (2014) and Carter (2006) suggest that gratitude is an emotion that includes feelings towards another, feelings with another, and more general feelings, such as being at one with the cosmos. Lambert et al. (2009) identified these differing aspects of gratitude, ranging from the personal to the transpersonal, in studies involving self-reported descriptions of gratitude by lay people (US English speakers). They identified this as a 'fuzzy' prototypical category (a central core of characteristics along with aspects not always in existence) rather than sharply delineated definitions. Steindl-Rast (2004) portrayed gratitude as thankfulness (personal or benefit-induced aspects), with the receipt of a gift at one end, and at the other, a peak experience of "cosmic oneness" (general or transpersonal aspects).

Peak experience is a concept originally presented by Maslow (1962) in Privette (1983), in which understanding is seen as "moments of highest happiness and fulfilment" (p. 69) during the motivational level self-actualisation (the individual works to actualise their own potential) and the highest of Maslow's (1991) revised motivational levels, self-transcendence, where "individuals seek a benefit beyond the purely personal and seek communion with the transcendent, perhaps through mystical or transpersonal experiences" (Koltko-Rivera, 2006, p. 306).

Other researchers, such as Wood et al. (2010) view gratitude as a life orientation, identifying a broader element with a non-personal focus. Wood et al. (2010) point to participants describing being grateful for "waking up in the morning" in their diary entries (Emmons & McCullough, 2003). Such experiences involve emotions, including gratitude, relating to religious experiences (Tsang, Schulwitz, & Carlisle, 2012; Michael E. McCullough, Kimeldorf, & Cohen, 2008; Algoe & Haidt, 2009; M. E. McCullough et al., 2001) and improving mental wellbeing (Emmons, 2008; Toepfer, Cichy, & Peters, 2012; Watkins, Woodward, Stone, & Kolts, 2003). As gratitude involves feelings towards, or with, another person, this suggests that gratitude is related to social presence (the feeling of being with another) within virtual reality research.

Considering the interpersonal aspect of gratitude, Algoe (2012) proposes a find-remind-bind approach to gratitude, arguing that the focus is upon how we relate, rather than the transaction

itself. She claims that responsiveness is important as well as the value of a benefit. She argues that gratitude acts to bind people as individuals and groups together when repeated successively (remind-bind) and, in addition to the "find" aspect of the initial giving of a benefit adopted by this thesis, forming bonds when first finding a stranger (Michael E. McCullough, Tsang, & Emmons, 2004; 2001; Bartlett & DeSteno, 2006; DeSteno, Bartlett, Baumann, Williams, & Dickens, 2010). This correlates with Frederickson's (2001, 2004) argument that positive emotions, such as gratitude, appear to build friendships and other social bonds.

Gratitude is one of a cluster of pro-social emotions. The scope of gratitude includes being directed towards and with others, which can lead to more general feelings which function to bring people together, whether as strangers, friends, lovers, colleagues or as groups. This focus of gratitude upon others suggests that social presence, as a feeling of being with others, may be involved within virtual reality research.

2.3.2 Benefit-induced or personal Gratitude

This thesis examines pairs of individuals and adopts the narrow, benefit-induced approach of gratitude, an aspect of gratitude upon which there appears to be broad consensus in the literature. There is little or no research into the relationship between gratitude and presence, suggesting that this is an under-researched area. As the benefit-induced aspect of gratitude is common to all theories, it was considered it to be an important aspect of gratitude to focus upon.

 McCullough and colleagues (2001) regard gratitude as a moral affect, analogous to other moral emotions, such as empathy and guilt. Lazarus and Lazarus (1996) in McCulloch et al. (2001, p. 251) describe gratitude as one of the empathetic emotions with a core relational theme as recognition or appreciation of an altruistic gift. Similarly, Campos and colleagues (2013) suggest core relational theme items "Felt benefited by another's action" and "Wanting to give back" (p. 42) . This notion of 'Wanting to give back' accords with Emmons and McNamara's (2006) claim that giving back is of benefit as there is a need to avoid free riders in social interactions. Emmons and McNamara (2006) argue that "genuine co-operators will acquire a reputation for trustworthiness and integrity, while free riders will not be able to sustain the high costs of acting with integrity, consistency and generosity" (p. 18). They argue that gratitude starts as appreciation and emerges into gratitude. McCulloch and colleagues (2001) refer to this wanting to give back as a moral motive to act pro-socially, with gratitude serving as a moral reinforcer, which encourages such pro-social behaviour. The concepts of transactional approaches being genuine, trustworthiness and appreciation are all associated with gratitude. This thesis identifies these aspects within virtual environments in situations involving interaction between avatars.

Much previous research into gratitude involved reading words, scenarios or recollecting experiences, with some studies using diaries to keep contemporaneous notes. Bartlett and DeSteno (2006) measured gratitude through a self-report questionnaire in an experiment which used helping behaviour to induce gratitude. This social interaction is consistent with views that emotions are 'largely social' (Griffiths & Scarantino, 2005, p. 446) and provides an example of how a lived emotional episode, which involves benefit-induced gratitude, can be arranged. Bartlet and DeStenos' (2006) approach has been adapted for use in this thesis, in conjunction with the questionnaire they used to measure gratitude (detailed in Chapter 4).

Neurological evidence from a study reviewing Holocaust victims' narratives, identified a correlation between gratitude and areas of the brain associated with social, empathetic and moral cognition (Fox, Kaplan, Damasio, & Damasio, 2015). This correlation suggests an involvement by the brain with benefit-induced-gratitude. It is notable, however, that reviewing the narratives of others may well account for the empathetic aspects. From the enactive perspective, caution should be exercised in interpreting such correlations as indicating a causal interaction or the formation of meaning. Emmons (2008) argues for a process account of gratitude, focused upon recognising that a gift has been received, calculating costly-benefits experienced and with emotions starting with appreciation. This appreciation then merges into gratitude. Memory of the benefit and benefactor, as well as the emotion of gratitude, initiates and sustains a motivational state to reciprocate the benefit received.

Emmons (2008) argues that correlations with brain activity demonstrate the involvement of limbic-frontal and face-processing areas, amygdala and limbic emotional systems; interactions between the two subcortical centres within the pre-frontal brain area that "control executive and evaluative processes" (p482) support his view. Whilst accepting the role of the brain, the enactive approach would reject interpretations of this evidence as purely brain-bound, evaluative processes and would suggest that the dynamic interaction between differing brain areas and role of the body has been overlooked.

2.3.3 Relationship to the enactive approach to emotion

This section highlights how gratitude theories relate to the enactive approach adopted in this thesis. It first focuses on the existing theories of gratitude, similar to the enactive approach; secondly concerns over dualism and the artificiality of the internal representation of meaning; the role of emotional episodes; the role of purposeful self-sustaining actions as meaning and, finally, the scaffolding of the dynamic reciprocal interaction between the organism and the environment.

EMBODIED PHENOMENOLOGICAL APPROACHES TO GRATITUDE

Theories relating to specific emotions embrace more general concepts about emotion such as the EAE adopted in this thesis. Considering gratitude within the framework of an EAE does not appear to have been explored in previous studies. However, there are phenomenological approaches that have done so (Hlava & Elfers, 2014; Carter, 2006) and suggestions that other pro-social emotions, such as compassion, could be examined in this way have been put forward by proponents of the enactive approach (Halifax, 2012), for example, with a suggestion that this approach may apply to gratitude as one of the religious pro-social emotions.

The enactive approach is a phenomenological approach. Like the enactive approach, Hlava, Elfers and Reids' (2014) phenomenological approach focuses upon gratitude that people experience, which emerges as they live out their lives and is intimately related to their embodied nature. They draw upon the work of Todres (2007), and Gredelin (2004) rather than Varella et al. (1974; 1996; 1991/1993) for the enactive approach. All draw upon the philosophy of Heidegger (1927/1996), Husserl (1936/1970; 1900/2001; 1901/2001) and Merleau-Ponty (1945/1962). Merleau-Ponty considers meaning as sense-making located around the body and emerging from its physical interaction with the world. Hlava, Elfers and Reid (2014) refer to this as "going beyond representational truth" and address the main dualist concerns. Todres (2007) explicitly relates this to the religious and transpersonal (2007) areas associated with gratitude. This addresses the primary criticisms of dualism and internal representation within the brain of meaning. The primary difference from the enactive approach of Varella et al. (1974; 1996; 1991/1993) is that in the enactive approach involves sense-making which emerges from our nature as biological organisms to purposefully self-create, sustain and adapt in a dynamic interaction with the environment.

APPRAISAL THEORY APPROACHES TO GRATITUDE

The enactive approach and the phenomenological approach of Hlava et al (2014) and Carter are critical of the appraisal theory commonly used in other gratitude studies (see Section 2.3.2). Lazarus and Campos at al. (2013) focus on appraisal theory and define core relational themes. However, whilst not explicitly focusing upon core relational themes, Frederickson (Fredrickson, 2001, 2004) proposes that positive emotions, such as gratitude, appear to build friendships and other social bonds (p151). She draws upon dualist appraisal theory and action tendencies (discussed in Section 2.1.2) and argues that specific action tendencies for positive emotions are "notably vague and underspecified" for positive emotions such as gratitude, in contrast to negative emotions such as fear flight response. Instead she claims that "positive emotions appear to *broaden* people's momentary thought-action repertoires and *build* their enduring personal resources" (Fredrickson, 2004, p. 147). Gratitude is thus causal. She also focuses on how "one's cognition about the world and social partner shift" (p. 460) so emphasising a dualism, with internal cognition separate from the surrounding environment. Emmons (2006), argues that

brain studies and gratitude, identifies studies associated with the brain the he suggests emphasises "neural networks that are efficient at both detecting and displaying tell-tale signs of gratitude" (observation and communication) and "interactions between these [amygdala and limbic emotion system] and prefrontal sub-cortical areas a dualist "controlling executive and evaluative processes" (internal brain bound cognition) (p24). However, evidence such as Pessoa's (2008) counters such dualist interpretations and supports the enactive approach.

Emotional Episodes

Gratitude theories generally include consideration of emotional episodes, most obviously where the episode involves a social interaction between a benefactor, recipient and the giving of a benefit. This section has identified evidence and theories that examine gratitude from lay peoples' self-reports (diaries, open questions within questionnaires and semi-structured interviews on the lived experience) and which identify that gratitude is focused upon two aspects: the general aspects and (as is especially common) those induced by a benefit. They differ in terms of focusing upon the episode as a situation to be cognitively evaluated, either focusing upon the relationships and transactions between people, or on a lived experience from the phenomenological perspective.

This section has identified that gratitude theory can cover a wide range, from narrow exchange of help to broader aspects of thankfulness or generic gratitude. It highlights that there is a divide between dualist appraisal-focused approaches and phenomenological approaches underpinning emotion theory more generally. The phenomenological approaches are very close to the enactive approach except that the enactive approach has a greater focus upon the purposeful enaction of an organism to sustain and adapt itself and has a greater emphasis upon the structural and dynamic interactions with the environment. This underpinning dualist divide also emerges from the varied approaches to presence, discussed in Section 2.4.

2.4   Presence: a major aspect of virtual environments

2.4.1   Introduction

Feelings of presence are a major aspect of the virtual reality experience (Slater, Usoh, & Steed, 1994; T. W. Schubert, 2003; Zahorik & Jenison, 1998; Sheridan, 1999; Frank Biocca & Delaney, 1995). Presence needs to be understood in order to understand the relationship between presence and emotion. This section examines the general theories of presence, both spatial (feeling of being there) and social (feeling of being with others). Within presence theories, common themes identified were, as for emotion theory, related to dualism (the divide between mind/body/world including cognition and emotion), formation of meaning and embodiment.

Seth (2012) describes this as the objective-functional and the broadly phenomenological. Willans et al. (2012), a book chapter derived from this thesis, describes objective-functional as a focus upon presence as a perceived pseudo-reality emulating objective reality and tending to maintain a separation between external reality, which is observed, and that which is subjectively experienced within the mind. Broadly phenomenological approaches tend to focus upon reality, as experienced in terms of actions.

Examining the concepts of dualism and embodiment from emotion theory led this thesis to adopt the enactive approach to emotion from the perspective of Varalla et al. (1991/1993). The review carried out of presence theory has identified that there is no enactive approach to presence, hence this led to the development of a novel enactive approach to presence (see Chapter 3). This was developed in order to explore the relationship between emotion and presence from an enactive perspective, without conflicting underpinning assumptions.

Just as later emotion theories recognise dualism between mind and body (Barrett, 2006; Damasio, 1999; Prinz, 2004a) so too have presence theorists, such as Bioca (1997) and Riva (2006). In doing so, the latter have drawn upon work by Damasio (1994), Seth (2012) and Riva et al. (2004; 2006; 2014), incorporating bodily links with interoceptive (internal) bodily monitoring. However, many of these theories maintain that meaning within the brain/body is separate from the external environment, which is sensed and internally evaluated. Alternative approaches embrace a wider action-based approach but place less emphasis upon the role of neurology. Researchers such as Riva et al. (2014) argue that "to fully understand the concept of presence [spatial presence], we need to connect to its social counterpart: 'social presence' " (p. 11) . As much of emotion is social, when researching the relationship of social emotions such as gratitude with spatial presence in this thesis, the role of social presence needs to be accounted for. Hence, this section introduces both spatial and social presence.

The model of Riva et al. (2004; 2006) shares much with the enactive approach, especially with its emphasis upon action and phenomenological aspects, but contrasts markedly in its adoption of an internal simulated world and of neo-Jamsian assumptions of Damasio and Russell (critiqued in sections 2.3).

2.4.2 Dualist: Objective-Functional approach to Presence

SPATIAL PRESENCE

The Objective-Functional model can be summarized by Lombard and Dittons' proposal that presence is the "perceptual illusion non-mediation" (Lombard & Ditton, 1997). The illusion emphasis continues with concepts such as Slater's (2009) Place Illusion (the illusion of being in a place) and Plausibility Illusion (the plausibility that that you are in a place).

Slater's view of presence has evolved from using subjective questionnaires (Slater, 1999), to rejecting overreliance upon subjective questionnaires (Slater, 2004) and, ultimately to the view that "multivariate physiological and behavioural data is used alongside subjective and questionnaire data" (Slater & Garau, 2007, p. 653). One aspect of this rejection is the argument that presence itself may be an artefact of the questionnaire, taking into account that a questionnaire may show significance and correlation even for a meaningless variable, based upon the using question 'How colorful was your day?' (Slater, 2004).

The use of behavioural data highlights agreement on the importance of actions between researchers from both objective-functional and broadly phenomenological approaches. However, there is a major distinction: for objective-functional researchers, the importance of actions is that they are often based on the premise that people feel and act as they would be in the real world when feeling greater levels of presence. For example, in both virtual and natural environments, anxiety may be operationally measured either by using objective physiological measures or by using behavioural measures, such as whether an avatar moves away from the edge of a steep drop (Meehan, 2001). The preference for objective measures and understanding virtual environments as 'other' or 'illusory' is fundamentally dualist, drawing upon a classical scientific approach in contrast to the Critical Realist approach of this thesis (see Chapter 4).

Presence researchers are not only concerned with behaviour in virtual environments but also with the usefulness of virtual environments for gaining greater insight into neuroscience. Sanchez and Slater (2005) suggested that presence may involve the "transportation of consciousness into an alternative, virtual reality" (Sanchez-Vives & Slater, 2005, p. 338). They looked towards the work of Damasio (1998), who argued that:

> *consciousness occurs when we can generate, automatically, the sense that a given stimulus is being perceived in a personal perspective; the sense that the stimulus is 'owned' by the organism involved in the perceiving; and, last but not least, the sense that the organism can act on the stimulus (or fail to do so) (Damasio, 1998, p. 1880).*

The potential of Damasio's (1994, 1999) work was also utilized by Riva et al. (2004) with an action-focused approach to presence from a broadly-phenomenological approach. Damasio's approach was criticised in Section 2.1.2.

SOCIAL PRESENCE

Social presence, like spatial presence, can also be considered in terms of more objective functional approaches which is important in order to ensure consistent underpinnings. Social presence is thus presented under objective-functional (2.4.2) and broadly phenomenological

(2.4.3) sections. There is a distinction between approaches to presence in 3D virtual environments with an avatar, as presented in this thesis, and that focused upon technologies such as TV, telephone communication and online chat forums such as Facebook.

One of the earliest and widely used conceptualisations of social presence is defined as "the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" (Short & Williams, 1976). This definition focuses upon the communication aspects across non-3D virtual environments but includes a psychological dimension, not just the physical there or not there. This was assessed by a list of social cues and included impersonal-personal, unsociable-sociable, insensitive-sensitive, cold-warm. Short and Williams (1976) were investigating aspects of media such as telephone systems. These, they considered, communicated sensory cues reliant upon divide between sensed external objects and internal mental processing of this information.

In a similar manner to Lombard and Dittons' (Lombard & Ditton, 1997) "perceptual illusion non-mediation" (Lombard & Ditton, 1997), Klimmet and Vorder (2003) relate social presence to "the illusion of being together with a mediated person, emphasising that social presence within a virtual environment is illusory and the real social presence must lie with really being together. This reflects a divide between objective reality and subjective illusory, a form of dualism rejected in this thesis.

Lombard and Ditton (1997) identified six approaches of social presence, emphasising the role of the medium as opposed to conveyance of social cues by a medium. These approaches include fidelity of representation of a communication medium or a medium that gives a user a sense of being transported to elsewhere. They identify a further two approaches that focus upon the social dimension of presence by regarding a character in a medium as an 'Other' social actor, or, even where the medium itself (e.g. a computer as a social actor) is anthropomorphised into a social actor itself. This is what Riva (Riva & Mantovani, 2014; Riva et al., 2004) refers to as media approaches to presence, in contrast to psychological or inner approaches to presence. The term 'inner approach' reflects Riva and colleagues' (Riva & Mantovani, 2014; Riva et al., 2004) simulated world approach, which is criticised from the enactive perspective adopted in this study.

Tung and Deng (2007) consider social presence as "the degree of awareness of another person in an interaction and the consequent appreciation of an interpersonal relationship." They emphasise that, in computer-mediated environments, a user's degree of feeling, perception or reaction is about being connected to another intellectual entity, which involves a subjective quality of communication. This provides evidence that the use of more dynamic emoticons (i.e. more like actual facial cues) makes the human-computer interaction more sociable. Tung and Deng (2007) extend the concept of CASA (Computers as Social Actors) to the use of dynamic emoticons as social cues, drawing upon BET and Ekman's (1993) view of facial expressions of

emotion, which involves a divide between mind and the external environment. This is criticised from the enactive perspective in Section 2.1.2.

Shen and Khalifa (2008) propose a multi-dimensional model of social presence: social presence is the awareness of the other sentient beings accompanied by affective and cognitive engagement with the others in computer-mediated social spaces" (p 729). They focus upon social presence as a property of community interaction. This involves three components: awareness (the extent to which a user believes other social actors appear to exist and are able to react to the user), affective social presence (the extent of the user's emotional connection, aroused by virtual social interaction) and cognitive social presence (the extent to which a user is able to construct meaning about their relationships and social space). This approach separates emotion and cognition, a form of dualism criticised by the enactive approach within this thesis. Shen and Khalifa (2008) support the concept that the "sense of physical reality is a consequence of internal processing" (p. 730) and communication in text-based environments involves "imaginative filling in gaps in information" (p. 730) emphasising their adoption of an internal mind paradigm, criticised by the enactive approach of this thesis. They argue that this conceptualisation of social presence can augment motivational theory by stimulating online community participation.

This section emphasised conceptualisations of presence, particularly social interaction and salience and awareness of an 'other' person. The section further identifies how objective-functional approaches to social presence can focus upon the media but that some approaches, such as that by Shen and Khalifa (2008), emphasise community interaction, more in line with the action focus of broadly phenomenological approaches to presence.

2.4.3 Narrowing Down Dualism: Phenomenological Approaches

None of these models have been explicitly considered from the enactive approach, although Willans (2012), in an early conceptualisation of presence, raised the possibility when considering spatial presence as an embodied perceptual emotion with meaning in the perceptual relations. Willans (2012) viewed such perceptual relations and appraisal as an emotion (as opposed to a cognitive feeling (T. W. Schubert, 2009)) through a confluence of direct perceptual relations (internal and external) in terms of their action potentials. This thesis arguesthat one difference between the enactive approach and Willans' (2012) approach is that, whilst both are non-rationalist, the direct perception model, drawing upon Gibson's (1979) approach to affordances (humans directly perceive objects in terms of their affordance to us), is reliant upon a static environment only and not on the dynamic reciprocal coupling of enaction between an organism and its environment.

In presence research, embodied cognition is regarded as part of two major models of presence: that developed by Wirth et al. (2007), and that proposed by Riva et al. (2004). Riva et al. (2004) suggest that presence is a psychological state and is not constrained to virtual environments. They both draw tight links between social presence and spatial presence (the feelings of being with others or in a place) and suggest that presence does not just occur in virtual worlds, even if it is very striking when it occurs there.

SPATIAL PRESENCE

Both presence and emotion can be viewed in terms of actions. Action-based models of presence approach this from varying theoretical perspectives, including a rejection of subjective questionnaires and a focus upon 'objective' measures (Slater & Steed, 2000; Slater, 2004; Slater & Garau, 2007; Slater, 2009), embodied cognition approaches (T. Schubert, Friedmann, & Regenbrecht, 1999; Wirth et al., 2007; Wirth, Hofer, & Schramm, 2012), Heideggerian/Gibsonian (Gibson, 1979; Heidegger, 1927/1962) (Zahorik & Jenison, 1998) and enactive or situated approaches (Carassa, Morganti, & Tirassa, 2005).

Zahorik & Jennison (1998) reject mind/body dualism and embrace Gibson's (1979) approach to perception and Heideggerian (1927/1962) approaches to being. They argue that spatial presence is 'Tantamount to successfully supported actions ' (1998, p. 84) within a virtual environment. This aligns well with the situated model of emotion, which is focused upon emotional episodes as skilful engagements (Griffiths & Scarantino, 2005). However, Zahorik & Jennison (1998) clarified that this was not to be confused with pragmatic reliance upon observable actions and behaviour associated with classic rationalist variants of scientific research, as discussed in Section 2.4.2 above. Sheridan (1999), who accepted that we can never objectively know reality, suggested the use of estimation theory in order to reconcile the dualist approach of orthodox scientific theory with non-rationalist approaches to process, and argued that people 'estimate' what the external reality is.

Carassa et al. (2005) also adopt a situated cognition approach to presence. They view presence as "not determined by physical space to which we are immediately tied by perception, be it natural, artificial or virtual; instead it is grounded in a meaningful situation that stretches in the past and faces the future" (Carassa et al., 2005, p. 387). This works on three levels: the situation, the action body movement and perception. They argue that presence does not result from the simulation of perceptual-motor abilities alone.

Varela (1990 cited Carassa et al. 2005) suggested that virtual reality systems, cognitive systems and the world co-define themselves. Carassa et al. (2005) argue that Varela's (1990 cited Carassa et al. 2005) suggestions also need to be integrated with cognitive dimensions due, in part, to the

past and present elements. Carassa et al. (2005) have assumed, however, that there is a need for separate higher cognitive functions. Di Paolo et al. (2010) refer to Lakoff's (1987) research as evidence that the enactive approach can also be applied to higher cognitive functioning and Thompson (2007) incorporates enculturation into the enactive approach.

Interoceptive Predictive Coding Model

In contrast to other phenomenological approaches, such as that by Riva et al. (2004), focused upon situated actions, the neurologically based proposal of Seth et al. (2012) extends the James-Lange '*afraid because we tremble'* approach to emotion (see Section 2.1.2). This narrows down any dualism between mind, brain and body and interaction with the world, but maintains a dualism between brain and world. Seth and colleagues' (2012) acknowledge a relationship between a person's actions (agency) and presence, however, they stop short of emphasising presence as "Tantamount to successfully supported actions" (Zahorik & Jenison, 1998, p. 84). Presence and Agency are linked but can be independent.

Presence is regarded as a subjective feeling state and the authors place a special emphasis upon the brain, and its relationship to the body, within the context of dynamic interactions with the wider world. Their model of presence involves two components within the brain: one associated with acting (agency) and the other a presence component, that mutually interact and follow the principles of 'Bayesian Inference'.

Bayesian Inference involves three aspects: a prediction (an expectation or belief), sensory information and a prediction error (a discrepancy between the sensory information and the prediction). The lower the prediction error the more likely the prediction is to be correct, hence minimising the prediction error is a form of inference about the sensory information based upon refined guesses. From prior experience and sensory information, the brain anticipates or predicts what sensory information will be received, based upon a probability that is represented, or coded, in the internal states of the brain. As the organism interacts with the world, new sensory information is received. The difference or errors from the predicted sensory information expected after the event leads to an updating of the probabilities (termed posterior) of the expectations or predictions. The connection between agency and presence arises from these processes that mediate interactions between agency and presence.

This accords with Seth et al.'s (2012) view that "presence is the result of successful suppression by top-down predictions of informative interoceptive [internal] signals evoked (directly) by autonomic control signals and (indirectly) by bodily responses to afferent [external] sensory signals" (p. 1). From Seth and colleagues' (2012) perspective sensory signals arise from two bodily areas, the external world facing sensorimotor system and the internal autonomic system. Prediction errors are evaluated against sensory signals of the internal bodily state (from the

presence module) and senses of external world (from the agency module). The presence prediction errors are fed upwards within the presence module to refine its presence predictions and to the agency module to refine the agency module's presence predictions. Thus, the two modules may work together to refine the feeling of presence. It is not necessary for the presence module to receive predictions and prediction errors for presence to have predictions and prediction errors lead to the feeling of presence.

This approach is in line with 'predictive coding': bottom-up/feed-forward prediction errors and top-down/feedback signals that convey predictions (Friston, 2010; Barrett & Simmons, 2015). There is neurological evidence (Barrett & Simmons, 2015) that there is a multi-hierarchical system in the human brain (especially within the layers of the cortex) such that top-down predictions are cascaded down and bottom-up prediction errors (based upon the difference with sensory signals) are cascaded up, so updating and refining the prediction errors. However, from the enactive approach adopted in this study, this perspective is still problematic in that Bayesian Inference forms an internal representation as a generated model of the world, which is rejected as a dualist divide between brain and world.

Free Energy

The EAP developed in this thesis addresses the dualists concerns, in part, by utilising an enactive approach of the Free Energy model (Friston, 2010, 2012), associated with the Bayesian Brain approach, as proposed by Kirchoff (2015). The Free Energy model (Friston, 2010, 2012) draws upon concepts of self-causation and emergent interactions based upon dynamical theory, similar to that within enactive theory (see Section 2.2). The Free Energy principle postulates that, in order for an organism to create and sustain itself in the short term, and not tend towards disorder (as measured by thermodynamic entropy), thermodynamic energy is needed. An organism will utilise any Free Energy available to do work, so reducing the amount available. Hence, as Free Energy is reduced, there is an increased tendency to order. When considered in terms of the sensory information needed in order to understand the world and to maintain itself (i.e. to move to or adjust in order to maintain its internal state), an equivalent Shannon-Entropy (tendency to disorder in communication theory) is relevant. Mathematically, there is an equivalent to thermo-dynamic Free Energy associated with this Shannon-Entropy. Hence as this Shannon-Entropy form of Free Energy is reduced there is a tendency to more order (i.e. less loss of information) and this is equated, arguably, from a Bayesian Perspective, to reducing prediction error or "surprisal". The mathematics utilised by Friston (2010, 2012) involved dynamical theory and coupling, in line with DST, as utilised by this the enactive approach (see Section 2.2). The enactive approach to the Free Energy Model developed by Kirchoff (2015) argues that the enactive approach can be consistent with the Free Energy Model without the assumption that it involves Bayesian inference and its dualist brain bound internal model of the world, but rather

the model is represented in the brain, body, world interactions as a whole, in line with the enactive approach. Details of how this relates to the EAP is given in Chapter 3.

Rivas approach to Spatial Presence

Riva et al. (2004) argue that the impact of cultural factors, not just technological factors, leads to the induction of presence. The importance of embodiment is recognized and they relate this to neurological research, including that of Damasio (1994, 1999) discussed in Section 2.1.3. This thesis argues that the criticism of Damasio's (1999) approach to emotion (see Section 2.1.3) also applies to the approach of Riva et al. (2004) to presence. It also highlights how Riva et al. (2004) view the relationship between emotion and presence. Riva et al. (2004) focus upon two commonly considered areas of presence: social presence and spatial presence.

Like Damasio's (1994, 1999) approach to emotion and consciousness, Riva et al. (2004) relate presence from the biological substrate to the higher level cultural and social activities of human beings. Riva et al. (2011) describes presence as "the intuitive perception of successfully transforming intentions into action (enaction)" (p. 1). Riva et al. (2004) argue that whilst presence is felt as a single entity, it can be divided into three processes: proto-presence, core-presence and self-presence, building upon Damasio's (1999) three levels of self: proto-self, core-self and autobiographical self (Riva et al. (2004) term this 'extended-self'.

The three levels of presence processes are:
- Proto-presence: embodied presence related to the level of perception-action coupling (self vs non-self) (equivalent to spatial presence)
- Core-Presence: the activity of selective attention made by the self on perceptions (self-versus the present external world)
- Extended Presence: is to verify the relevance to the self of possible/future events in the external world (Self vs possible/future external world).

Riva & Waterworth (1945/1962) explains that presence is "an evolved process related to the understanding and management of the causal texture of both the physical and social worlds of the evolutionary approach"
(p. 206). Criticism of Damasio's (1994, 1999) approach includes that the distinction between the older and newer parts of the brain, in evolutionary terms, is not as marked as Damasio suggests, and militates against this translating to separate layers of presence.

This section has highlighted those presence theories that adopt a broadly phenomenological approach. Whilst there is a narrowing down of dualism to take on board approaches such as the surrounding context, there remain discrepancies between internal top-down cognition (Carassa et al., 2005) and internal brain-bound generative models (Seth et al., 2012) or a lack of emphasis

upon the role of neurology (Zahorik & Jenison, 1998). However, there are also many, and growing, similarities with the enactive approach of this thesis, ranging from criticisms of classic Cartesian Dualism to approaches involving more dynamic views of the brain with feeling embedded within the brain-body relationship.

SOCIAL PRESENCE

The underlying concept of self-presence argued in this thesis is based upon "the ability to project oneself socially and emotionally in an online community"(Riva et al., 2004). They argue that, in the experience of "optimal presence, biologically and culturally determined cognitive processes are working in harmony". Ijsselsteijn and Riva (2003) regard social presence as "the feeling of being together, of social interaction with a virtual or remotely located communication partner" whilst others refer to "the illusion of being together with a mediated person" (Klimmt & Vorderer, 2003, p. 1).

Biocca (1997, p. 22) emphasised that social presence is the degree to which "a user feels access to the intelligence, intentions and sensory impressions of another" (1997, p. 22). Whilst social interaction involving social presence, and spatial presence can involve many emotions, social presence theory can focus particularly upon empathy as the "empathetic simulation of the internal states of another" (1997, p. 22), or "the capacity to see oneself in another person, to get inside another's thoughts and state of mind"(Riva & Mantovani, 2014, p. 24).

> *Mediated social presence is the moment-by-moment awareness of the co-*
> *presence of another sentient being accompanied by a sense of engagement with*
> *the other (i.e., human, animate, or artificial being). Social presence varies from*
> *a superficial to deep sense of co-presence, psychological involvement, and*
> *behavioral engagement with the other. As a global, moment-by-moment sense*
> *of the other, social presence is an outcome of cognitive simulations (i.e.,*
> *inferences) of the other's cognitive, emotional, and behavioral dispositions.*
> *(Biocca, Harms, & Gregg, 2001).*

The focus of Biocca at al. (2001) upon "cognitive simulations" (i.e. inferences) highlights that whilst they reject the dualism of mind and body, in line with Damasio (1997), they maintain the dualism between body and environment criticised in Section 2.1.2.

Embodied Social Presence

In comparison with disembodied theories of social presence is the embodied social presence (ESP) theory. ESP is another action-focused approach to presence that rejects the Cartesian dualism between mind-culture and embodied social presence (ESP) (Brian E. Mennecke, Triplett, Hassall, & Conde, 2010; Brian E. Mennecke, Triplett, Hassall, Conde, & Heer, 2011). Mennecke et al. (2011) propose that social presence "is experienced in shared collaborative environments occurring in virtual worlds and mediated via embodied representations of social actors" (p. 433). They focus upon an important goal which is to understand the "reality behind the mask" of the other social actors. This is comparable with views of social presence that aim to understand the intent of others. The authors draw upon Activity Theory (Kaptelinin, 1996) which emphasises the role of tools (physical and conceptual) and symbols (such as psychological tools as mediating the transformation though activity to an objectified motive or object). From this perspective, an avatar may be regarded as a mediating tool.

ESP is distinctive from the enactive approach, especially because of the form drawn for purposeful actions that the enactive approach builds up from the individual organism (only understood in conjunction with the environment) and then social structures in terms of 'participatory sense-making' (Froese et al., 2011) and enculturation (Thompson, 2007).

ESP goes from focusing upon the digital other (as an avatar), to digital self (as an avatar), to real others (the main goal of social presence); this in turns leads back to digital self and finally the real self. ESP builds upon both activity theory and distributed cognition. Activity theory focuses upon the socially determined activity (as a transformational set of actions) and argues that the mental processes are derived from external actions i.e. consciousness (i.e. human mind), thus, activity and mental processes are merged as one. Activity theory argues that tools (both physical and conceptual) and symbols are used to mediate all activity.

The Enactive Approach, as adopted in this thesis, focuses upon the role of biological organisation and the need to sustain and adapt, thus building up to the social context utilising "participatory sense-making" (Froese et al., 2011), in contrast to ESP which provides little explanation of the role of biology, as opposed to being embodied. The Enactive approach may be more suited to explaining how the biology relates to the world and small groups, whilst ESP may have greater potential explanatory value when associated with large cultural concerns. However, the enactive approach, is being developed is a manner that addresses wider cultural aspects utilising the "cell to society" approach of Froesse at al. (2011).

ESP contrasts to the enactive approach in that the latter places more emphasis upon purposeful action driven by the fundamental nature of being an organism, and the structural coupling of action with the environment rather than the implications of activities within a social, historical and cultural concept. ESP shares the concept of the role of the avatar as a tool, similar to Riva et.

al.'s (2014) approach to presence. In emphasising the 'avatar as tool' approach, ESP highlights the role of the body, drawing upon Merleau-Ponty's (1945/1962) emphasis upon the body "as my point of view upon the world, as one of the objects of the world" and Lakoff and Johnsons' (1999) emphasis upon embodied cognition as opposed to thought ('all in the mind') or just the brain. To this extent, ESP addresses mind-body dualism, and body-world dualism concerns in the same manner as the enactive approach. The authors also place social presence within the framework of activity theory.

Riva's Approach to Social Presence

Like his approach to Spatial presence, Riva and Mantovani (2014) conceive of social presence as involving the following three layers:

- proto, or others, social presence (the intention of the other is toward the self)
- joint, or interactive, social presence (the self and the other have the same intentional focus)
- shared social presence (the self and the other share the same intention).

For shared presence, Riva and Mantovani (2014) identify the importance of empathy, and the "*capacity to see oneself in the other person, to get inside another's thoughts and states of mind*" and recognising intentions as the same as his own. Riva et al. (2004) explicitly support an internal simulation of the external environment approach, where meaning and the external environment are simulated within the brain.

Riva and Mantovani (2014) expand upon the role of intentionality and consider social presence as a *"selective and adaptive mechanism which allows the Self to identify and interact with others by understanding their intentions"* (p. 20). They do however, in the process, maintain a dualist distinction between older and newer parts of the brain and the role of internal simulation, consistent with Riva and Mantovani's (2014) approach to spatial presence.

This thesis has structured the examination of presence theory within this context in Sections 2.4.2 (objective-functional) and 2.4.3 (broadly phenomenological approaches) which align with sections 2.1.1 (Dualist Embodiment to Disembodiment) and 2.1.2 (Narrowing Down Dualism: Embodied Internal Representation) respectively.

2.5 Emotion and Presence

Research into the relationship between emotion and presence has mostly been focused upon the role of fear and anxiety.

Huang and Alessi (1999) argue that there are many parallels between emotion research and presence research. They claim that, like emotion, presence is continuously changing and dynamic, influenced by physiological self-perceptions and cognitive self-descriptions. They emphasise that people feel presence and do not think about their level of presence.

Empirical studies into the relationship between feeling present and feeling emotion have suggested that, for virtual reality environments, anxiety increases presence and presence also increases anxiety, using a foreboding or calming environment (Riva et al., 2007a). Similarly, anxiety and fear have been measured using scenarios involving virtual deep pits where people react as if they were in danger of falling in (Meehan et al., 2002) or display social anxiety (Mühlberger, Wieser, & Pauli, 2008). The levels of presence and emotion are not only generated by static scenes, but also by the use of narrative. This can increase both the sense of presence and emotion as shown by greater fear responses and feeling of presence. For example, where an exercise in a virtual environment involved a storyline that a virtual killer was on the loose, this generated greater feelings of presence and emotion compared with a storyline of no killer on the loose (Gorini, Capideville, De Leo, Mantovani, & Riva, 2011). Films and images that induce media-presence can also induce a sense of emotion, such as those used in mood induction procedures (Velten, 1968). Virtual reality has been used successfully in the treatment of anxiety and traumatic stress disorders, due to its ability to induce emotion.

 Västfjäll (2003) argues that a subjective sense of presence is not actually an emotion (focusing on 3D sound systems) and suggested that there is a correlation between emotion reactions and immersivity in a sound field and that "participants reporting a strong feeling of, and sense of, being in a sound field reported stronger emotion reactions" (p 186). He notes, however, that there can be three reasons: a) the feeling of presence is an emotion, b) emotion is an integral part of presence, c) emotion, is at the very least, a pre-requisite of presence or d) emotion is determined by presence. He emphasises that the correlational study has not identified causation in the suggested relationship between emotion and presence. Tajadura-Jiménez and Västfjäll (2008) focus upon the emotional aspects of auditory sound, especially self-representation sounds of the heartbeat, and showed a correlation between estimates of how near or far they are by the judgement of emotional stimuli. They argue that, in the same way that visual cues of an avatar increase the sense of presence, self-representation sounds may increase the sense of presence in virtual environments.

Bouchard et al. (2008), using virtual snakes scenarios, find that self-reported anxiety increases self-reported presence. They suggest that there may be a reciprocal relationship, to the extent that higher presence also increases anxiety. Bouchard et al. (2011) also investigated the emotional valence of verbal exchanges and online telepresence, defined as the "illusion of being *there*, *in* the therapy room *with* the other person" (p. 104), referring to 20 participants in videoconferencing, suggesting that stronger emotions in emotionally charged discussions contribute to a stronger feeling of self-reported presence. Whilst, in a two-dimensional (as opposed to three dimensional) environment, this suggests that social exchanges may increase the sense of presence.

Wirth et al. (2012) identified a correlation between emotional involvement and spatial presence. Wirth et al. (2012) draw upon the approach by Lerner & Keltner (2000) that emotions are of differing valence which leads to different cognitive appraisals. They argue that emotions "motivate or urge to direct mental activities to the emotion eliciting event" and virtual environments are objective items "regarded as a media" (Wirth et al., 2012, p. 22). Thus, Wirth and colleagues' (2012) approach is dualist.

The above studies are focused upon the relationship between presence and emotion, however immersion is another characteristic of virtual reality and video games which, as an overlapping construct, may be confusing these findings involving presence. Emotion is at the heart of the immersive experience. Brown and Cairns (2004), from a grounded theory study of eight gamers, describe three stages of immersion: engagement, engrossment and total immersion, which they equate with presence. This aligns with Lombard and Ditton's (1997) review identifying concepts of presence as immersion, where they state that when users feel immersive presence they are involved, absorbed, engaged and engrossed. Brown and Cairns (2004) describe immersion as "the degree of involvement with a game" (p.3). There is a significant involvement of emotion. Engagement involves the gamer being interested, paying attention (a willingness to concentrate) to the game, and maybe losing a sense of time (sometimes leading to guilt). Engrossment involves a high level of emotional investment, losing and awareness of their surroundings and a suspension of belief. For Total Immersion, they note its fleeting nature, adding that attention is needed, sense of time is altered, and sense of self is lost. Emotion is one of the main barriers to total immersion, requiring empathy for the characters and atmosphere where game features are relevant.

 Jennet and colleagues (2008) argue that immersion is a separate construct from presence which is only part of the experience. They regard presence as a "state of mind, immersion is an experience in time" (p.7). This seems difficult to justify given that actions, as for action-based concepts of presence, take time too. Jennet et al (2008) have a broad definition in that it covers all aspects of the gaming experience "the prosaic experience of engaging with a video game" yet

constrain it to video games. Their quantitative studies suggest that the immersive experience is associated not just with pleasurable states similar to flow (Csikzentmihalyi, 1990), but could also lead to increased levels of anxiety. They emphasise five characteristics of immersion: cognitive involvement, real world dissociation, challenge, emotional involvement and control. This involves many factors that overlap with questionnaires identifying presence; for example questions involving control, cognitive involvement, and suspension of disbelief and attention allocation, are all in the MEC-SPQ (Vorderer et al., 2004) questionnaire. It would be expected that, with these overlaps, correlational studies into emotion and immersion would deliver similar results to those with presence, and that immersion and presence would be highly correlated. An example is the study by Wirth et al. (2012) identifying a correlation between emotional involvement and spatial presence.

None of this research was from an enactive approach and all can be criticised from a dualist perspective. No research into the relationship between gratitude and presence was identified.

2.6   Summary and Conclusions

This section summarises and draws conclusions from the literature review including the refined research aim and questions.

The literature review led to the adoption of an enactive approach to emotion. In the introduction, an overview of the main approaches to emotion it identified all were problematic from a dualist standpoint. Even where, to an extent, mind-brain and even mind-brain-body unification exists, there tends to remain a cognition-emotion and body-environment or world divide with brain-bound cognition (see Section 2.1.2). The enactive approach does, however, bring together mind-brain-body-world as one dynamical system. It places an emphasis upon meaning-making emerging from purposeful dynamic interactions as individuals act out their lives. This is the primary motivation for adopting the enactive approach to presence. This meaning-making or sense-making, generated through the actions as life is lived, is termed the lived experience .

This led to the primary collection of empirical evidence in the primary research question:

- What are people's lived experiences of emotion, especially gratitude, and presence within virtual reality environments?

The review identified that there remained uncertainty over the relationship between emotion and presence and the explanatory theories used were dualist in nature (see Section 2.5). The enactive approach addresses these concerns. This led to two secondary research questions:

- What is the relationship between emotion, especially gratitude, and presence?
- To what extent can accounts of the lived experiences of emotion, especially gratitude and presence, within virtual reality environments, be explained using an enactive approach?

The review identified a gap in the literature; there was no enactive approach to presence or gratitude and no studies into the relationship between enactive emotion, presence or gratitude or even non-enactive gratitude and presence (see Figure 2.1). In order to understand the relationship between emotion and presence, a novel enactive approach to presence needed to be developed there needed to be developed (see Chapter 3) that aligned with the enactive approach to emotion.

Chapter 3 **A Novel Enactive Approach to Presence**

This chapter presents a novel enactive approach to presence (EAP), both spatial and social. No such approach currently exists, yet it is essential when applying the enactive approach to emotion (Colombetti, 2014a), introduced in Chapter 2, and to non-enactive approaches to presence, without involving contradictory theoretical underpinnings (see Figure 3.1). There is also a growing interest in the philosophical, cognitive and affective disciplines (Colombetti, 2013; Hutto, 2017; Kirchhoff, 2017; Micheal D Kirchoff, 2015) and in the enactive approach since Schubert and colleagues' (1999) and Riva and colleagues' (2004) early rejection of the enactive approach to presence left no such model for enactive based researchers and practitioners within the immersive field.
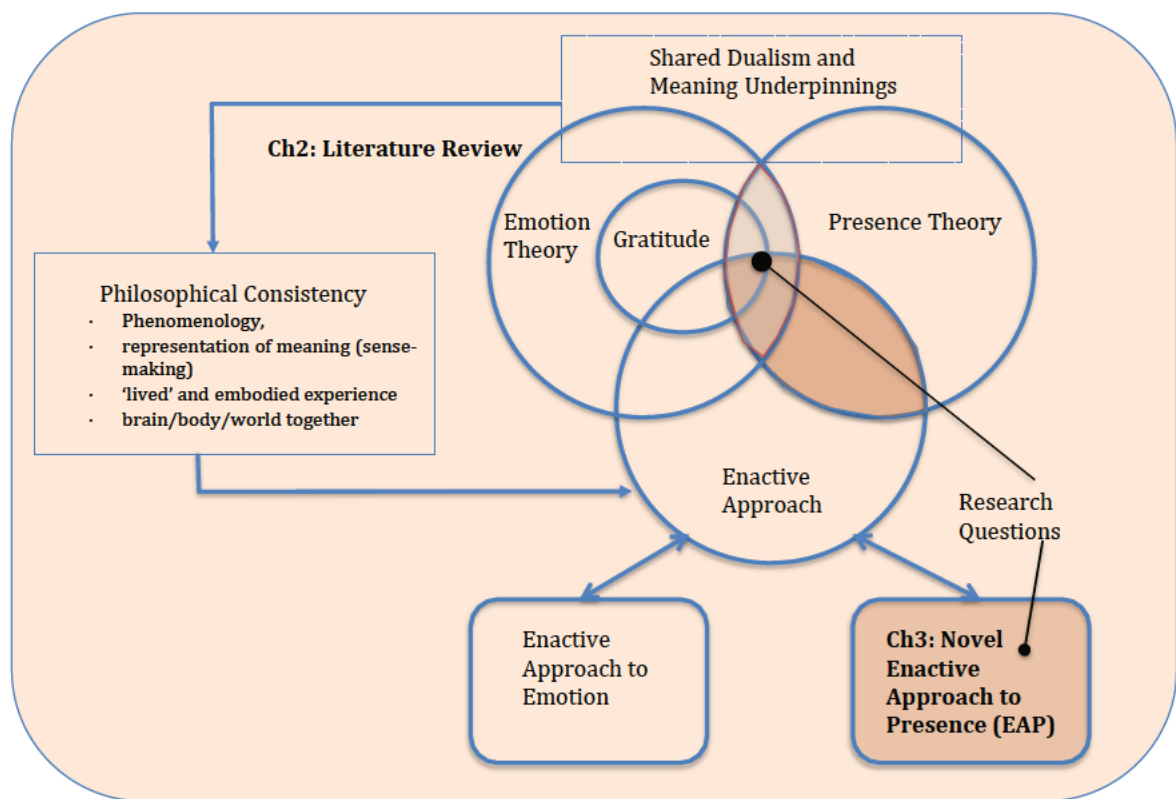
Figure 3-1: *Relationship between the EAP (Chapter 3) and the Prior Literature (Chapter 2)*

This Chapter first outlines the EAP (Section 3.1) then focuses upon where the emotional episodes are taking place that relate to presence, so highlighting the spatial aspects of being there (Section 3.2). The Chapter then continues to expand upon the feeling of being in a space (spatial presence) in Section 3.3. Spatial presence focuses upon the individual in the world, whereas social presence involves the relationship with others, and therefore expands beyond the individuals to the interactions between individuals, is dealt with in Section 3.4. Section 3.5. Identifies the criteria

against which the model is evaluated in Chapter 6. Section 3.6. provides a summary and conclusions.

3.1 Overview of the Enactive Approach to Presence (EAP)

In general, an enactive approach focuses on purposeful actions and reciprocal dynamic interactions with an environment by bringing together the mind/brain, mind/body, and body/environment. This places interactions with the environment, natural and synthetic, as of primary importance similar to the "successfully supported actions" (Zahorik & Jenison, 1998) approach to Spatial presence. This contrasts with perceiving an objective computer simulation then processing this perception in the mind with an emphasis on embodiment. This approach accepts that higher order conceptualisation is possible without mental models, rejecting approaches such as Glenberg's (1997) framework for embodied cognition, which argued that internal mental models are needed for such thinking and is adopted by Schubert et al. (1999) and Wirth et al. (2007) in their approach to presence.

The EAP applies the enactive approach to spatial presence (the feeling of being there) and social presence (the feeling of being with another), rather than emotion as discussed in Chapter 2. This enactive approach regards meaning as emerging from purposeful, self-sustaining actions of autonomous embodied organisms dynamically interacting with their environment; this is sense-making. Whilst both spatial and social presence are not unique to virtual environments, the EAP includes presence within such environments. As such, it addresses the role of the avatar's body along with the natural body, proposing that these exist in a near symbiotic relationship experienced as a single body (a phenomenological body). This Veerapen (2010) describes as symbembodiment. Consequently, the actions taken in a virtual environment are focused around this single body.
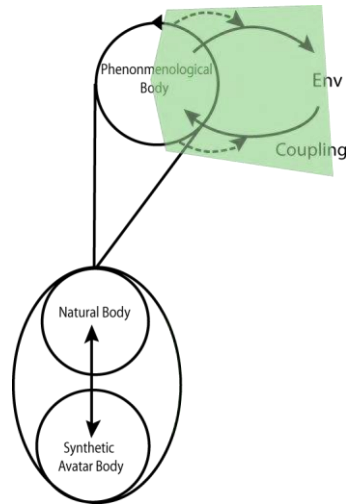
Figure 3-2: Enactive Spatial Presence. An Illustration of the dynamic interaction coupled between the environment and the phenomenological body from which Spatial presence emerges (Highlighted in the green area) at the level of the whole organism.

The principles of the EAP are consistent with the dynamical systems approach to emotional episodes (Colombetti, 2014b) as discussed in Section 2.1.2.

A fundamental element of this approach is that the body is dynamically coupled to the environment via the sensorimotor mechanism. An organism's actions are purposeful, so as to maintain its existence and wellbeing. It can modify its dynamic coupling so enabling a wider range and subtlety of interactions. The enactive approach to Spatial presence is illustrated in Figure 3-2 at the level of the whole-organism (omitting the internal bodily and neurological system). It is focused around the phenomenological body and emerges from the dynamic coupling between the environment and the organism (see the green area of Figure 3-2).

The key elements of the EAP are that:

- presence emerges from purposeful, self-sustaining actions (enaction) as meaning (sense-making) in a dynamic reciprocal interaction between the autonomous organism and the environment, not as a simulated world in the brain
- the dynamic reciprocal interaction involves sensorimotor coupling, as a dynamical system, which may be adapted by the organism
- dynamical self-organizing patterns (of presence) form in the same way as emotional episodes and moods
- presence emerges from dynamic interactions with the somatic neural system
- the locus is around an embodied organism (natural and synthetic together in a symbiotic relationship): the symbembodied self

- the enaction is scaffolded in a dynamic interaction with environment
- it is a felt experience.

For social presence, the EAP emphasizes: first the importance of social cognition within social interactions, second the importance of understanding the intentionality of others and, thirdly, the role of embodiment, which in virtual environments includes the role of the avatar body, and finally the role of direct coupling between individuals.

For social presence (see Figure 3-3), the EAP extends the key elements of spatial presence to focus upon the dynamic and reciprocal interactions (Froese, Paolo, & Ezequiel, 2011) between people as social agents (organisms, such as humans, with a capacity to interact socially). This sense-making is joint or participatory between all social agents involved in the interaction. From an enactive perspective, such participatory sense-making is considered Social Cognition. Riva and Mantovani (2014) regard Social Cognition as how people process social emotion. The research in this thesis involves two such agents interacting as avatars in emotional episodes, including acts of helping to trigger gratitude. From the EAP perspective, this interaction is a socio-cognitive interaction between symbembodied selves.
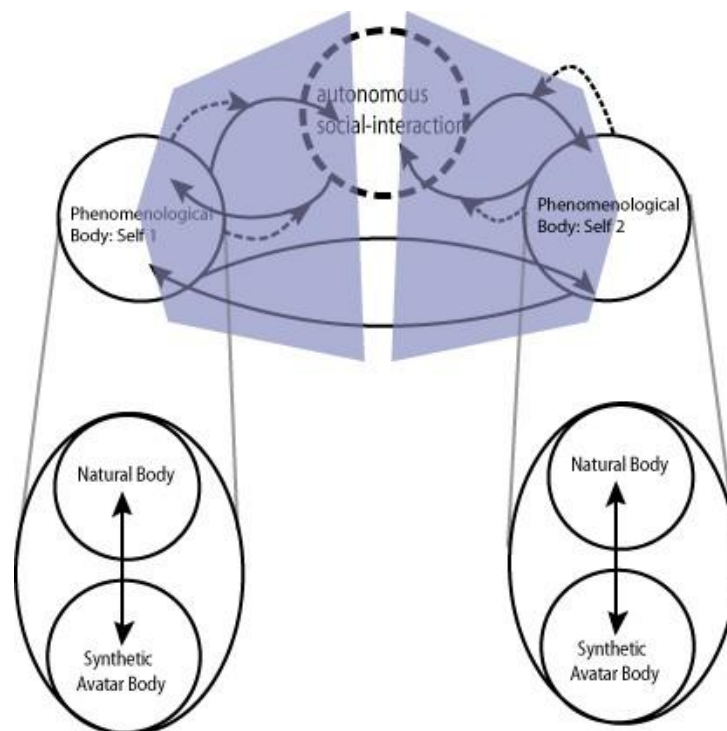
Figure 3-3: *Enactive social presence: the relationship to others. The Blue shaded areas are two emergent social presences of two social agents (Self 1 and Self 2). The Phenomenological Bodies are socially interacting and dynamically interacting a) with the autonomous social-interaction pattern (Dashed Circle). The coupling is in solid lines and the adaption to the coupling in dashed lines. During the social interaction the two selves also couple directly. This diagram is at the level of whole-organism's and their interactions.*

As these socio-cognitive interactions are themselves part of a dynamical system, they themselves form self-organising patterns with a measure of autonomous existence. An example is a goodbye that takes on a life of its own and is difficult for either person to end. The existence as an autonomous entity for a social interaction is far more precarious than for living organisms, as it is dependent upon the interactive agents' joint on-going interaction, energy and physical substrate to exist.

Figure 3-3 illustrates, for social presence, the mutual coupling with the social interactions and the co-regulation of this coupling (dashed arrow) between two social agents. The relationship is, however, dual asynchronous in that either person can ultimately end it and for each person the sense-making is from the perspective of themselves. In a virtual environment, this social presence as joint sense-making, for each individual's perspective its locus is around their phenomenological bodies. Social interaction is characterised by co-ordination, e.g. to give, requires co-ordination between a giver and at least one recipient. The areas highlighted in blue in Figure 3-3 indicate the body, interactions and coupling with the external world from which social presence emerges. Within social agents are further dynamical coupled interactions from which internally generated feelings emerge. There is therefore a balance between the individual and the coupled social interaction. In addition to the interaction having a sense-of sociality, social presence theory emphasises the need to understand the intent of others. This is only partially addressed by Froesse et al (2011). The EAP proposes that understanding the intent of others, over short periods, emerges from socio-cognitive interaction coupled with each social agent.

A socio-cognitive interaction has a shared goal, and, in participatory sense making, for it to continue, it needs to minimise surprisal (the difference between the actual environment and the modelled environment, within Bayesian logic) at the level of the interaction. Kirchoff (2015) describes this as "mutual predictive error reduction" between what the predicted intention is and the actual actions. The EAP therefore argues that in order to infer the intentions of others needed for social presence there have to be interactions that maintain it. This involves reducing the Free Energy or mutual prediction error. In turn, this requires maintaining co-ordination.

3.2 Where

This thesis focuses upon the relationship between emotion and presence. Emotional episodes must exist somewhere, but where? This is especially pertinent when dealing with virtual environments, where there is a potential conflict between the synthetic computer-generated place and the natural, frequently termed, 'real' place. The 'where' in question focuses upon where the person is, and where their body is during the emotional episode.

3.2.1   Where is the Person in all of this?

In the natural environment the issue of where a person is can be generally left as an implicit, unquestioned assumption. In synthetic environments, however, where the biological body cannot enter synthetic space, and a synthetic environment is not real (when real is defined as being the natural environment), this implicit assumption is challenged. This has triggered much research into presence within the "virtual" world community, particularly as to how 'present' people feel within such environments.

The EAP adopts a phenomenological approach and endorses Heidegger's (1927/1962) suggestion that there are two principal structural characteristics to being:

- Spatiality: the space is not around us but within us
- Being with: we exist not on our own terms, but only in reference to others.

These align with concepts of spatial presence and social presence. For Heidegger (1927/1962), the space we are in is not objective, Euclidian geometric space, but space as we experience it whilst going about out life: a phenomenological space. The room we may be sitting in is, to us, a room and not an objective arrangement of molecules travelling at great speed around the sun. We can never be in a non-space. The person, from the perspective of the EAP, is in a phenomenological space. On the Social side, the EAP adopts the approach that individuals cannot be considered only from the perspective of the individual, but how that individual perceives others. Whilst also endorsed by researchers into presence, such as Riva (2006), who adopt broadly phenomenological approaches to presence, the EAP focuses more fully upon the Heidegger's (1927/1962) rejection of dualism and places an emphasis upon the role of the body, discussed in the following section.

3.2.2   Where is the Body?

When interacting within a virtual environment, it is possible to have two bodies, a natural one and a synthetic one (a representative avatar), yet the locus of the interactions is the body. The EAP incorporates Veerapen's (2011) view that a symbiotic relationship forms between the

synthetic avatar and the natural body, which she terms 'symbembodied', utilizing a phenomenological body.

Veerapen (2010, 2011) conducted a 2½ year autoethnographic study, drawing on her direct experiences within the virtual world, Second Life, similar to the environment used in this doctorate's research, viewed via a desktop PC. She examined her experience using phenomenological analysis, with particular attention paid to Merleau-Ponty's (1962) approach to embodiment and its location. Merleau-Ponty's (1945/1962; 1967) philosophical approach is consistent with the enactive approach, in that it places all action and perception as located around the self's body. Our body is not just any object but as the locus of our action and perception is experienced as a body: a phenomenological body. She summarizes this as "the complex relation between self and place, enacted by and through the phenomenological body, resulting in emplacement (being-in-place)" (p. 1).

This thesis suggests that Veerapen's (2011) conceptualization of the symbembodied self can be applied not only to emplacement, but also to the loci of the emotions that do not lie solely within the natural world or in the biological brain, but in the sense-making of the multiple interactions between the symbembodied self and its environment (natural and virtual). Thus, emotional episodes, the associated cultural scaffolding, and the sense of being-in-place (spatial presence) are all orientated around the same locus, the symbembodied self.

The EAP contrasts with Veerapen's (2011) emplacement in that, whilst Veerapen focuses upon the embodied role of self, she does not place sufficient emphasis upon the biological structure and the deep continuity from simple organisms to complex social systems that the enactive approach used in this thesis (outlined in Section 2.2.1) does. The next section introduces the EAP as applied to Spatial presence.

3.3 Enactive Spatial Presence

This section describes the enactive approach to Spatial presence (the feeling of being there).

The EAP is a broadly phenomenological approach, where meaning emerges from purposeful, self-sustaining actions of autonomous embodied organisms dynamically interacting with their environment. There are other broadly phenomenological approaches (discussed in Chapter 2). One such is the model of Riva et al. (2004) which has similarities to the enactive approach, but only at the unconscious, immediate spatial and physical interaction level (proto-presence). The authors do use the term 'enactive', however, because action is central to their approach.

The EAP considers Spatial presence to be a felt experience. Spatial presence has been argued as a cognitive feeling (T. W. Schubert, 2009). However, it has been noted that Spatial presence can have affective qualities (feeling either good or bad: Schubert, 2009; Willans, 2012), and to this

extent, presence is similar to emotion. It is a felt experience. This thesis proposes that the EAP is consistent with dynamical systems theory (DST) (outlined in Section 2.1.2) and can also be applied to presence, consistent with Colombetti's (2014) DST approach to emotional episodes and mood.

The operational definition of the enactive approach to spatial presence proposed here is:

> *The felt experience of being there emerging from the purposeful, self-sustaining, actions (enaction) in a dynamic interaction between an autonomous embodied (natural and synthetic together) organism and its environment (natural and synthetic).*

EAP conceives that the space around an individual in a virtual environment can be described as an experienced or phenomenological space based around the self as the locus (Heidegger (1962)), as raised in Section 3.3.1. Heidegger (1927/1962) does not address the embodied aspects, but the enactive approach, adopted by EAP, emphasises that this locus lies around the embodied organism, consistent with phenomenological philosophy as argued by Merleau-Ponty (1962). As stated in Section 3.3, the EAP contends that this locus is around the phenomenological body (the symbembodied self) as proposed by Veerapen (2010, 2011). Veerapen (2010, 2011)focuses at the level of the whole organism ignoring the deep continuity from simple cellular organisms to complex neurological and social systems addressed by enactive approaches, such as the EAP, and is insufficient as an approach to Spatial presence. Figure 3.2, illustrating Spatial presence highlights this by describing the phenomenological body aspect of the self-constituting embodied organism as having an autonomous existence. This is illustrated in Figure 2-4.

The EAP emphasises the reciprocal dynamic sensorimotor coupling between the organism and its environment, in line with the enactive approach which draws upon a DST approach (Colombetti & Thompson, 2008; Thompson & Varela, 2001; Varela, Maturana, & Uribe, 1974). DST emphasises the role that attractors and repellors, both social and spatial, would have in the environment (virtual or natural) relative to the locus involved in this coupling. A visual analogy is given in Figure 2-6, as the attractors forming basins, or attractions and repellors forming peaks of a landscape (termed a state space) in the development of organs in a self-creating human body. From a DST perspective, control factors limit the range of possible attractors and repellors. An example is the maximum size an organism can be before it can no longer absorb oxygen directly but needs lungs. Similarly, attractors, repellors and control factors influence the self-organisational dynamical systems that contribute to the feeling of Spatial presence and can be located around the self. A major aspect to understanding the EAP is to consider it from the perspective of the coupling with the environment.

In the EAP, presence, in its interactions, can be considered as scaffolded by "Cultural Scaffolding" in a manner similar to Griffiths and Scarantino's (2005) approach, suggested in respect of emotion in Chapter 2. Griffiths and Scarantino (2005) focused upon the situated aspect of emotion, including meaning emerging from 'Skilful Engagement' with the environment, consistent with the enactive approach. The environment provides for the range of influencing and necessary factors in the coupling, including approach, control parameters and attractors affecting presence. These, potentially, include social, cultural, and implied spatial factors from the cultural scaffolding. If presence is located where phenomenologically you feel you are, then the locus will change, in line with both presence and emotion, and these will share the same locus and surrounding environment and many of the same drivers. Through this environment, the enactions (which will also be shared as they are from the same individual) will influence each other. Presence, as a dynamical system, will therefore shift attractors and repellors of the bodily state in a manner that is similar to how Colombetti (2014) suggests mood does, with attractors and repellors influencing other emotions. Colombetti (2014b) suggests that emotional episodes "recruit or entrain various processes (neural, muscular, autonomic, etc.)" (p. 69). The EAP argues that the same mechanism as applies to emotion generally applies to Spatial presence.

Enactive Spatial presence, as sense-making, emerges from the brain-body-environment coupling, marked green, in Figure 3-2. This is, in effect, a lived model of Spatial presence.

This section focused on the feeling of being in a space, the next section focuses upon being with others.

3.4 Enactive Social Presence

As for spatial presence, there is no enactive approach to social presence. This section presents the social presence aspect of the EAP.

An operational definition of enactive social presence is developed which is similar to that for spatial presence, except that it focuses upon the social dimension as follows:

> *The felt experience of being with other social agents emerging from the purposeful, self-sustaining, actions (enaction) in a dynamic interaction between autonomous, embodied (natural and synthetic together) social agents and their environment (natural and synthetic).*

The EAP regards social presence as requiring both social cognition, discussed in Section 3.4.1, and understanding the intentions of others, discussed in Section 3.4.2, whilst accounting for this experience to be in virtual environments as synthetic avatars, discussed in Section 3.4.3. The role of avatars is stressed as the research in this thesis involves the interaction between avatars in a

virtual environment. The EAP for social presence focuses upon dynamic and reciprocal socio-cognitive interaction (Froese et al., 2011) in a dynamical interaction between social agents (organisms need to have the capability to be socially aware) (see Figure 3-2). Such socio-cognitive interactions are participatory-sense making, which, for social agents, is enactive Social Cognition.

3.4.1   Social Cognition and Interaction

This section introduces the sense of sociality based upon an enactive approach to social cognition as proposed by Froesse et al. (2011), which is a core aspect of an enactive approach to social presence. The importance of social cognition is mentioned by Riva and Mantovani (2004) including emphasising the importance of intentionality for social presence. For the EAP, the processes involved in social cognition form a key part for explaining others' intentionality, a core aspect of social presence, as discussed in Section 3.4.2. This is not fully addressed by Froesse and Di Paulo (2011).

In the EAP, the enactive approach focuses upon the role of a coupling between an autonomous, self-maintaining, system, such as an organism and its environment, through dynamic interactions with the environment. Purpose, as sense-making, then ultimately emerges from the maintenance of this organism as an autonomous system. This coupling is regulated and adapted. Regulating and adapting couplings is the primary way in which dynamic interactions are changed.

For social cognition and social presence, an organism needs to have the cognitive ability to track "other" rather than just self (Froese et al., 2011). The authors argue that complex organisms, such as humans, with a nervous system, are able to do this. In order to maintain their existence and wellbeing, simple organisms, such as bacteria or the very early stages of a human embryo, only need to focus upon maintaining their internal metabolism within a narrow range e.g. between the maximum and minimum body temperature needed for well-being. This is akin to Damasio's (1999) and Riva's proto-self (2004). However, more complex organisms with a neurological system are able partially to decouple their dynamical systems. This provides for the coupling to become a system which is more open to outside influences, albeit still through the mechanism of structural dynamic coupling. Complex organisms with organs such as a nervous system are still autonomous structures. For this reason, the definition of social presence published in Willans et al (2015) has been modified to refer to social agents rather than the more generic term organism. This reflects the fact that social presence is confined to organisms from whose structure has emerged a more flexible ability to focus upon "otherness". This provides for a wider range of activity and a more complex cognitive domain that includes social cognition, as defined by Froesse et al. (2011), as "regulated sensorimotor coordination whereby the other is recognised at such" (p21)).

The sensorimotor coordination that emerges from the dynamical interaction between social agents is known as the socio-cognitive interaction. Socio-cognitive interaction is a form of participatory sense-making. That is, instead of sense-making being reliant upon the sensorimotor interactions by a single autonomous being, as for spatial presence, the sense-making is a result of two or more beings. An example from benefit-induced gratitude examined in this thesis is that the act of giving requires a giver and a recipient. Such coupling with a socio-cognitive interaction tends to orientate those interacting social agents towards a shared goal associated with this participatory sense-making.

Sense-making, such as the feeling of social presence (The shaded area in Figure 3-3), is therefore a balance between the sense-making of an individual agent (which actually feels) and the joint sense-making.

The two or more social agents as dynamical systems coupling lead to the interaction emerging as an autonomous dynamical system itself. Thus, the socio-cognitive interaction develops a property of autonomy, albeit dependent upon the energy and enaction of the interacting social agents. To maintain social interactions requires co-ordination and for the interaction to maintain its existence and overcome the tendency to disorder (entropy). Such activities themselves have goals, albeit being modified. This dependency upon the social agents makes most interactions temporary.

The next aspect of social presence is that of understanding the intentions of the Other.

3.4.2 Other's Intentionality and Order

Social presence theories emphasise that in the feeling of being with another, the other is a sentient social being with intelligence and intent and an understanding of the intent of the other. This is variously described as empathy, "understanding the reality behind the mask"(Mennecke, Triplett, Hassall, Conde, & Heer, 2011), or as Riva and Mantovani (2014) state " social presence" – which enables the Self to identify and interact with the Other by understanding his intentions" (p.11). The EAP has a distinctive approach to this, which is presented in this section. Riva and Mantovani (2014) argue that this involves a "comparison between the expected intentions and the perceived actions", however, they attribute this to an internal meta-cognitive process, i.e. the formulation of an internal model rejected by the enactive approach. The EAP utilises an enactive variation on the meta-cognitive process.

The EAP proposes that we can infer the intentions, i.e. predict, for short periods of time when social agents are dynamically coupled in an enactive socio-cognitive interaction.

Riva and Mantovani (2014) propose a "forward dynamic model" that generates a prediction of the consequences of performing a motor command. This prediction is compared with the actual sensory feedback, with errors derived from the difference between the predicted state and actual state used to update the internal model and improve the performance. This is the same internal cognitive Bayesian Brain approach to cognition utilized by Friston and Frith (2015) and Seth and colleagues'(2012) approach to Spatial presence.

Instead, the EAP adopts the enactive formulation of the Free Energy Model, as proposed by Kirchoff (2015). Hence, as this Shannon-Entropy (Shannon, 1948) form of Free Energy is reduced, there is a tendency to more order (i.e. less loss of information). This is a move to more order, such as a stable metabolic state of an organism, however, it applies to all autonomous dynamical systems, including the autonomous socio-cognitive interaction that emerges within a social interaction. Prediction Errors are the difference between the internal general model of the world as expected and the structures of the environment. This difference is known as surprisal. This surprisal relates dynamics between the external environment and internal environment (via dynamical coupling). Maintaining more order involves minimising this surprisal. This is done by acting to maintain its internal state e.g. moving to an environment of the right temperature to exist. The alternative is to adjust the generative model to match the environment, i.e. improve the prediction. However, from the enactive perspective, the generative model is not just brain or bodily bound conceptualisation.

An enactive generative model is not a probability modelled within an organism's internal environment but is represented in the brain-body-world (the world has to be within the niche that the organism or structure can exist in). Adjusting the couplings of the bodily sensorimotor or bodily neurological dynamical systems, in both cases, is adjusting this generative model. The action and interaction is sense-making. Hence, social agents exist in a world of meaning. Social Interactions involved in social presence involve socio-cognitive interactions. A socio-cognitive interaction has a shared goal, and in participatory sense making, for it to continue, there is a need to minimise surprise at the level of the interaction. Kirchoff (2015)describes this as "mutual predictive error reduction." Kirchoff (2015) highlights Friston and Frith's (2015) argument that:

> *If there is a shared narrative or dynamic that both brains subscribe to, they can*
> *predict each other exactly, at least for short periods of time… when two or more*
> *(formally similar) active inference schemes are coupled to each other… the*
> *result of this coupling is called generalised synchronisation (p. 391)*

Friston and Frith (2015), however, utilise their non-enactive Free Energy principle, to include internal inference as an "active inference scheme". For the EAP, the "shared narrative" is the participatory sense-making and involves the autonomous socio-cognitive interaction in coupling the social agents. For the enactive approach, the model is not an internal model, but is

represented in the brain-body-niche coupling, an environment suited to the well-being focused around the individual social agents, i.e. from the perspective of each social agent. From adjustments of such couplings between individual autonomous social agents and a shared autonomous dynamical system, the shared narrative emerges and is modelled or represented as one system. There is, therefore, a balance between the autonomies of the individuals and that of the interaction. Ultimately, however, the interaction is dependent upon social agents.

Active inference, in non-enactive terms, involves acting on the environment to alter the sensory input (as the environment is now different). This is sense-making. From the perspective of the EAP, social presence involves joint-sense making. The social agents are therefore coupled in a manner in which they can predict each other. This involves a mutual predictive error reduction (errors are more disordered, hence increased entropy) with reducing the Free Energy of the autonomous socio-cognitive interaction, and it thus requires the shared interaction to be maintained. The EAP therefore argues that, in order to infer the intentions of others, needed for social presence, there have to be interactions that maintain it. This involves reducing the Free Energy or mutual prediction error. In turn, this requires maintaining co-ordination.

3.4.3 Virtual Environments

In one sense, the avatar is a tool, as is the whole computer system. EAP emphasises the embodied nature of the avatar and that it is a focal point for social interactions. EAP agrees with Mennecke at al. (2011) that the avatar, however, allows for a greater richness of interactions than non-avatar based communications, e.g. Facebook. This provides the many dynamical attractors, repellors and controllers influencing the dynamic interactions and their coupling. The EAP focuses upon the avatar as a symbembodied self, as for Spatial presence discussed in Section 3.3.

Social presence emphasises the distinction between Self and Other. The EAP regards the social agent as being defined in relation to others. This is an inherent property of being (Heidegger 1962/1926). To this end, EAP agrees with Froesse at al. (2011) that self may be a process of individuation from others, rather than an internal calculation of otherness.

3.5 Evaluation Criteria

The role of the EAP in this thesis is to provide a coherent lens consistent with enactive approaches to emotion. As a novel approach to presence theory, its explanatory value in providing fresh insights into the relationship between emotion and presence is evaluated.. Contrary and Inclusive evidence is considered. This is presented in Section 6.4

3.6 Summary and Conclusions

This chapter presented a novel approach to presence based upon enactive principles. This thesis is focused upon the experience of presence and emotion. The EAP enables the developing body of research based upon the enactive approach, as applied to emotions (Colombetti & Thompson, 2008), to be related to presence. The literature review (see Chapter 2) reveals that this enactive approach, as understood by Varela et al. (1991/1993), has not been applied to emotion or presence in virtual environments. This gap for presence leaves conflicting theoretical and philosophical underpinnings when relating the EAE to synthetic environments. The EAP involves two aspects of presence: spatial and social. In both cases they involved dynamic coupling between the environment, and, for social presence, a dynamic interaction between individuals. Spatial and social presence are represented in the dynamic interactions between the individuals and the environment. For social presence, this involves a balance between an autonomous interaction or joint sense-making and the individual. These are indicated as shaded areas in Figures 3-2 and 3-3.

Chapter 4 Research Design

This chapter presents the rationale and justification for the approach, methodology and the methods for collecting and analysing the data chosen.

This thesis aims to provide a fresh insight *into the experience of emotions within virtual reality environments*.

The primary research question is:
"*What are people's lived experiences of emotion, especially gratitude, and presence within virtual reality environments?*".
This is followed by two complimentary secondary questions:

- Secondary RQ1: What is the relationship between emotion, especially gratitude, and presence?
- Secondary RQ2: To what extent can accounts of the lived experiences of emotion, especially gratitude, and presence within virtual reality environments be explained using an enactive approach?

Prior quantitative experimental research suggests a relationship between emotion and presence, from which Secondary RQ1 was derived, and that this relationship is generalised across all individuals. Gratitude is a specific case of the general principle, which has not been studied previously in virtual environments, and there was pre-existing gratitude induction procedure (Bartlett & DeSteno, 2006a) that could be modified to create a virtual world experience. An analysis of prior literature identified concern over dualism relating to both emotion and presence, potentially addressed though a growing body of research using an enactive approach (see Section 2.2). In order to gain a better insight into how the lived experience of emotion and presence could be explained from the enactive perspective Secondary RQ2 was derived. Such an enactive approach to emotion existed (see Section 2.) but no corresponding enactive approach to presence (EAP) did so one was theoretically derived (See Chapter 3). The research design used in this thesis aims to gather empirical evidence of people's experience of emotion and presence which can then be used to identify any fresh insight into the relationship between emotion and presence that the enactive perspective may give, which in turn evaluates the novel EAP theory. This thesis, therefore, aims to inform theory rather than identifying causation in terms of statistical generalisation across a population or build a bottom up theoretical framework. It is not an experimental approach and no hypothesis is tested, although one potential outcome of this research could be to develop such hypotheses.

These aims are addressed using a qualitative inductive and idiographic approach, Interpretive Phenomenological Analysis (IPA), which draws upon hermeneutic, idiographic and phenomenological principles. This is followed by recontextualising the participants' interpretations through an enactive lens using the EAP. This provides a rigorous insight into the implications of applying the enactive approach to the experience of emotions within virtual

reality environments obtained using IPA. IPA was adopted as it focuses upon the participants' "understandings, experiences and sense-making activities" (Smith et al., 2009, p47) where the lived experience is considered to be formed from sense-making activities in this thesis so addressing the primary research question. The abductive process focuses upon the relationship between emotion and presence, including gratitude (Secondary RQ1) and applying the enactive lens (Secondary RQ2). The analysis and findings are discussed and evaluated in relation to other salient theories in Chapter 6.

The virtual environment's context is artificial, a gratitude inducing scenario has been engineered and some numeric data is used, however it differs from an experiment in four main ways: First there is no hypothesis testing; secondly, no dependent or independent variables are defined; thirdly, there is no focus upon causation and finally, the design does not control and manage confounding variables.

The IPA Framework is an established inductive methodology, with associated methods (discussed in Sections 4.5 and 4.6) and paradigms. It is consistent with the enactive approach to meaning utilised in this study and suitable for human-centred research from an enactive perspective. From the enactive perspective, emotion is regarded as an unfolding episode. This follows the phenomenological approach to lived experience associated with Heidegger (1927/1962) and Merleau-Ponty (Evans & Lawlor, 2000; Merleau-Ponty, 1945/1962; Merleau-Ponty & Fisher, 1967).

The main study's focus is upon emotional episodes where emotion, especially gratitude, and presence during these episodes are experienced. These episodes take place in a virtual environment where two avatars, one the participant and the other a confederate, interact. The confederate helps the participant to complete a boring exercise, so intended to lead to gratitude. The context is slightly varied: helping or not helping; low presence or higher presence; using a standard laptop display or using virtual reality headsets. This main study is preceded by three development studies: a first pilot evaluating the developed virtual environment, a questionnaire evaluating the impact of the avatar's appearance and a second pilot evaluating modified virtual environment, gratitude induction and the interview protocol.

A range of data is drawn from two sources: rich in-depth contextualised data, including interviews, and self-report Likert scale questionnaires. The primary source of data is the interview accounts essential for obtaining the participant's understanding of their experience. The secondary aspect of this research is where external theory is used to gain insight into the participant's accounts and how these accounts relate to other theories. The abductive phase involves recasting findings of Chapter 5 from the enactive perspective, which is then contrasted with other current approaches. This abductive phase aims to understand from an external perspective, the participant's account, the nature and factors involved between emotion,

especially gratitude, and presence and enables an evaluation of the explanatory value of the enactive approach to presence.

The synthesis of qualitative and quantitative data is not uncommon (Creswell, 2014; Pope, Popay, & Mays, 2007). This thesis adopts an interpretive approach to the synthesis of quantitative questionnaires in line with arguments by Sandelowski (2013) who rejects the binary distinction between quantitative and qualitative and argues that:

> "Closed-ended highly structured questionnaires are typically used to draw formal generalisations from probability samples to populations, but they may also be used to draw particularising generalisations from and about purposefully selected cases" *(Sandelowski,2013,p.6)*

These questionnaires give a directly comparable measure of how particular individuals in this particular context would have answered, so enabling idiographic comparison with the rich and detailed account obtained via IPA interviews.

The chapter ends by discussing, justifying and critiquing the pre-studies and pilots which were used to inform and develop the main study (section 4.8). The measures taken to ensure the validity of the study are discussed in section 4.10. Ethical issues involved in carrying out this research and how they were addressed are discussed in section 4.11.

4.1 Positionality (Personal Stance)

Both critical realism and Interpretative Phenomenological Analysis used in this study emphasise that knowledge creation is interpretive and influenced by culture and history. This applies to the participants' and the researcher's involvement, to choosing an enactive approach, interviewing and analysing research data and evaluating the enactive approach to presence. Reflecting on the undertaking of this thesis has enabled me to be aware of preconceptions that may hamper having a mind that is open to new knowledge and listening to the views of the participants. Therefore, I will present here a reflection upon my background and the personal approach and pre-conceptions that have influenced my approach, evaluations and judgements related to this study.

My view of knowledge creation as interpretative and influenced by a person's context is consistent with the critical realist approach adopted in this study, it is therefore necessary to make my personal stance explicit. I accept the approach that there is an actual world; there are actual interactions and that these interactions may but not always (due to complex interactions) lead to actual events, especially for social interactions. However, as humans, we can only understand these potentially observable events through our interpretation.

I had pre-conceptions about the subject of this research. I have prior experience of the virtual environment Second Life which is almost identical to the environment used in this study. There I experienced a high intensity of many emotions, especially social emotions, and intense spatial and social presence that surprised me and went beyond that of social media, such as Facebook.

This experience, combined with my reading of prior theory and development of an EAP, may have influenced my interviewing and interpretation of the evidence, and there can be a tendency to interpret the participants' experiences as similar, and to be more open to cues which suggest a similar experience. In addition, during the analysis, I may have been more open to identifying the relationship I expected but was not certain about: that high presence environments would be highly emotional. Consequently, I made a conscious decision to remain open to alternatives, which drew me towards the rigour of keeping to an existing framework such as IPA. The adoption of IPA itself and my attempt to understand the philosophy behind it (Riva, 2011) may have influenced my identifying aspects such as intentionality which would not be expressed or assumed by the participant themselves explicitly.

Most of my foreknowledge preceded studying for a PhD. From an early age I tried to make sense of my and others' place in the world. As a child, I wondered about death, tried to conceive of nothingness and even tried to have no emotion or feelings. I failed in having no feelings; I still loved and cared, wondered and hurt. When someone helped me, I could feel grateful. Emotion was central to being human and being me.

This sense of self, association with others in the world, centrality of emotion and role of death is reflected in the adopted enactive approach and the influence of a key philosopher, Heidegger (1927/1962). In the enactive approach, purposeful actions and meaning are derived from maintaining self-existence and the precarious nature of life (Varela, Rosch, & Thompson, 1991/1993). Similarly, Heidegger (1927/1962) considered being both in space and time. His fundamental 'moods', such as angst towards a future death, meant that actions are always meaningful. This is consistent with the enactive approach to emotion. (Colombetti, 2014; Slaby & Stephan, 2013).

At the heart of the literature, the enactive approach and the research design utilising critical realism, is the divide between objective-functional approaches and interpretive approaches. I came to this research initially with two views of truth, which made me open to both approaches. One was grounded in my interest in meteorology and computing and the other from my spiritual life. In my early career, I had joined the UK Met Office, where there is a strong tradition of the classic hypothetico-deductive approach and a focus upon predictive modelling of forecasts. This was emphasised in meteorology training and associated research. It was here that I learned to value objectivity and logic and developed a presumption that understanding the world meant statistical generalisation to a population. This provided my primary model of research and was

emphasised as the true way to do research; a view I revised whilst undertaking this PhD. Reading the ontological and epistemological arguments whilst trying to understand emotion made me question assumed ways of working and, importantly, the role of interpretation in research, although this questioning also drew upon my past questioning.

I continued to try to make sense of my place in the world. I prayed, as do many in my culture. I prayed, not to Jesus but to any divine being. In response I felt a connection, awe and a one-ness that had a breath-taking intensity. My experience resonated with the concept of transpersonal gratitude. From my spiritual experience, I consider the truth to be interpretive in nature. I read the Bible, which to me is a narrative about people living and experiencing the world and their connection with the divine. I found that the Bible had to be interpreted in its entirety as understanding the divine through these narratives. Unwittingly, I had adopted a broadly hermeneutic approach. This hermeneutic approach to phenomenology (traceable back to Heidegger (1927/1962) is a cornerstone, along with idiographic aspect, of IPA and may have influenced my acceptance of it.

My spiritual experience may also have influenced my acceptance of critical realism, with its interpretive approach to theory development. This is similar to my approach to assessing the truth of entities such as God who cannot be directly observed or tested. As the divine is impossible to prove or test, truth in this context can only be addressed through rational argument and faith, drawing upon my experience of the world, my emotions, my prayer, meditation and the testimony of others. My experience of the world includes scientific evidence, which is said to be objective. There came a point where I had to believe not prove. My faith was based upon my evaluation of what seemed credible based upon the evidence to hand and was not totally blind. This is like the critical realist approach that "Our interpretation is always fallible or epistemically relative, but this does not mean that all theories are equal, or that there are not rational grounds for choosing between them" (Mingers 2011). I acknowledged that others' experience and views of life may differ from my own, such that different individuals in differing cultures could make different conclusions. This also introduced the concept of differing views of truth, such as differing religions. This attitude makes it easier to accept that different participants may have a different experience of virtual reality than me, but I had to accept their interpretation. However, the reality under investigation is their experience, not whether their experience was correct. However, I privileged one truth over the other. In this thesis, especially the discussion section (Chapter 6), I judge the evidence from this research in the context of prior research, whilst respecting others' views.

4.2 Boundaries and Context of the Study

Through exploration of the novel enactive approach to presence, this research aims to provide a deeper understanding of the experience of emotion and presence, especially gratitude, within a virtual reality environment. It aims to provide fresh insight rather than identifying causation and aims to inform theory rather than to generalise across a statistical population. The enactive approach involves the mind-body-world interacting together. This thesis, however, focuses on the close interactions of up to three humans at the social level, rather than the neurological aspects, group or wider societal aspects which are considered beyond the scope of the study. It further excludes from study the supporting IT infrastructure and associated conditions such as cybersickness.

4.3 Research Paradigm

This thesis draws upon idiographic, phenomenological and hermeneutic traditions rather than positivist paradigms typical of experiments. It places this within a Critical Realist research paradigm, with consistent ontological and epistemological underpinnings with both IPA and the enactive approach used to address the primary and secondary research questions. There is a balance between the particular (idiographic) and the general (drawing upon norms) such as a particular theme from individual participants and shared themes from multiple participants.

Critical realism incorporates the interpretive aspects typically associated with qualitative research and views of reality as mind independent, typically associated with qualitative research yet grounded in an actual reality. According to critical realism, knowledge including concepts of causality are considered as a "social and historical product" and this approach:

> *"analyses causality in terms of the nature of things and their interactions*
> *rather than objective measurement of facts to identify repeatable fixed laws"*
> *(Bhaskar, 1978, 1989; House, 1991; Robson, 2002)*

The limitations of relying upon repeatable fixed laws for social research leads critical realism to emphasise the importance of intensive case studies; an idiographic approach. The critical realist paradigm is not just about causation. The secondary research questions involve recasting the enactive theory using abduction, a major mode of inference used within critical realism which Danermark et al. (1997/2005), quoting Habermas (1972), describes as "a mode of inference broadening our knowledge and stimulating the research process"(p.94).

The enactive approach draws upon a phenomenological and hermeneutic tradition of Merleau-Ponty (1945/1962; 1967), and Heidegger (1927/1962) with a situated, embodied and dynamical approach to knowledge creation. From this perspective, humans inhabit a world of meaning or sense-making. It is exploring the participants sense-making of their emotional experience and presence within virtual environments that is the focus of the primary research question. The EAP is an enactive approach from the autopoietic (self-creation) perspective (Varela et al., 1991/1993). These approaches to knowledge creation and autopoiesis are shared with Mingers' (1995, 2001) framework bringing together critical realism and autopoietic systems with information systems theory.

Mingers' (1995) argument, from autopoietic principles, is that the self-organising organisms form more complex organisms and the purposefulness of their interactions with the environment give meaning in the cognitive domain of humans. Thus meaning, for humans, is derived from their lived experience not from the objective facts, in line with arguments by Maturana (1980). His approach, like concept relates back to the phenomenological traditions of Heidegger (1927/1962) and Merleau-Ponty (1967; 1945/1962) amongst others. However, unlike Maturana's (1980) support for a purely interpretive approach, Mingers (2001, 1995) argues that as this meaning generation (as sense making) derives from the structure of autopoietic organisms purposefully and dynamically interacting with the structures of the environment, in line with the critical realist view which is also a key part of the enactive approach.

This section has justified the adoption of the critical realist approach in terms of its coherence with the enactive approach (Varela et al., 1991/1993) and demonstrated a consistency with the phenomenological, hermeneutic and idiographic approach in this thesis. It extends existing theory and usage by Mingers (1995, 2001) in the fields of information science into the enactive approach and argues that humans inhabit a world of meaning or sense-making. The critical realist approach also embraces abduction. Understanding the sense-making of the experience of emotion and presence is the primary research question.

The next section justifies the methodology for this study consistent with both critical realist and the enactive approach including IPA.

4.4 Methodology

This section justifies the choice of methodology in this thesis. This research draws upon the idiographic (the particular), phenomenological and hermeneutic tradition rather than positivist experimental approaches typically involving an experimental approach. It does this in order to focus upon the lived experience of the participants, as they encounter presence, emotion and being in a virtual environment and address the primary question.

This involves two aspects: an broadly inductive approach using IPA and an abductive approach through the enactive lens using the EAP. IPA not only draws conclusions from shared interpretations by many individuals but also the particular experience of an individual, but in all cases, this needs rich contextual data to provide the evidence.

This research aims to gather a rich, participant interpreted experience of presence and emotion during the virtual world exercise through semi-structured interviews. Qualitative, inductive studies can be very open to the kinds of responses obtained but provide the richness wanted. The risk is that these responses may not address the research topic and led to a number of interviews being discarded on these grounds (see Annex J). As feelings of emotion occur in all human interactions and presence is widely reported, it was considered highly likely that IPA would provide responses in the areas wanted without unduly constraining them. This influenced keeping the broad topic of emotion when focusing upon gratitude.

The inductive methodology used in this thesis is IPA, and it follows the recommended 6 steps approach by Smith et al. (2009). IPA is drawn from three philosophical traditions: idiographic, phenomenological and hermeneutic.

Critical realism advocates intensive case studies in the social sciences. This aligns with the idiographic underpinnings of IPA which evaluates at the level of the individual.

Larkin et al. (2011) argue that IPA is also an appropriate methodology for research from an enactive perspective, as in this thesis, with the shared emphasis upon sense-making and interpretation of lived experience. Like the enactive approach, its philosophical underpinnings draw upon the hermeneutic phenomenology of Heidegger (1927/1962). IPA is focused at the level of the whole individual, which is needed for this research, but which is not suited to other aspects, such as the neurological aspects, which are beyond the scope of this thesis. Such phenomenological and hermaneutic approaches align well with the critical realist paradigm as argued by Mingers (2001, 1995) and hence IPA which also has similar phenomenological and hermeneutic underpinnings.

Whilst IPA involves the researcher's interpretation of the participants' interpretation of their experience, it remains grounded in the interpretation of the participant and does not have an externally imposed theory applied by the researcher. This thesis, however, is interested in imposing an external theory to understand the relationship between presence and emotion (RQ1-4) from an enactive approach and evaluating the EAP. This requires an abductive approach which, in the context of critical realism, is described as:

> *Abduction is thus an inference where redescription or recontextualization is the central element. By means of abduction we recontextualize and reinterpret something as something else, understanding it within the frame of a totally different context. In this way we introduce new ideas of how individual phenomena are part of the structure and internal relations.* (Danermark et al. (1997/2005).

Danarmark (1997/2005, p. 93) describes three forms of abduction; undercoded, creative and overcoded:

- Undercoded abduction abduction is that "mode of inference characterized by automatism and naturalness. It is a matter of spontaneous interpretations.
- Creative abduction "when a researcher observes something from a frame of interpretation that nobody has used before?". Danermark further emphasises
- Overcoded abduction focuses upon we "choose between a number of possible frames of interpretations or theories."

Undercoded abduction has occured within the overall inductive IPA stage which recognises that there is always an interpretation by the researcher. However, IPA incorporates and manages this to maintain a closeness to the participants' interpretation. This abductive stage focuses primarily on the creative and overcoded abduction.

As an overall basis for the study design, therefore, IPA provides a specific means to interpret the experience of the phenomena associated with emotion and presence. This methodology is applied to provide an analysis of the experiences of the participants within the virtual world, followed by an abductive reconceptualisation of these experiences from the enactive perspective, to explore and evaluate the enactive theoretical approach including the EAP developed in Chapter 3.

The next sections discuss the specific study design and methods used to address the research aspect of this thesis and the first four research questions, concerned with the relationship between emotion and presence.

4.5 Study Design

This section translates the high-level methodologies of critical realism and IPA, as outlined in the previous section, to the specific method of the study. As the study aims to gain an understanding of the individuals lived experience and provide the evidence to engage and inform theory in contrast to experimental studies aiming to identify causation and generalising across a population.

Drawing from the critical realist paradigm and methodological principles discussed in sections 4.2 and 4.3, the research design outlines three phases, all of which share a common core which has evolved from taking an initial prototype fixed study design and platform, used in the first development phase, piloting a refined version of the prototype, and, finally, carrying out the main study, as modified in the light of the pilot. A separate questionnaire-based study was used in the development phase to show how participants may respond to the appearance of avatars. This is discussed later in section 4.8.2.

The enactive view contributed by Chapter 3 leads to a research design focused around the lived experience of participants interacting in four contexts embracing an unfolding emotional episode within a virtual environment.

MAIN STUDY OVERVIEW

The main study has a design involving pairs of people, in the non-computer-generated world, interacting with their environment and together via avatars (character representations of themselves) in a computer-generated virtual world to induce the emotion gratitude.

This interaction forms an emotional episode (or a contrasting non-emotional episode where the resultant emotion does not occur) through which the social-emotion gratitude is generated, consistent with a situated approach investigated in this research. The exercise is based upon the gratitude induction procedure devised by Bartlett and DeSteno (2006b). Their induction procedure involved participants undergoing repetitive tasks where a problem occurs at the last moment with the video monitor displaying the results they need to write down (in the original a faulty monitor connection). The virtual world adaption used in this study has a script enabling a virtual button that needs to be pressed upon completion to send the results to a database. One "participant" (a confederate) then helps fix this so preventing the main participant from having to redo the boring tasks.

As a virtual environment the context is artificial and a gratitude inducing scenario has been engineered but this is not a scientific experiment as there are no hypotheses being tested,

variables defined and the environment is not designed to control or manipulate variables. Unlike experimental studies which may need multiple studies examining one variable at a time this is qualitative study which captures a large amount of rich data and multiple factors per individual so needing only one main study. Other studies were needed, however, to evaluate and pilot the research environment and study design (see Section 4.8).

The primary source of evidence is from semi-structured interviews which aim to gather rich contextual data about the participants' understanding of their experience. This is supported by the use of self-report questionnaires into aspects such as presence, gratitude and whether the ruse and study purpose were identified which provides numeric data. This is summarised in figure 4-2. This is discussed in more detail in section 4.5 and section 4.6.

An outline of the procedure is as follows:

Welcome, inform and obtain consent, fit equipment.

Phase 1: In-world training and familiarisation in the environment.

Complete demographic and initial self-report questionnaires into prior anxiety.

Phase 2: In-world baseline emotions in a neutral in-world park environment.

Phase 3: In-world introductions and meeting the confederate.

Complete self-report questionnaires into presence (spatial and social).

Phase 4: In-world Box Pushing/Button Pressing exercise with either gratitude induction or not (see Figure 4.3).

Complete self-report gratitude and presence (spatial and social) questionnaires alongside a check whether the true purpose of the study has been identified and scenario plausibility check.

Questionnaire into the levels of gratitude

Semi-structured interviews, incorporating video stimulation.

Finish by debriefing the participant, including revealing the use of a confederate, and thanking participant.

	Training		Neutral Park		Introductions	Meet Alone	Exercise	Gratitude Induction		
Semi-Structured Interview										[red]
Affect/Anxiety self report		[yellow]								
Presence self-report (spatial and social)									[yellow]	
Gratitude self-report									[yellow]	
Genuine Confederate & Study Purpose Check.									[yellow]	
Video	[yellow]		[yellow]		[yellow]	[yellow]	[yellow]	[yellow]		
Lab Notes + Diary										

Figure 4-2 Schematic layout of main research fixed study design. The yellow blocks indicate when data is collected. The semi-structured interview is highlighted in red to indicate the primary importance attached to this measure.

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Figure 4-3 Pushing Box exercise (LHS) and Button to press at the end of the exercise (RHS)

The next section discusses the selection of these participants.

SELECTION CRITERIA

This section presents and justifies the criteria and number of participants selected for the study. It justifies the purposive selection criteria which aim for a homogeneous group, omitting those with characteristics, such as mental health problems, which may mask the effects being researched. Participants were selected using purposive sampling. The participants were

obtained from Coventry University through adverts across the university. Their details were logged into a spreadsheet and they were allocated to each of the four laptop/Oculus Rift, Helped or Not Helped randomly in order to avoid personal bias, and to ensure a representative sample. There may, in practice, be an element of 'snowball selection' as participants tended to refer their friends.

The selection criteria were therefore that all participants: a) are studying for a degree or have completed a degree at an English-speaking university b) have no current serious mental health problems and c) have normal eyesight when corrected by glasses and d) do not have photosensitive epilepsy or migraine. The final criterion was introduced to ensure the safe usage of the Oculus Rift virtual reality headset. Adverts were circulated at the main student hub, in the engineering and computing faculty main building, the research students' Facebook group. The educational criteria exist because this study focuses upon emotion and gratitude in the English-Speaking culture as different languages and cultures have differing expressions and, arguably, emotional responses. Universities also require a level of fluency which was needed by the participants to express their experience with the richness desired. The mental health criterion is because those with such conditions may have a range of factors peculiar to their condition and so be outside of the scope of this study. The final criteria are to ensure participants can safely use the virtual reality headset.

PARTICIPANT NUMBERS

Fifty-five participants were involved in the research. Eighteen participants were interviewed, 14 during the main study with 4 interviewed and 37 surveyed (excluding incomplete responses) during the pilot and development stages. In the main study only eight were considered to pass a pre-determined quality threshold for the interviews being suitable for IPA and address the research questions (see Appendix J). The strength and justification for using IPA is its analytic depth and rich contextualisation to inform theory rather than an aim to be statistically representative of a wider population.

In accordance with IPA, the number of participants needed was not determined ahead of time, but rather determined by "the degree of commitment to the case study level of analysis and reporting; the richness of the individual cases; and the organisations constraints one is operating under" (Smith, Flowers, & Larkin, 2009, p. 51). IPA is an especially detailed analysis of the participant interview at the micro-level and hence is very time consuming thus only a relatively small number of participants can be analysed with the rigour and detail desired within the time and resources available within a Phd. The primary concerns are to obtain a detailed account of the human experience and to ensure quality IPA studies rather than quantity (Smith et al., 2009). The final participant numbers were determined by this quality criteria, relevance to the research question and a subjective assessment that saturation was being approached (see Appendix J and Table 5-5 of the overall super-ordinate themes in Chapter 5). This exceeds Smith et al.'s (2009)

suggestion of 8 participants for a doctoral thesis when taking into account the development phases, additional qualitatively analysed questionnaires and the abductive analysis from an enactive perspective.

There were adjustments needed after 10 participants had taken part; the study was suspended due to a cautious approach to participant experiencing cybersickness occurring in the latter part. It was restarted with modifications to reduce this. These included changing to the later DK2 headset, reducing the amount of turning in the box pushing exercise by changing to pressing buttons (still a boring task). The computer used was changed to include a more powerful graphics processor (reducing lag); the time spent in the park was reduced (length of time in a virtual environment affects cybersickness); the controls of the Oculus Rift were changed to give a more natural way of moving and a wireless gamepad was introduced. The use of skin conductance, which proved unreliable in the first pilot, and which hampered a more natural interaction, was abandoned. A new interview protocol (Appendix E) was introduced, after having been reviewed and accepted by three independent and experienced qualitative researchers, although there was some variation in views as to how structured a semi-structured interview should be.

As a qualitative design, the tolerance to variation is greater than in a classic experiment where understanding is drawn from a statistical variation against a set condition, which needs to be tightly controlled, whereas, for this study, understanding is primarily drawn from rich interview data which provided contextual information about the change. Key to this was having high quality interview data. It was considered that not only were there ethical health and safety matters with undue cybersickness, but in some cases it was severe enough to go beyond the tolerance of a qualitative study to become more focused upon cybersickness than the emotions under study. This main study was originally intended as an additional pilot but the rich quality of the interview data addressing the research questions was of sufficient quality to treat it as the main study.

	Oculus Rift DK1 No helping	Oculus Rift DK1 Helping	Laptop No helping	Laptop Helping
Male	1	2	2	2
Female	0	1	1	1

Table 4-1 Participant numbers in main study (Box Pushing)

A new version of the Oculus Rift (DK2), better specification of computer and slightly redesigned exercise with less turning is introduced to continue the study. External feedback suggested a new interview protocol too.

	Oculus Rift DK2 Helping	Oculus Rift DK2 No helping	Laptop Helping
Male	1	1	0
Female	0	0	2

Table 4-2 Participant numbers in main study (Button Pressing)

EQUIPMENT AND TECHNOLOGY USED

Whilst the emphasis in this study is upon the experience of presence, emotion and gratitude in a virtual environment, rather than technology, it was still necessary to choose and develop a research environment. This section describes the equipment used and justifies the decisions taken.

The virtual world platform Open Simulator (OpenSim) was chosen as it is a commonly used platform, has the technical features to enable the scripting, avatar interaction and collection of data needed and the ability to ensure privacy and anonymity for the participants. The platform, being open source, may be made available for others should any of the study wish to be replicated or other studies be carried out in the same context. Much prior research into avatars and presence has been carried out using the virtual environment Second Life. OpenSim is almost identical to Second Life and has the advantage that it can be run privately, so maintaining participant anonymity, is far cheaper, and the environment can be backed up and made available to other researchers.

The virtual world platform selected is OpenSim 0.7.4 using a standalone simulator (using the Diva r20232-b compilation) a MySQL version 5.1.37 running under OS X 10.7.4 Mono Version 2.10.9. This was running on an Intel Pentium 4 PC running Linux; Ubuntu Server 12.0.4. Removing unneeded programs optimised the Linux operating system. The client viewer was a modified Firestorm (OpenSim Version) v4.3.1.31155 running on a MacBook Pro (Mid 2012).

4.6 Data Collection Method

This section presents and justifies the collection of data needed in this study. This study collects evidence on the participants' experience of presence, emotion and gratitude within a virtual environment. In line with the IPA approach, it focuses upon how participants understand their experience. The data collection is from the following types of source:

- Video of virtual world activity
- Semi-structured interviews
- Self-report questionnaires.

The main source of evidence for IPA is from the semi-structured interviews in which participants describe their virtual world experience, including presence and emotion. Their recollection could be incomplete and video was therefore used, where needed, to stimulate their memories (Henry & Fetters, 2012; Kagan, Krathwohl, & Miller, 1963). A secondary purpose of using video is to enable the researcher to better understand the context of a participant's comments obtained during the interview. The video was captured in mp4 format by a screen capture of the events using a 2D virtual world browser and played back using QuickTime during the interview.

SEMI-STRUCTURED INTERVIEW EVIDENCE

An in-depth semi-structured interview is used to capture the rich account of the participant's 'sense-making' and experience as the emotional episode of interest unfolds within the virtual environment. The video stimulation is used within the interviews by providing space for the participant to freely describe the events. These are followed by questions to maintain the focus on presence, emotion and gratitude and the research questions. Whilst an unstructured interview can provide for the maximum uninfluenced input from the participant, consistent with IPA, some structure helps to maintain focus upon the research questions, especially for relatively inexperienced interviewers. As the quality of the interview is highly important, interview training was carried out prior to the main study and an interview protocol developed.

The initial interview protocol was piloted prior to use (Appendix D), with a more structured form introduced when the study was refined to lessen cybersickness by moving from box pushing to button pressing in the exercise (Appendix E). The protocol in an IPA interview is used as a guide, but "it is not a rigid structure, and the role of the interviewer as an *active* listener…will often suggest times when it is preferable to abandon the structure and to follow the concerns of the participant" (Smith et al., 2009, p. 64). This avoids losing the participant's interpretation, essential for the research, by unduly constraining them. In this way, the protocol was applied to carrying out the interview. Audio recordings of these interviews are transcribed verbatim. The video and audio recordings and transcripts are stored together in MaxQDA 11 software which provides an audit trail to improve validity.

In the first place what is wanted is the interpretation by the participant of their experiences, which requires setting aside the preconceptions and interpretation of the researcher. The interviewer aims to set aside, as far as possible, their pre-conceptions in order to listen to the views of the interviewed. To aid this self-awareness by the interviewer, his pre-conceptions were reflected upon and noted in a research diary. The interview starts with a welcome to build initial rapport, a reminder of their rights to withdraw, not to answer if they were not comfortable and

consent to the audio recording. The broad focus of the interview was highlighted. The questions are open and comments and responses by the interviewer kept to a minimum and are structured to examine the virtual world experience in the order that they occur. At each stage, the video was played first for the participant to talk though.

Self-Report (first Person) Questionnaires

Self-report questionnaires collect numeric data on presence and gratitude. They were chosen to supplement the narrative accounts of the participants experience and are especially useful when addressing the secondary research questions which focus upon engaging with theory. They are used for three reasons: first, they provide the same measures of presence and gratitude as used in prior quantitative empirical research; secondly, these measures are based upon prior operational assumptions and theoretical views of presence and gratitude and thirdly to communicate new findings. These first two reasons are supported by Colombetti (2014) who argues that emotion questionnaires "reflect previous theoretical assumptions about the nature of emotion experience". They therefore make it easier to compare the rich data from the interviews with alternative theoretical models upon which they were based. A criticism, from a critical realist perspective, of empirical research using measures such as the ITC-SOPI (Lessiter, Freeman, Keogh, & Davidoff, 2001) questionnaire which cannot identify causality, is due, in part, to being unrelated to rich contextual data. The third reason is to communicate new findings; having this research directly related to other measures helps relate the findings to empirical studies. A major difference is that the questionnaires were devised for quantitative studies for statistical analysis across large populations. Sandowlski (2011) drawing on Check, 1996) argues that questionnaires can be understood as "something other than a data collection device" with different readings of questionnaire data. This research focuses upon the individual and specific cases; hence, the usage is different. These questionnaires are therefore evaluated qualitatively with limited numerical illustration. However, due to being only snapshots and quantitative closed questions, they provide limited information and context compared to the interviews. These questionnaires are therefore regarded as supporting information to the richer, deeper contextual data from the interviews.

The questionnaires for spatial presence were the ITC-SOPI (Lessiter et al., 2001) and MEC-SPQ (Vorderer et al., 2004) questionnaires. These embrace two differing approaches to presence. For social presence, aspects of the ITC-SOPI referring to characters, the GAC questionnaire and a bespoke question about how genuine the other participant's behaviour was were used. A judgement about the order of the interviews and questionnaires was needed as no solution was perfect. Whilst having closed questionnaires before interviews may bias them, leaving the questionnaires until after a long interview would affect the recall of the participants' virtual experience. Therefore, the questionnaires preceded the interviews, so that participants could still remember their experience. The self-report questionnaires may influence the interviews, in that they focus around closed questions related to concepts and issues embodied within the

operational constructs they measure. However, in order to minimise poor recollection, or the possibility that the 30-minute interview might hamper recollection, the interviews followed the final self-report questionnaires.

Following on from the collection of the data is its analysis. The methods used to analyse the data are described in the next section.

4.7 Data Analysis Methods

The data analysis methods discussed in this section use Interpretive Phenomenological Analysis of the semi-structured interviews (including video stimulated recall) and qualitative analysis of the questionnaires, examined in sections 4.6.1 and 4.6.2 respectively. The focus is upon cases of emotional episodes and the individual participants' lived experience within those cases. The analysis therefore focuses upon the individual (drawing together the interview and questionnaire analyses), then upon all individuals within a given context (forming cases), finally, a comparison between cases. Comparing data between idiographic samples is used to illustrate and inform; the key focus is upon the theoretical comparison, as, for ideographic research, any wider contribution beyond the individual is a contribution to theory, not statistical generalisation.

4.7.1 Interpretive Phenomenological Analysis

This thesis adopts the six-stage approach to IPA of Smith et al (2009) adapted for consistency with critical realism and for comparing cases (see Table 4-1). These six stages are described in more detail below.

Steps 1 and 2 involve close reading of the participant's interpretation which is added to the right-hand column in the MaxQDA software (see Appendix H), the comments include any additional thoughts. These comments include descriptive, linguistic and conceptual concepts. Prior understandings and theories are temporarily set aside.

Step 3 involves identifying initial themes that emerge from these detailed notes. Although added as "codes" in MaxQDA, the effect is to annotate these themes in the left hand column.

Step 4 involves bringing together and summarising the themes so far suggested to form overarching themes. Much use was made of the MaxQDA graphical representation of themes.

Step 5 involves analysing the data of the next participant within the case.

Step 6 involves looking for common patterns across all participants. As with steps 3 and 4, this involves successively greater input from the researcher's interpretation in "reconfiguring and relabelling" (Smith et al., 2009, p.101) the themes. Within step 6, the questionnaires are incorporated.

The analysis is written up using thick narrative, making explicit the participants' interpretation and the researcher's interpretation. This makes transparent the interpretations from participant, researcher and external theory, so aiding assessment of the arguments.

Step	IPA Data	IPA Analysis	Questionnaire Data	Questionnaire Analysis
1	Verbatim interview transcript	Get a 'feel' for the data by reading and reading	Questionnaire Data	Read and read individual responses. Generate numeric summaries for the individual
2.	Output is a column of initial notes and comments.	Make initial notes. Initial descriptive, linguistic and conceptual thoughts about both potential themes	Initial notes and potential themes and structures	Initial Notes: Both, descriptive and conceptual thoughts. Note down potential themes
3.	A more focused summary of emergent themes	Summarised Emergent Themes	More focused summary emergent themes	Summarise the themes
4.	Summary of themes Graphical Representation of Themes	Identify Connections. Form: superordinate themes		Identify Connections. Compare and refine with the interview themes and rich data. Provide tabulated/graphic summary
5.		Next Participant interview is analysed		Next participant
6		Across all Participants	Form overall super-ordinate themes	Merge with interview overall super-ordinate themes
Individual Summary		The questionnaire and interview analyses are brought together The analysis is summarised at the level of the individual		
Across All Participants		Overall Themes developed, written up in Chapter 5		

Table 4-3 The stages of IPA and the Qualitative Analysis of Questionnaires in the Study

4.7.2 Questionnaire Analysis

This section examines the approach to analysis of the self-report Likert scale questionnaires. This analysis is primarily qualitative and structured to follow the IPA stages of analysis (see Table 4-

3). Synthesising qualitative and non-qualitative research is well established. The qualitative analysis of individual questionnaires follows from the critical realist research paradigm that all knowledge is interpreted, including that gained from quantitative questionnaires, and secondly, the idiographic and case study nature of the IPA methodology used. This analytic approach agrees with Sandelowski's (2014) view that no quantitative study escapes 'qualitising' and that closed-ended questionnaires may also "draw particularising generalisations from and about purposefully selected cases" (p. 6). This thesis seeks such generalisations as part of the IPA methodology adopted. The questionnaires' purpose of relating prior concepts and measures of presence and gratitude to the rich context of individual cases analysed requires that individual questionnaires be analysed at the same levels as the IPA of the interviews.

As with the IPA, for textual narratives the focus is: firstly, upon understanding both the participant's interpretation and the researcher's, and, secondly, upon the particular individual. The thin nature of the data can only be fully analysed in conjunction with the rich contextual information from the interviews. Hence, the structure of the analysis follows the structure of the IPA analysis of interview data, albeit that the choice of questions is narrower and based upon the knowledge claims of the broader academic community. IPA focuses on the interpretation of both the participant and the researcher but initially focuses on the participant. The IPA analysis of the interviews is carried out prior to the questionnaire analysis in order to focus more closely upon the participant rather than the broader academic community's and researcher's interpretation of the questionnaires. The questionnaires are then analysed within the richer context provided by the interview.

The questionnaires were imported into MaxQDA as a single text document with the questions marked as codes (see Appendix H).

The IPA analysis of questionnaires was carried out in the following steps:

Step 1: a qualitative approach focused upon each individual was adopted examining individual questions, as well as their aggregate scores within each questionnaire. The aim is to focus closely upon the participant's understanding of the questionnaire questions. The questionnaires are scored, and summaries made. Numeric summaries and marking are carried out according to the design.

In step 2 initial thoughts from the data are noted down in a separate section, including potential themes.

In step 3 these are summarised into themes and potential themes. Determining the themes depends upon the context, hence this needs to be done after the first three steps of the interview analysis.

In step 4 the questionnaire results are tabulated and summarised. This is a more detailed analysis, taking into account the interview data. The interview output is synthesised at this stage at the level of the individual. This is combined with step 4 of the interview analysis at the level of the individual.

Step 5 involves analysing the data of the next participant within the case.

Step 6 looks for common patterns across all participants. Steps 3 and 4 involve greater researcher's interpretation than the first steps. The two presence questionnaires, encapsulating different approaches to presence, are also contrasted at this stage. This questionnaire analysis is incorporated into the interview analysis of step 6.

Tabulation and summary descriptions of the data are provided to be referred to within the thick narrative description used as the output from the interview analysis.

This section examined the approach to analysing the evidence from the main study. This is followed by applying an enactive lens to the findings as discussed in the next section.

4.7.3 Abductive Enactive Lens

The themes derived from the IPA gave a deep insight into the participants' experience of emotion, including gratitude and presence so addressing the primary research question. The EAP is theoretically derived and used to inform theory rather than a 'bottom up' empirically derived

theory or framework. Using a prior theoretical framework is consistent with an abductive approach where the IPA findings are considered from an enactive perspective then reinterpreted in the light of enactive theory and the EAP (see Section 4.4). This is in line with the IPA secondary research questions where the abductive approach aims to provide fresh insight into existing data but does not aim to test as in deductive approaches. Its explanatory power is in providing insight into the rich data rich but relatively few IPA studies. Like IPA, its strength is the focus upon rich context but is limited in identifying prevalence across a large population. Unlike IPA, which remains open to the participants interpretation of their experience; this step can focus more narrowly upon the secondary research questions within Chapter 6.

From the IPA study and themes, and the individual interpretations developed, redescriptions from the enactive perspective were developed and related to the themes obtained, including critical comparison with pre-exisiting theories carried out. These are presented in chapter 6 as is the evaluation of the EAP.

Individual cases drawn from the IPA findings were selected where they relate to secondary research questions 1 and 2.

The starting point is examining to what extent IPA findings meet the assertions based upon pre-existing assertions about the relationship with emotion and an extension to gratitude (Secondary RQ1).

This section examined the approach to analysing the evidence from the main study. However, the platform and research design had to be developed and tested in a robust manner to ensure credible and trustworthy research is carried out. The next section describes the development of the study.

4.8 Development of the study

This section focuses upon the studies carried out to ensure the development of a robust research platform and instruments needed for the study. There were four main aspects to this: an initial exploratory pilot study of the first prototype exercise; a survey evaluating the avatar appearance; a study bringing together all aspects and the development of the interview protocols. These are examined in sections 4.8.1, 4.8.2, 4.8.3 and 4.8.4 respectively.

4.8.1 First Pilot

This section presents the design of the pilot used to test the prototype research platform and exercise. This included both technical concerns and how the platform was experienced by potential participants. An interview-based case study approach was chosen: first, as this was

similar to that envisaged in the final study, and secondly, because rich detail about issues regarding the individual's experience of the environment was wanted. This provided the first insight into the lived experience of a participant and an unfolding emotional episode required to explore the enactive approach to presence developed in Chapter 3 and enabled a refinement of the main study.

PARTICIPANT

For the pilot, a single participant was selected using purposive sampling. The aim was to select a single participant with characteristics similar to the participants in the main study. The selection criteria therefore included: studying for a degree or have completed a degree at an English-speaking university, have no current serious mental health problems and are part of the English Speaking cultural grouping (Inglehart & Baker, 2000) as this was expected to be the main cultural grouping from which participants would be drawn in a study based at a UK University. The participant met the criteria. Informed consent was obtained in accordance with the Ethics approval (P4419). Using a single participant is considered proportionate at this early stage of development and is in line with Yin's (1994) suggestion of piloting upon a single participant in the first instance for case study research, which IPA is. The participant selected was female. As participants in the main study would be both male or female no gender was preferred but the first volunteer who met the selection criteria was female.

THE RESEARCH DESIGN

Even at this early stage of development, the design broadly reflected the main study design discussed in section 4.5. The format follows four phases: general training, neutral park environment, introductions and meeting the confederate and the pushing the boxes scenario. The key differences from the main study were that all four phases were in one session, there was no gratitude induction and only the laptop was used. However, the virtual gratitude induction process had been devised at this stage. A virtual researcher was introduced at the start in order to settle the participant and guide them through the initial stages of training. The intention was to keep as much of the research within the virtual environment as possible in order to replicate a virtual experiment as closely as possible.

Lessons were learned from the pilot which influenced the design of the main study. In particular, the participant's navigation skills were poor and the training period leading straight into the main exercise did not give enough time nor properly develop the skills needed to carry out the exercise. The early involvement of the avatar researcher had a significant impact upon the emotional experience within the virtual environment experience, so this was changed in the main study. The feedback and analysis from the pilot is presented in more detail in Chapter 5.

The procedure followed was:

The initial procedure: to welcome, inform and obtain consent from the participant.

Phase 1: In-world training and familiarisation in the environment.

Virtual researcher met the participant upon entering the virtual environment. There were signs giving advice on using the virtual environment.

Phase 2: In-world baseline emotions in a neutral in-world park environment.

The participant was left alone at this point.

Phase 3: In-world introductions and meeting the confederate.

Phase 4: In-world pushing boxes scenario without gratitude induction.

DATA COLLECTION

During this early evaluation of the research design the gratitude induction procedure was not carried out. Gratitude induction was to be tested at a later stage in the pilot. The ITC-SOPI questionnaire (Jane Lessiter et al., 2001) was chosen as the presence questionnaire to use as this was the same measure of presence most commonly used within prior presence and emotion studies (Riva et al 2004; Bouchard 2012).

This left the data collection during the pilot as:

- Complete ITC-SOPI presence questionnaire
- Unstructured interview focused upon the participant's experience from her point of first entry to the various phases of the study. This was unstructured to enable maximum flexibility, following unforeseen concerns at this early exploratory stage.

The interview with the single participant was conducted outside of the virtual world environment, but video recall techniques, to help stimulate the recall of the experience, could not be carried out due to technical problems. The emphasis was upon the experience of the participant, as they understood it, interpreted by the researcher at a later stage.

Data Analysis

Both the interview and questionnaires were qualitatively analysed using thematic analysis rather than IPA at this stage, and a qualitative evaluation of the single questionnaire was carried out as, for a single participant, there was little choice. The interview was analysed first in order that the questionnaire could be evaluated within the richer context of the interview.

THE ENVIRONMENT

The environment was the same as that used in the main study it was being developed for, described in section 4.53. However, at this stage, only the laptop display was used, as the focus was upon the core virtual exercise and platform, so a standard Firstorm Opensim viewer was used that was not modified to allow virtual reality headsets to be used.

The choice of the OpenSim platform utilised the current skills of the researcher in scripting, building virtual environments and designing avatar clothing.

Figure 4.4: The researcher (male) and participant (female) avatars in the pilot.

Both theory and evidence from the pilot study suggested that the appearance of avatars could have an important impact upon factors such as trust, potentially related to the emotion gratitude being researched. This aspect therefore needed to be refined further to prevent avatar design issues becoming the predominant focus of this study rather than presence and emotion. The next section introduces how a survey into how particular avatar appearances to be used in this study are perceived, in order to improve its design and focus.

4.8.2 Avatar Appearance Evaluation

This study aimed to minimise the risk of a problematic avatar design that would unduly distort the main study by evaluating and identifying an avatar design of the confederate that would be acceptable across the participants. The first pilot study and extant literature suggested that appearance could alter the feelings towards an avatar. Test 2, the participant, in the first pilot, raised concerns over power dressing and a frumpy appearance. Prior research found that white avatar dress correlates with more pro-social and helping behaviour(Merola, Penas, & Hancock, 2006); the very same behaviour being used to induce gratitude in this thesis. The use of statistical techniques is a consequence of analysing prevalence across a population using a survey rather than identifying causation or statistical generalisation across a population typical of positivist experimental research.

The questionnaire is therefore designed so that participants rate the emotional aspects of the avatar's appearance. The questions and justification are summarised in Appendix G. Images of potential avatars to be used within the study, but wearing different clothing, are presented (see Appendix F). The images and the questions are presented in a random order to avoid any impact

of the sequence of questions. These design decisions were based on the experience of the pilot, which suggested that the context was important in how avatar dress was perceived. In that case, the. The Avatars used in this and the following main study are attached in Appendix F and a summary of the questions and their justification is in Appendix G.

Participants

Thirty-seven participants were recruited (17 Female, 20 Male) after those with missing data were excluded. The same criteria as the intended main study were applied. A snowball selection criterion was applied at the Coventry University Student Hub where there was a high proportion of students. With the relatively large number of participants it was felt that there was little need to apply purposive sampling. Adverts were circulated at the main student hub, in the engineering and computing faculty main building and the research students' Facebook group.

Data Collection

The primary measure is an online questionnaire with a pre-registration procedure using a privately hosted lime survey. The images selected included neutral, ugly and good-looking in light, dark and mid tones. All data are fully anonymised with a unique user ID generated using one-way encryption (SHA1) of identifiable material. Images are embedded into the survey form. In Appendix G the specific questions developed, along with the justification and the references to prior literature that informed the questions, are examined.

Analysis Method

In order to identify how people would react in general to the avatar appearance, they were asked to rate aspects of avatar appearance in a survey. The participants' avatar ratings were analysed using Krippendorff's Alpha using the KALPHA macro (Hayes & Krippendorff, 2007) with SPSS 25 as it is preferable to other inter-rater coefficients due its capability of handling multiple raters and robustness against missing data. This is used to assess participant agreement rather than as a validity measure based on the consistency of multiple researcher's evaluation of an objective fact. Bootstrapping was used to enable an estimate of reliability. Entries with no ratings assessed were removed as this alters the bootstrapped confidence levels but not Krippendorff's Alpha. The inter-rater rating is very low (Overall $\alpha=0.0555$), see Table 5-3. This suggested that it was unlikely that the avatar appearance of the confederate would be problematic in the main study and any of the avatar's designs presented may be used. Consequently, the original confederate avatar was used in the main study and all the avatars used in the avatar evaluation survey were provided as a selection for the participants to choose from. This enabled them to select the avatar that most closely related to their own particular taste.

An internal validity check was carried out using an internal cross-check that the avatar ratings were consistent with prior research for the factors being analysed. If statistically significant results for these factors are returned it suggests that: a) The questionnaire is measuring what

was intended and b) the sample size is large enough to measure the factors; making an inter-rater measure, such as Krippendorff's Alpha, meaningful in this context. This cross check was of 4 male avatars in a neutral blue T-shirt across three subjectively ugly, good looking and mid-level attractive avatar to provide a spread of assessments of attractiveness. The Neutral blue was selected in the avatar appearance questionnaire test piece, in accordance with the Manchester Colour Wheel (Carruthers, Magee, Osborne, Hall, & Whorwell, 2012; Plass, Heidig, Hayward, Homer, & Um, 2014), which was devised to help enable practitioners to identify whether children are feeling neutral, anxious or depressed, where blue is neutral. It was expected that more positive and trusting connotations would be attached to these avatars. This was analysed using Spearman's Rank Correlation appropriate for use with the ordinal Likert scale questionnaire. A descriptive check confirmed it met the monotonic assumptions of Spearman's rank correlation. Fuller details about the results are given in Chapter 5, section 5.2.

With the information from the pilot and the avatar design chosen, the next stage was to incorporate the modifications and test these. The following section discusses the second pilot study which focused on gratitude induction and interview protocol.

4.8.3 Second Pilot: Gratitude Induction and Interview Protocol

The second pilot evaluated the changes from the first pilot, including the addition of the GAC gratitude and the MEC-SPQ presence questionnaires and the interview protocol. Informed consent was obtained in accordance with the Ethics approval (P4419). Three female participants of the English-Speaking Cultural Grouping were chosen, two were helped and one was not helped. The study design was as for the main study except only a laptop display was used. The same participant selection approach and criteria as the avatar evaluation survey were used.

The second pilot identified that the gratitude induction, interview protocol and changes from the first pilot were acceptable. Problems identified in the first pilot were not repeated. There were some technical concerns around note taking and recording. Anxiety of the researcher during the interviews had an impact. This was partly due to the fact that the researcher had to act as the confederate himself due to the volunteer confederate withdrawing at the last minute.

4.9 Triangulation

This section introduces the triangulation methodologies adopted in this study. Triangulation involves the mixing of multiple theories, methods, data sources and/or researchers with the aim of enhancing the validity of research findings or combining different insights into the study (Modell, 2009, p. 209). This study has been led by the interview data but used the questionnaires as supplementary material in forming the themes during the IPA phase, and for comparison of like for like measures with external theories during the abductive phase.

This research triangulates the rich contextual data from video and semi-structured interviews revealing the participants' own sense-making with questionnaires typically used by the correlational studies. Triangulating between the interview and questionnaires has two main benefits. First, it introduces a different insight theoretical interpretation of gratitude and presence (spatial and social) and their associated factors for consideration. These theoretical concepts of presence, gratitude and their associated factors are implicitly or explicitly embedded in their design. Secondly, the questionnaires provide a common measure, enabling the results of the correlational studies, such as presence measured using the ITC-SOPI (Riva et al., 2007), and gratitude using the GAC (Bartlett & DeSteno, 2006b), to be more readily understood within the context and experience of the participants in this study.

This research is qualitative and idiographic rather than a statistical measure of central tendency over many participants. In line with the idiographic approach, the emphasis is also upon the individual's questionnaire. As such, no probabilistic or statistical analysis is involved beyond simple descriptive, such as percentage, means and medians, as these would have little meaning. Hence, these are evaluated qualitatively. The summaries and storage of questionnaire data uses SPSS 25.

There are two questionnaires for spatial presence (MEC-SPQ and ITC-SOPI) that measure differing conceptualisations of presence and are suitable for comparing with empirical studies into emotion and presence. The sections of the questionnaires that are broadly comparable are listed in Table 4-5 below.

MEC-SPQ Questionnaire Sections	ITC-SOPI Questionnaire Sections
Attention Allocation	Engagement (part of)
Spatial Situation Model	Unique to MEC-SPQ
Spatial Presence: Possible Actions	Engagement (part of)
Spatial Presence: Self Location	Spatial Presence
Higher Cognitive Involvement	Unique to MEC-SPQ
Suspension of Disbelief	Unique to MEC-SPQ
Domain Specific Interest	Unique to MEC-SPQ
Unique to ITC-SOPI	Negative Effects

Table 4-5 Broadly equivalent sections of the ITC-SOPI and MEC-SPQ questionnaires

There is further triangulation with a question regarding levels of emotion in the ITC-SOPI questionnaire. Aspects of social presence were triangulated using three questions from the ITC-

SOPI questionnaire and an additional question on how genuine the participant felt that the confederate was.

Triangulation is applicable as a way of providing confidence in the validity of data. This study places an emphasis upon theoretical triangulation and the need for differing methods of triangulation as a means of ensuring trustworthiness. Data triangulation can be reliant, however, upon an assumption that there will be a regular occurrence, rather than a tendency to occur, from the critical realist assumptions in this study. Hence, the benefits of validation have to be treated more tentatively than for an interpretive approach such as Yin's (1994) approach to case study research. Corroboration, however, does increase the trustworthiness of the theories.

Trustworthiness and credibility, otherwise known as validity of the research, is discussed in section 4.10.

4.10 Validity

This research aims to be both trustworthy and credible. As interpretive qualitative study Yardley's (2000) four principles are followed which are appropriate for IPA (Smith, 2010, p. 180) rather validity concepts such as internal, external, construct or ecological validity appropriate to statistical experiments or surveys; these are applied in the Avatar Appearance Survey (see Section 4.8.2) but from a critical realist and interpretive perspective. For example, Ecological Validity as initially proposed by Brunswick (1947) is associated with intercorrelation between perceptual cues and uncertainty on a task and frequently confused with representational design for psychological experiments involving sampling of the environment in order to achieve statistical generalisability (Araujo, Davids, & Passos, 2007; Brunswik, 1947). Qualitative research is generally considered more natural and contextual which is parallel to some uses of the term ecological validity. The contribution of this study is aimed at similar virtual environments to this with similar engineered environment aspects in games and simulations (see Section 4.2). In this study, the "natural context" is an artificial virtual environment as replicated in the research environment (see Section 4.2). Yardley's (2000) principles are: sensitivity to context; commitment and rigour; transparency and coherence and finally, impact and importance.

SENSITIVITY TO CONTEXT

Sensitivity to context is important in this study as the focus of the research is upon understanding emotion and presence as an unfolding episode. From the enactive approach here, this emphasises that humans live in a world of meaning and it is their understanding and experience of presence, emotion and environment that is being studied. This is addressed, firstly by the adoption of IPA and critical realism. Secondly, the cases focus upon the context and constructs in particular environmental contexts. Thirdly, the use of IPA pays close attention to the interpretation by the individual, but also recognises the interpretation by the researcher,

especially during the analysis phase. One of the major reasons for using a semi-structured interview is to garner the rich contextual information not collected in many empirical studies. Awareness that the study itself forms part of the context, possibly leading to demand effects, is addressed by including checks on the participants' perception of the reasons for the study and genuineness of the confederate (key to gratitude).

COMMITMENT AND RIGOUR

Commitment and rigour ensure that a well thought out approach is consistently carried out. The thought-out adoption of IPA, and carrying this out using predetermined stages, emphasises the rigorous approach adopted. The development environment and interview protocols have been piloted and tested first. Training in the research approach has been carried out and the whole study is based upon a thorough review of the existing body of knowledge that led to the development of the enactive approach to presence in Chapter 3. To enable quality assurance, the data, transcripts, interim analysis documents and original files are collated together, enabling an audit of the process. Construct validity is considered as "whether data that is empirically available gives valid knowledge about the actual manifestation of the alleged generative mechanism" (Zachariadis et al., 2013, p. 808). Valid knowledge, in terms of understanding presence and emotion, comes from a focus upon understanding the participants' interpretation. This is evaluated against IPA quality selection criteria and rigorously followed the IPA approach. When relating to other prior studies, the same measures of presence and gratitude have been used, but these have been triangulated with the specific context of this study.

TRANSPARENCY AND COHERENCE

The explicit research design and its place in the literature highlight the thought-out approach to maintaining coherence. The design has aimed to maintain coherence in assumptions between the models of emotion and presence used and the research paradigm throughout the thesis. A trail from data to analysis is maintained by collating the interview transcripts, analysis records and a write-up approach, making distinct the interpretation of the participant (evidence) and the researcher. A reflective positionality makes transparent key historical and personal factors influencing the thesis.

Finally, any research needs to be worthwhile and to have impact by contributing to the body of knowledge. It is not the aim of nor would be inappropriate to apply these finding as statistical generalisations. It is appropriate however to use these to inform theory especially in virtual and gaming environments with similar contexts to this study and may be applicable beyond these.

This thesis aims to create new understandings by:

- Extending studies to explain the relationships between presence and emotions such as anxiety to the social emotion gratitude
- Analysing the research data from an enactive perspective
- Providing explanations (from an enactive perspective) of the factors and influences in the relationship between emotion and presence, or should no such relationship be identified, to account for this
- Evaluating the significance of the novel enactive approach to presence developed for this study.

Its contribution is:

- Investigation of the existence of a relationship between emotion (specifically gratitude) and presence, leading to the corroboration of existing research from a novel perspective of analysing individual data points rather than data trends
- Investigation of the non-existence of a relationship between emotion (specifically gratitude) and presence in certain circumstances, which goes beyond the current normalised explanations of the relationship
- Deeper understanding of the factors and influences of the relationship between emotion and presence gained from the application of a novel analysis perspective using the enactive approach
- In the process of analysing the research data from an enactive perspective, the contribution of the developed enactive approach to presence model itself will be evaluated.

The practical implications are:

- A greater awareness of the balance between reliance upon technical solutions, such as headsets, and the possible need for less technically immersive environments, provided the scenario is sufficiently emotional

- The enactive approach places an emphasis upon the whole dynamic interactions between self and avatars in a dynamic interaction with the environment
- Gratitude is associated with stimulating wellbeing, such as countering depression, and pro-social behaviour, such as team working. Insight from this research may help develop scenarios to lessen depression or aid group cohesion.

4.11 Ethics

APPROVALS

This study has been through the Coventry University Peer Review process (Ethics registrations numbers P4419, P11207, P17503 and P60562) and has been approved by the Associate Dean (Faculty of Engineering and Computing) on behalf of the Chair of the UARC prior to any fieldwork or experiments being started. The avatar appearance survey was carried out in conjunction with the Auckland University of Technology ethics committee 13/308. Additional approval was sought when usage of the Oculus Rift Head Mounted display was introduced as I felt that additional health and safety issues warranted a marked change from the original approval. This approval is subject to no data leaving the European Economic Area which has been complied with. This study is carried out in conformance with the British Psychological Society and British Computer Society codes of practice as: a) the area of the study is broadly psychological research within a computing environment and b) the principal researcher is a Chartered IT Professional and Member of the British Computer Society and so bound by its ethics and codes of conduct. Informed consent of the participants has been sought and the participant information sheet and the Ethics Approval Applications (Appendix A).

INFORMED CONSENT AND TRANSPARENCY

Ethical approval is obtained from Coventry University. It is felt important that there is recognition of the contribution of the participants and that participation was given freely with informed consent. All participants were informed beforehand of the intent and aims of the research. However, in order for the gratitude induction to work, it was essential that they felt that the act of helping was a voluntary act by the confederate. Hence, this deception, and that the research is into gratitude, were not made explicit. Instead, reference was made to the behaviour of two individuals in virtual worlds. To overcome this, participants were debriefed after their interview about the true intent and role of the confederate and were able to freely withdraw without any penalty. It was also emphasised that allowing participants to withdraw was quite normal in order to reduce any inadvertent pressure upon their free decision.

PRIVACY: ANONYMISATION

All data are anonymised, and an identifier generated from the provision of an email and month/day of birth was given to the participants to enable later withdrawal. The interview data, in particular, are reviewed to go beyond a simple change of name but to remove contextual information. In its place, surrogate information designed to still communicate the anonymised context, e.g. reference to a city can use another similar city, was used. Ensuring participants were free to withdraw without penalty was not only aimed at respecting the information they were contributing but had practical health and safety issues. Any discomfort through a potential side-effect, such as cybersickness (similar to travel or sea sickness), of using virtual reality headsets might not be envisaged by the participant and their experience of discomfort may not be recognisable to the researcher. Still less is it possible for the researcher to evaluate what level of discomfort they view as acceptable. For all of these reasons, the right to withdraw during the research study without penalty was emphasised. There is a possibility that people may suspect these participants are associated with Coventry University due to the PhD being carried out at Coventry University. There is the possibility the participants themselves may discuss their origins. Participants will be subject to and agree to respect the privacy of others under a 'Chatham House Rules' agreement.

PRIVACY: DATA SECURITY

Participants place trust in the researcher that their contribution will be kept secure. There is an onus upon the researcher therefore to ensure this. In this study all electronic data, including any video and audio recordings are held in encrypted computer partitions using 256-bit AES. Secure passwords are used and kept separate from the data. A responsible person for the management, control and data protection is allocated; namely the principal investigator and the Director of Studies, should he unable to discharge his duties e.g. disposal of the data following death. All data are allocated anonymous identifiers or pseudonyms relating the various items of data to participants. This is cross-referenced to permission forms (electronic or paper) in order to enable all data associated with any agreement with an individual to be identified e.g. to ensure that participants may still remove their consent or request the destruction of their data. This is held in a locked or encrypted drawer or folder away from the actual data. An identifier linking together the participant and confederate and aspects of the study will be made e.g. video recordings of the same activity. Some of the work involves data stored on servers based in or owned by wholly American owned companies, but this will be avoided if possible. Even with EEC/US Safe harbour laws the US Patriot Act makes such data available to US authorities. On the 6th October 2015 the Court of Justice of the European Union (CJEU Case 362/14) declared this Safe Harbour agreement as invalid and it cannot be relied upon to maintain the levels of privacy recurred by EU data protection laws so justifying this precaution. http://curia.europa.eu/juris/documents.jsf?num=C-362/14

HEALTH AND SAFETY

There is an onus on the researcher to maintain a safe environment without causing harm or discomfort beyond normal reasonable expectations. Thus, the researcher retained the right to withdraw participants if this was needed in addition to the participant's right to withdraw. This occurred on one occasion during the main study and a review was carried out to ensure a safe environment was maintained. A health and safety assessment was carried out prior to the study and reviewed during it. From this assessment, additional limitations such not accepting participants who had photosensitive epilepsy or migraine were introduced and ethical approval obtained when the Oculus Rift head mounted display was introduced.

DATA SHARING AND RETENTION

When providing their data, participants make them available conditionally based upon maintaining privacy and the expected usage. However, it is also considered important that other researchers can validate published claims. Similarly, the purpose of this research is to contribute understanding to the scientific, academic and the wider communities. The provision of anonymised research data will therefore be made available for other researchers to validate their results. Raw data will be retained for 5 years after successful completion of the thesis or publication of papers from this research, whichever is later, in accordance to guidance by the American Psychological Association (2010). The OpenSim environment in which the research is carried out will also be made publicly available. All the material is open source and publicly shareable. Thus, the both the environment and associated context is open for scrutiny. Only data needed for the research are collected, as outlined and justified by this Chapter.

4.12 Summary

This chapter presented the approach, methodology and the methods for collecting and analysing the data needed to investigate the relationship between emotion, especially gratitude, and presence. It explains that the thesis adopts a critical realist paradigm and utilises rigorous empirical IPA to obtain the rich contextual evidence over time of the participants' emotions, including gratitude, and presence. The themes and empirical evidence from IPA form the basis of an abductive recontextualisation using the enactive approach. This provides a fresh insight into the relationship between emotion and presence. The chapter also covers the studies used to guide and pilot the development of the virtual environment and the instruments such as the questionnaires.

The next chapter presents the feedback and analysis of this work (Chapter 5) leading, in Chapter 6, to the evaluation of the enactive approach to presence developed by this thesis.

Chapter 5 Results and Analysis

This chapter focuses upon the feedback from and analysis of the data collected using IPA for the principal study. The main study focuses upon the individual participant's interpretation of their experience and aims to look deeper into this, beyond simple description this addresses the primary research question. This is a broadly inductive approach and, whilst aiming to minimise the foreknowledge of the researcher, drawing away from the participant's interpretation; it draws upon the increasingly interpretive role of both, such that this is a product of both. The analysis revealed eight high level superordinate themes: purpose and intentionality, curiosity, exploration and evaluation episodes, unfolding presence, weirdness and dissonance, role of the avatar, gratitude and orientation of emotion (its nature and intentionality), and culture and foreknowledge. The secondary research questions are addressed in Chapter 6 where the accounts derived in the main study are considered using an abductive approach to recast though an enactive lens and engage with other relevant ideas, concepts and theories in Chapter 6. The questionnaires of individuals, analysed separately from the interviews, are presented in this chapter although the themes are derived from the interviews. More detailed use of the questionnaires is presented in Chapter 6.

The results did identify gratitude being associated with increased social presence, but less so spatial presence, and other factors that can moderate this. It further identified that emotion more generally can be associated increased presence within the virtual world, but this was not always the case in themes. This is more fully discussed and examined in Chapter 6. All names given are pseudonyms, chosen by the participants, in order to protect their identity.

The results and analysis are dealt with in the following sections:

- Development Phase: First Pilot Results and Analysis - section 5.1
- Development Phase: Avatar Appearance Survey - section 5.2
- Development Phase: Gratitude Induction and Interview Protocol Pilot - section 5.3
- Main Study - section 5.4.

The relationship between these studies is illustrated in Figure 5.1.
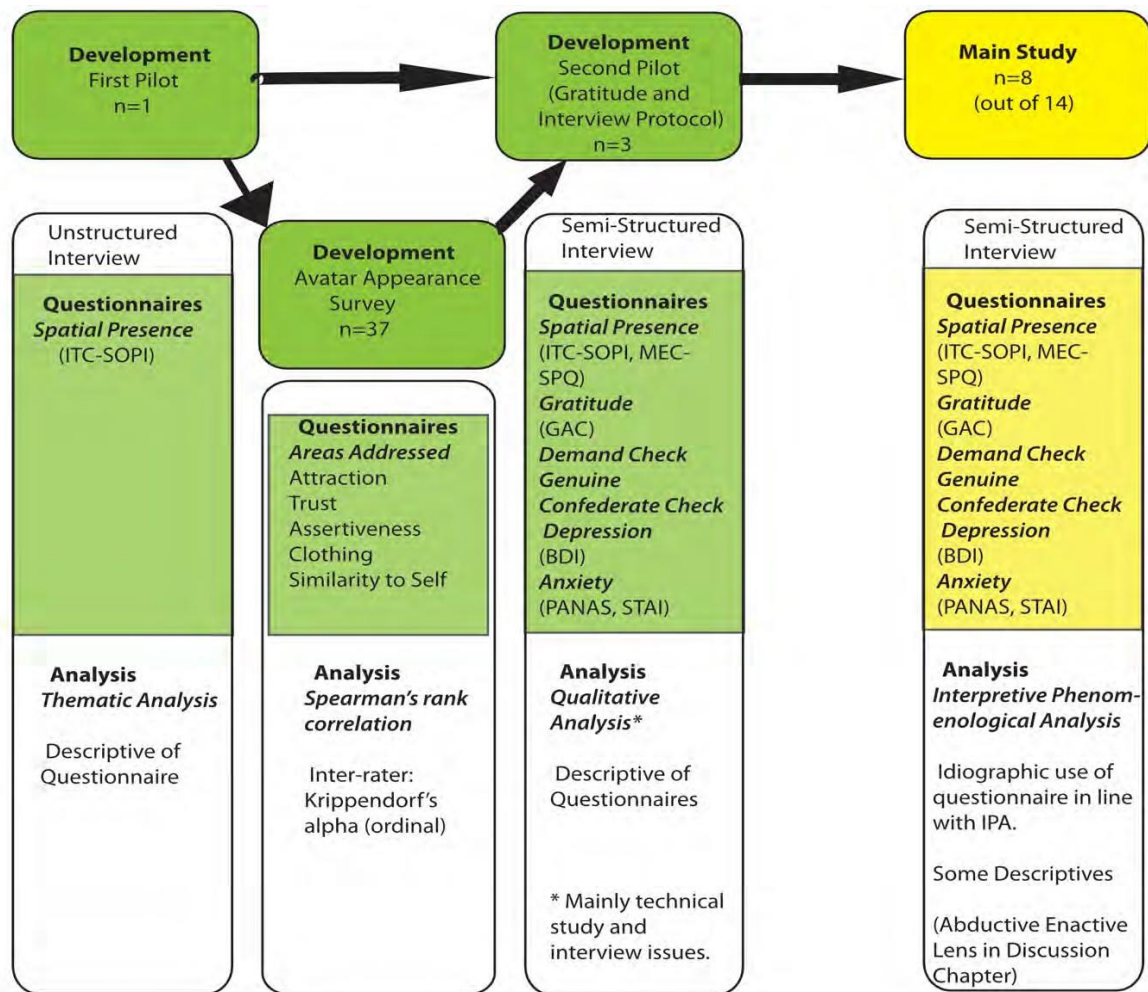
Figure 5-1: Overview of research studies carried out.

5.1 First Pilot

The section examines and analyses the first pilot used to evaluate the prototype research environment and exercise. This aided the design of the virtual environment and informed the main study in phase 2. The first pilot involved a single participant called Test 2 interviewed using a post exercise unstructured interview focusing upon her feelings during the exercise. It was analysed using thematic analysis (Braun & Clarke, 2006). Presence was assessed using the ITC-SOPI presence questionnaire.

The results are presented in section 5.2.11 for each stage of the virtual world exercise. The stages are:

a) Pre-exercise: Initial registration

b) In-world: training and familiarisation (with an opportunity to change her clothing)

c) In world: 'calming' park environment

d) In-world: a box pushing exercise

e) Follow up ITC-SOPI Presence questionnaire.

5.1.1 The Virtual Environment & Exercise

The main exercise involved pushing a box around a chequerboard (see figure 5.4). This was the most "*stimulating aspect of the experience*" for the participant. Upon meeting the confederate (played in this case by the researcher in a separate room), Test 2 reported not knowing the protocol and so said nothing. In response to the confederate's question about her experience to date, Test 2 described it as "*Tedious*".

Figure 5-2: Calming Park of Pilot Virtual Environment

She broke off conversation with the confederate after the confederate's comment: *"I know what you mean but at least it is all for the good of mankind (intended as a joke) as* "*unctuous*". Test 2 also assumed that the confederate was a chat bot (a pseudo-avatar programmed by artificial intelligence) to say such a thing. Test 2 did not trust the researcher; when the researcher said the experiment "was not competitive" she thought "yeah right!". She was irritated by language she considered too "American", for example, "*people instead of folks*". Test 2 expressed pleasure at seeing the "Magic Mushrooms" (buttons pressed at the end of the exercise). She reports being uncertain as to which side of the board to use. Whilst trying to find out how to use the big red button, she discovered an option "sit". She especially enjoyed discovering by herself how to sit on the red button (Figure 5.5), to which she exclaimed in the chat '*just experimenting*'. Navigation continued to be a problem but was improving by the time of the exercise. Comments in the ITC-SOPI questionnaire suggested that navigation and control was improving ("I felt I could move objects (in the displayed environment)" (Question B19) was annotated "eventually").

Figure 5-3: Chequerboard with block exercise   Figure 5-4: Test 2 on the Press to Finish button

The overall experience was positive compared with the negative aspects of Test 2's previous experience of the Second Life, a similar virtual world, such that she reported a desire to investigate Second Life again. Identified design weaknesses prevented the exercise being fully completed which, combined with the lack of an independent confederate, meant that no test of inducing gratitude was possible at this stage.

5.1.2 Introduction to First Pilot Analysis

This section presents an overview of the analysis of the pilot. Thematic analysis was carried out, and the focus was on improving the main study's design methodology. The unstructured interview of the first pilot, while still focused upon experience of the environment, differed from the main study in that the pilot focused upon the experience of the environment whilst the main study focused upon the emotions and presence.

Themes that emerged were:
- The wide range of emotions experienced: anxiety, anger, threatening, boredom, delight and enjoyment
- demand effect
- lack of rapport between the participant and the confederate
- the sense of abandonment in the park
- culture, identity and trust
- cultural group identity
- social norms
- personal identity
- the influence of having a constant confederate is variable
- trust

- low presence conditions may be too high
- spatial presence increased during exercise despite strong early emotion
- a major factor maybe engagement
- control, navigation and immersion.

5.1.3 Approach to Knowledge

Test 2 did not see the researcher as independent, leading to her forming views about the researcher's avatar's clothing; for example, the large shoes where perceived as skates and the clothing was seen as having a role within the study, i.e. power dressing. From the researcher's perspective, this clothing was innocuous and just a garment to maintain the modesty of the avatar.

This highlighted the distinction between the participant's interpretation of the 'facts' and that of the researcher. The participant's view meant that , for her, the 'reality' was power dressing aimed towards her (the object of the researcher's interest). The clothing was interpreted as an "object of power". Whilst the participant mistook the researcher's intention, the researcher's interpretation of the clothing as respectable and relatively realistic with little impact was different. It could be argued that the avatar design and its style of clothing are interpreted not objective facts. It is this interpretation that has modified what the clothing is, i.e. it has become an object of power, the imbalance of which feels threatening to the participant. This distinction highlights that knowledge about this particular reality ("clothing") depends upon human interpretation and the "lived experience", and differing perspectives of both the participant and the researcher. This is at the heart of critical realism, IPA and the enactive approach discussed in Sections 4.3-4.4.

5.1.4 Culture, Identity and Trust

TRUST

Trust was a significant issue; Test 2's view of the 'psychology experiment' was that it involved 'psychological games'. The statement by the researcher that the confederate was not in competition with the participant was not believed. There was not complete trust that the confederate was who she purported to be (i.e. a human), as the participant perceived the confederate to be a 'chat bot'. Being clearer in explaining the role of each section of the study helps with this. It is important to ensure that the confederate's 'script' does not seem too mechanical.

PERSONAL IDENTITY

Personal identity and the identity of the researcher's avatar were important, as indicated by the participant's view that her avatar was dressed in a 'frumpy' manner in contrast to the researcher's avatar. This endorses taking care over the avatar's dress in the main study design

and suggests that it may allow more choice if the avatar's dress is selected by the participant at registration.

SOCIAL NORMS

Test 2 felt unsure as to the etiquette involved in responding to 'Hi' and hence did not respond. This is consistent with the cultural scaffolding view of the impact of social norms (Parkinson, Fischer, & Manstead, 2005). It also reveals that there was an expectation that there may be cultural norms within the virtual environment that may be different from her known norms and could be broken. The interviews in this study could identify these.

CULTURAL AND GROUP IDENTITY

The participant is part of the English Language cultural grouping which includes both British and American nationalities (Inglehart & Baker, 2000, p. 29). Despite this, the participant discriminated between British English and 'Americanisms,' the latter being a derogatory term. This suggests that, even if there is homogeneity in terms of values as used by Inglehart and Baker (2002), aspects of group identity could still affect the study. Elfenbein and Brady (2002) suggest that emotion recognition was better between members of the same national, ethnic, or regional group. Therefore, the nationality, ethnicity and regional group in addition to using the world value based cultural groupings (Inglehart & Baker, 2000).

CONSTANT CONFEDERATE IS VARIABLE

In the study context, using the same confederate, is assumed to be a constant. However, if the confederate is perceived by the participant as a member of another group (intergroup emotions may come into play). Membership of 'another, particular, group' may be the true 'fact'. Maintaining the same confederate is a variable in this environment. One option is to have a confederate of the same group as the participant. Determining the group identify is complex, so not practical in the time frame.

5.1.5 The Emotions

This section analyses the various emotions expressed orally by the participant, including the terms: anxiety, anger, threatening, boredom, delight and enjoyment, as well as generic emotion as rated in the ITC-SOPI questionnaire (the maximum 'Strongly Agreed') (see Table 5.1). The study focuses upon gratitude and other emotions around it but does not want the other emotions to prevent the focus upon gratitude.

DEMAND EFFECT

The pilot demonstrated demand effects, which influenced the participant's interpretation. Test 2 described feeling anxious, as Test 2 viewed it as a "psychological experiment" involving "psychological games".

LITTLE CONFEDERATE AND PARTICIPANT RAPPORT

There was a lack of rapport between the confederate and the participant since the participant was bored (considered a negative affect) and responded to the confederate's greeting "How are you" chat with the single word 'tedious' from Test 2. A lack of rapport could potentially affect social emotions such as gratitude in later studies.

ABANDONMENT IN THE PARK PHASE

The reported sense of abandonment and the negative mood of the participant suggest that the calming park phase did not work entirely as anticipated. It has also been demonstrated that the participant experienced many emotions other than gratitude during the first pilot. Prior to the main study there was concern that such feelings could obscure feelings of gratitude, so the park environment needs to stabilise the previous emotional feelings. An improvement to the study design involved a more rigorous mood induction procedure (Västfjäll, 2002).

5.1.6 Presence

This section considers the implications of the pilot for presence. There were two measures of presence; the interview responses and the ITC-SOPI (Lessiter, Freeman, Keogh, & Davidoff, 2001) questionnaire.
The interview identified issues such as control and immersion, other aspects from the interview's responses are compared when aiming to understand the validity of the ITC-SOPI questionnaire from a qualitative standpoint.

CONTROL, NAVIGATION AND IMMERSION

One of the technical issues identified as significant by the pilot was the participant's control and navigation skills. This affects the level of immersion and hence, arguably, the level of presence (Brown & Cairns, 2004; Lombard & Ditton, 1997). The analysis leads to suggestions on how to address this aspect.

This participant was new to the OpenSim environment, hence her navigation skills were, as expected, limited. This meant positioning herself to read the signs giving instructions difficult and there was significant disorientation during the chequerboard exercise. This improved with practice by the end, including an increased ability to manage objects. This improvement is demonstrated by participant choosing to sit on the red button, although not intended by the researcher (see Figure 5.3).

The reported difficulty in reading, understanding and remembering the instructions for the chequerboard exercise suggest a need to improve these. It is not clear from this pilot whether a participant who was more experienced in using the OpenSim viewer controls would have found this task simpler.See Section 5.1.8 for mitigation.

ITC-SOPI QUESTIONNAIRE

The ITC-SOPI questionnaire is designed to investigate presence, especially spatial presence (see Table 5-1). It is a widely used and well-validated questionnaire (Lessiter *et al.*, 2001) including studies into the relationship between emotion and presence (Riva *et al.*, 2007). The pilot tested the questionnaire and enabled presence aspects of the design to be investigated. As a single questionnaire result, no statistical generalizations can be made. The laptop environment of pilot 1 was expected to be lower than virtual reality headsets of the main study. The results (Table 5-1) are broadly in line; the computer game values obtained during validation, shown in Table 5-2, except the ecological validity is low even assuming the highest rating for the missing answer.

Participant	Spatial Presence	Engagement	Ecological Validity	Negative Effects
Test 2	2.6	3.23	1.75 (1 unanswered giving a possible maximum of 2.5 and min of 1.6)	1.0

Table 5-1: First Pilot ITC-SOPI Presence Questionnaire results

The responses were on a 5-point scale: Strongly disagree (1), Disagree (2), Neither agree nor disagree (3), Agree (4) and Strongly Agree (5). They indicate any occasion of agreement during the time within the virtual environment, not an "average" experience. In this case, Test 2 consistently chose the highest level of agreement. The questionnaire responses cover all time within the virtual environment so do not distinguish between the orientation, calming stages or the gratitude-inducing checkerboard exercise that the earlier stages were preparing the participant for.

Table 5-2*: Results from validation of ITC-SOPI Presence questionnaire (Lessiter et al., 2001)*

Yet, there was such variation. Test 2 made annotations on the questionnaire sheet suggesting that she only felt 'drawn in' (question B1 contributing to Engagement) towards the end, which is consistent with her description of "Tedious" when beginning the chequerboard exercise and following the calm phase where engagement was so low as to result in her reading a magazine. She annotated a spatial presence question, "I felt I could move objects (in the displayed environment)" (question B19) with the word "eventually", which is consistent with her ability to become more engaged, as suggested by Jennet et al. (2008).

However, it could be argued that there is ambiguity as to the meaning of a level of agreement. It is not clear if distinctions between agree and strongly disagree truly reflect the degree of feeling. Does 'agree' compared with 'strongly agree' to the phrase "I felt that", used in many of the questions, mean that there was a weak versus strong feeling? Alternatively, does it mean "most of the time", as opposed to "some of the time" or even confidence in the recollection (which may reflect when the feeling occurred)? When the statistical measures from a randomised selection of participants are used it will be assumed that variations in the participants' assumptions will not be significant; in this single questionnaire the participant may be making atypical assumptions. It also needs to be born in mind that the difference between 'strongly disagree' and 'strongly agree' is not a linear one. The uncertainty or non-linear aspect of the components of this survey is acknowledged in the verification of this survey. The questionnaire makes use of the word 'content' and, by adding annotations to her questionnaire responses, the participant indicated she did not understand; furthermore, it was one of the questions affecting ecological validity that went unanswered. She also expressed confusion over the "sense of being in the scenes" and she marked 'felt like the content was 'live'' as confusing or not understood.

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Regarding the ITC-SOPI questionnaire, many aspects of spatial presence could not be altered within the environment as there was no sound (a point emphasised by annotations) or temperature or smell so all scored a 1 (Strongly Disagree), which is unsurprising. When dealing with those questions relating to visiting or being in a physical space the responses were much more positive: "I felt I was visiting places in the displayed environment" (question B9) – 4 (Agree), "I felt I wasn't just watching something" (question B12) - 5 (Strongly Agree). With all the non-visual sense questions removed, the mean spatial presence score rose to 3.29. It cannot, however, be assumed that the revised spatial presence score is strictly comparable to those in either Table 5-1 or Table 5-2, as the different questions between the component questions do not necessarily carry the same weight. It does, however, suggest that any sense of presence induced by different display environments supporting different senses (e.g. smell or sound, stereo sound versus mono sound) will have measures of spatial presence due to this issue alone. This aspect would be independent of any other attribute within the virtual environment. It is important, therefore, that any choice of technical-immersion stimulating the environment for spatial presence is identical in this respect, so avoiding introducing a systematic bias.

Notably, the question "I responded emotionally" (Engagement – question B32) was rated a 5 (strongly agree). This is consistent with the reported references to emotion in all stages of the pilot. Ecological Validity scores were very low (1.75+missing question) emphasised by the comment "Totally unnatural" to the question B5 "The displayed environment seemed natural". For this individual, the spatial presence and engagement scores approximate to that of the cinema display with no negative effects and a markedly lower ecological validity (how similar to the natural world the virtual environment is) score. There is a marked distinction between spatial presence questions relating to extra senses such as sounds, smell or temperature or multiple senses, which generally scored a 1 (strongly disagree) and all others (3.29). The most direct question relating to feeling in a place "I felt I was visiting the places in the displayed environment" (Spatial-Presence – question B9) was rated a 4 (agree).

The ITC-SOPI uses the term content yet notes on the questionnaire suggested that the term 'content' e.g. it felt like the content was 'live' could not be understood. A key term like a 'sense of being in' was not understood 'almost smell' was taken literally with the comment that there was no smell. A comment next to one of the engagement questions (B1) was "only towards the end".

In the pilot, increased reports of spatial presence occurred at the end (with the abortive chequerboard activity) rather than during the early stages, despite clear emotions being expressed early on 'anxious and threatening' during the orientation stage and suggestions of negative emotions ('abandoned and bored' or 'tedious') when referring back to the calming park stage. The fact that presence varies, despite a constant technical-immersion, demonstrates that, for spatial presence, there is no 1:1 relationship between technical-immersion (e.g. laptop monitor versus cinema screen) as the media platform has not changed, and that the major factor

may be engagement rather than the technology. There was a notable degree of interaction in the early stages between the participant and the researcher, with associated emotional responses.

There were reports of some involvement with physical objects e.g. expressions of pleasure related to learning how to sit on the red button. It is not clear from the report whether the presence of the researcher or the confederate was significant. Research into the relationship between emotions within virtual environments has suggested that narrative is important. There is a clear narrative throughout (the relationship between power dressed researcher and the psychological experiment) which may have stimulated the emotional responses.

This section has included an analysis of the validity of the ITC-SOPI questionnaire from a qualitative standpoint. One conclusion from the pilot is that any high and low presence-inducing environment should not differ in the senses catered for, as this will, by the nature of the ITC-SOPI questionnaire, involve a systematic bias in favour of environments with the extra sense. It is unclear whether changes of such extra senses would influence other factors.

5.1.7 Summary

The pilot showed that the overall approach to the research design is correct and is consistent with the enactive approach to emotion and affordance-based models of presence but that of the ITC-SOPI questionnaire model of presence has notable limitations.

There is evidence of how the pilot's context strongly influenced emotions being felt and that many emotions were felt. There was a very rich interaction between the participant, other avatars and individuals and the environment, as a situated model of emotion would suggest. Culture, identity, social norms and trust were all significant issues displayed. The group identity issues highlighted the need to track the participants' national and regional affiliation (and not just their values) as well as the potential bias introduced by using a single individual as the confederate in all groups.

 A high level of emotion demonstrated within a low presence environment suggests that: a) there may be little measurable difference between high and low levels of presence environments, b) there is a possibility that the level of presence in the tested environment is too high and does not show a condition where the lack of presence hampered the generation of emotion; should such an assumption be valid. Gratitude induction was piloted in the second pilot (see Section 5.4). There is a possibility that it is too marked, with little measurable distinction between low and high presence environments. The calming phase appeared to generate unwanted emotions (from the perspective of gratitude induction) rather than dampen them. This suggested that an improved mood induction procedure should be adopted.

The ITC-SOPI presence questionnaire, whilst useful for comparison with other research, demonstrated a poor link between its ecological validity measure (as realistic images rather than valid cues) and the emotions observed. The analysis suggests that this may be due to its non-affordance-based approach to knowledge and may have highlighted an underlying weakness in the implicit ITC-SOPI model of presence. It is important that ways of measuring ecological or affordance-based models of presence are assessed. It is also unclear whether the pilot is taking place in all virtual or partly virtual and partly real worlds. Given the focus upon the link between the spacial aspects of the emotional model used and presence, a better understanding of an explication of both space and presence may be needed. Avatar control issues prevented the gratitude induction exercise being carried out, although control was improving. This suggests that the orientation phase needs improvement. Instructions were hard to read and need to be improved.

The participant's and researcher's perception of the same object (the dress) were different. This is consistent with the view that knowledge of objective facts is interpreted in the social context in which they occur, and that subjective facts can be created by this interpretation. This view of knowledge aligns with the critical realist approach adopted within this research. It is also consistent with the cultural scaffolding concept within the situated perspective view of emotion, supporting the use of this model within the study. It is in line with the concept of affordance, e.g. the object of dress is to afford appropriate modesty for the both the participant and researcher but can also be perceived as an object affording power, threatening the participant. However, it is also possible for the interpretation to be understood in terms of a cognitive model of emotion (albeit one accepting the knowledge creation from the perspective of each individual).

5.1.8 Implementing the lessons learned

The pilot was designed to inform the development of the research platform. The first pilot confirmed the robustness and technical aspects of the virtual environment. It broadly confirmed the design of the exercise and buildings. The first issue was related to the high level of negative emotion and anger that could potentially impede any gratitude induction. The second issue was the avatar's appearance, including the clothing worn by the researcher and by the participant, having a potentially negative impact. The third issue related to initial problems navigating the environment. The navigation issues were addressed by introducing a separate training session independent of the main exercise, to bring all participants up to a baseline minimum standard. The researcher's avatar was dressed neutrally. The intention had been for the participants to select their own clothing, however this proved to be technically challenging for the participants and their initial dress had already influenced them. It was decided, therefore, to present future participants with a choice of avatars before entering the virtual environment. The avatar appearance needed to be investigated further to select the most appropriate avatar for the

confederate. In order to do this, the avatar appearance concerns were investigated and evaluated using the avatar appearance evaluation study detailed in section 5.2.

5.2 Avatar Appearance Evaluation

This study examines the appearance of avatars and their impact upon social factors such as attraction, trust, assertiveness, comfort, to be with as part of doctoral research into the role of emotions including gratitude associated with presence within virtual environments. The first pilot study and extant literature suggested that appearance could alter the feelings towards an avatar which would impact upon studies especially gratitude, a pro-social emotion. This study aimed to minimise the risk of a problematic avatar design that would unduly distort the main study by evaluating and identifying an avatar design of the confederate that would be acceptable across the participants. Thirty-seven participants were used (17 Female, 20 Male).

The research identified that no particular avatar was preferred yet participants could identify expected correlations between avatar attractiveness and trust, assertiveness, and overall comfort to be with. The participants avatar ratings were analysed using Krippendorff's Alpha, which is preferable to other inter-rater coefficients due its capability of handling multiple raters and robustness against missing data (Krippendorff, 1970, Hayes & Krippendorff, 2007). The inter-rater rating is very low (Overall, α=0.0555, see Table 5.3). This lies within the 95% confidence limit based upon bootstrapping of 10,000. For the purpose of the main study this is good. The low alpha levels indicate that there was little agreement between participants over how they rate particular avatar in terms of attractiveness, trustworthiness, assertiveness or comfort. This suggests that no particular avatar is preferable to the group at large. Identifying causation is not needed nor aimed for in this study (it may be due to individuals having no preference, or individuals having a preference which is not shared (Hönekopp, 2006)). Thus, any of these avatars is equally suitable as the confederate's avatar from the perspective of these factors, and the group as a whole.

Category	Raters	Units	Krippendorff's Alpha (Ordinal)	95% Confidence Lower Limit	95% Confidence Upper Limit	Within 95% Confidence
Attraction	37	20	0.0772	-0.0124	0.1646	YES
Trust	37	20	0.0317	-0.0603	0.1211	YES
Assertiveness	37	20	0.0289	-0.0636	0.1174	YES
Comfort	37	20	0.0641	-0.0246	0.1517	YES
Overall	37	80	0.0555	-0.0345	0.1421	YES

Table 5-3: Inter-rater analysis of Appearance Survey (Participants rating avatars)

An internal validity check was carried out using an internal cross-check that the avatar ratings were consistent with prior research for the factors being analysed. If statistically significant results for these factors are returned it suggests that: a) the questionnaire is measuring what was intended, and b) the sample size is large enough to measure the factors; making an inter-rater measure, such as Krippendorff's Alpha, meaningful in this context.

This cross-check was of 4 male avatars in a neutral blue T-shirt, across three subjectively ugly, good looking and mid-level attractive avatar to provide a spread of assessments of attractiveness. It was expected that more positive and trusting connotations would be attached to these avatars. This was analysed using

Spearman's Rank Correlation appropriate for use with the ordinal Likert scale questionnaire. A descriptive check confirmed it met the monotonic assumptions of Spearman's Rank Correlation. The findings were in line with pre-existing research, which was that the attractive avatars are perceived as more trustful. There was a strong correlation of trust (ρ (83) = 0.576, p<0.01), moderate correlation (ρ (83) = 0.305, p<0.01) with assertiveness and very strong correlation with comfort (ρ (83) = 0.755, p<0.01) against attraction as expected. N=83 was obtained by pooling together all the ratings across male avatars and excluding missing ratings. All results were highly significant below the 0.01 level for the neutral and attractive avatars. This indicates that the sample size and population is sufficient to assess between these factors of interest in the study.

This study suggested that it was unlikely that the avatar appearance of the confederate would be problematic in the main study and any of the avatar's designs presented may be used.

5.3 Second Pilot: Gratitude Induction and Interview Protocol

The second pilot was a technical evaluation of the gratitude induction procedure, interview protocol and improvements drawn from earlier development studies (see Sections 5.2 and 5.3). Three female undergraduate participants, P1-3, of the English-Speaking Cultural Grouping, with a mean age of 20 were involved. All participants used a laptop display. Using three participants is proportionate with the eight participants involved in the main qualitative IPA study.

All the questionnaires used in the main study were included, with the MEC-SPQ (Vorderer et al., 2004) and the Gratitude Attribute Check (GAC)(Bartlett & DeSteno, 2006) added. Participants P1 and P2 were helped and P3 was not helped. The GAC had a 7-point Likert Scale (modified from 5 of the Bartlett and DeSteno's (2006), as a result of the first pilot's findings). The GAC questionnaire results indicate that the gratitude induction worked. Both of the helped participants, P1 and P2, ranked much more highly than P3, who was not helped, with overall means 6 and 1 respectively (see Table 5-4). P3 did not record how positive she felt. This gratitude was reflected during the interviews. Feeling that a benefactor is acting genuinely (4 for P1-2, compared to 2 for P3) is consistent with gratitude building more positive feelings (Fredrickson, 2004). Participant P1, obtained the highest ranking despite their view that they had "been set up" and realised that the confederate was, in fact, the researcher.

Participant	Helped?	How grateful	How appreciative	How positive	Confederate Act Genuine	Mean GAC Rating
P1	Helped	7	7	7	4	7
P2	Helped	5	4	6	4	5
Mean		6	5.5	6.5	4	6
P3	Not Helped	1	1	-	2	1*(how positive missing)

Table 5-4: Pilot 2 GAC questionnaire and Genuine Confederate

The interview protocol was considered acceptable by the researcher, in that it helped him guide the interview without constraining it unduly and was easy to follow and did not constrain. However, the interview data was poorly recorded due to the anxiety, technical overload of the researcher, and technical difficulties (due to the having to take over the role of the confederate in addition to the existing tasks and roles; when all three trained confederates dropped out at the last moment). This was resolved in the main study especially, by finding committed confederates. This was unlike pilot 1, where the unstructured interview had less anxiety and fewer additional tasks despite the researcher being the confederate. It was not possible at this stage to test the virtual reality headsets as the first, affordable, Oculus Rift headsets were not yet to be released by the manufacturer.

5.4 Main Study

This section presents the main study analysed using IPA (see Chapter 4). It focuses upon the primary research question: What are people's lived experiences of emotion, especially gratitude, and presence within virtual reality environments? The themes presented were drawn together from those of the individual participants' themes.

The themes were developed and refined in increasing order of the amount of researcher interpretation. These were derived from the interviews. All the evidence of the main study was drawn together, with the main distinction being that part involved an exercise pushing a box whilst a later part involved pressing buttons to address emerging cybersickness concerns.

The study involved using a 15" LCD Monitor in a notional low presence context and the Oculus Rift head mounted display (developer kits 1 and 2) for a notional high presence context. Limited access to research facilities led to the study being carried out in different rooms, the layouts of which are given in Figure 5-5. Idiographic use of questionnaires is presented here for comparison but are of most use when addressing the secondary research questions.
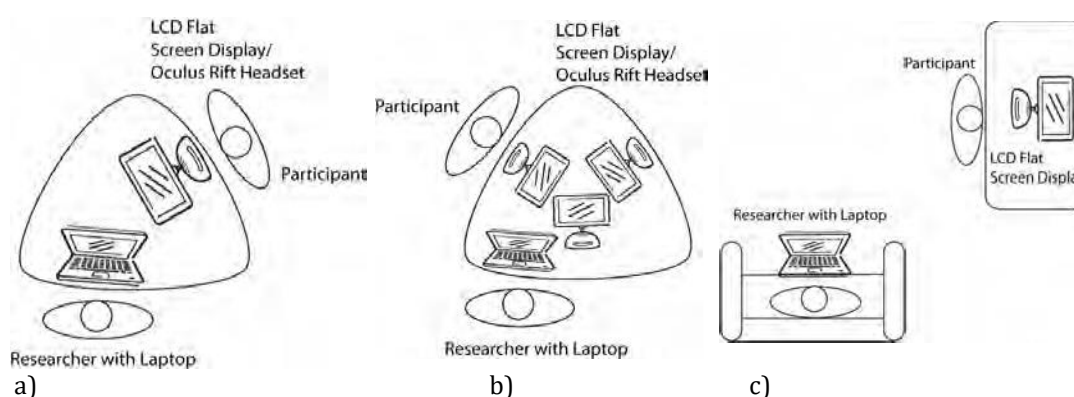
Figure 5-5: Layout of the research environment

5.4.1 Individuals' Super-ordinate Themes

This section draws together the super-ordinate themes developed at the level of the individual. There has been some "reconfiguring and relabelling" and their relationship to the individual themes is given in Table 5-5. Appendix O, gives a portrait of each individual's experience and a summary of the individuals' themes. These collated super-ordinate themes are utilised in Chapter 6 when viewed from the enactive perspective, applying the EAP. Thus, there is a growing degree of researcher interpretation and involvement of extant theory.

The themes identified interrelated aspects of the participants' lived experience of the research. Their avatars' pseudonyms were chosen by the participants and have been kept as these reflect part of their experience as an avatar; for instance, Test 2, clearly expressed the view that this was a psychological experiment. Whilst this thesis does not focus upon identity, it considers these pseudonyms to be part of the context of the results, even if not analysed in this research. The themes identified are purpose and intentionality; curiosity, exploration and evaluation episodes; unfolding presence; weirdness and dissonance; role of the avatar; gratitude: other, benefit, help; orientation of emotion: its nature and intentionality, and culture and foreknowledge. This includes issues associated with spatial presence (unfolding Presence: observer, immersed, present and embodied with breaks sub-theme), social presence (social presence as a dynamic unfolding episode's sub-theme) and the gratitude-helping (Gratitude: other, benefit, help theme) experiences. The presence theme includes aspects such as the relationship between emotion and presence, e.g. unfolding episodes with positive emotions leading to increasing social presence,

with social anxiety then decreasing social presence. As the focus of the participants' experience was the avatar, the three avatar-related sub-themes focus upon the avatar itself, experienced by the participant as an object, a body, a tool and the locus of the participant's virtual world actions. These also address aspects of the avatar as a representative, or even virtual embodiment, of others, and a special emphasis that emerged about whether the avatar is considered as representative or an embodiment of a real human being. These aspects of the avatar relate to spatial presence, for example, as an object and tool, when the participant experience is as an external observer. The feelings towards others and social interactions with the avatar can affect social presence and emotion, for example, when a doubt over the human nature reduced feelings of gratitude for David Beckham. Aspects such as distinctions in acting, weirdness and navigation are specific themes which inform the relationship between presence and emotions. The analysis, interpretation and evidence of these super-ordinate themes is given in Sections 5.4.2 to 5.4.9.

The participants

Eight participants were selected for the IPA study based upon pre-set interview quality criteria, namely the richness, the length and the relevance to the research questions (see Appendix H). These participants were broadly homogeneous in that they there were all postgraduate, white and came from a similar European
cultural grouping (English speaking, Protestant or Orthodox)(World Values Survey Organisation, 2011). There were four female and four male participants. In practice there was an element of snowball selection as word spread round that I was looking for participants and there seem to be a greater willingness for postgraduate students to offer themselves as participants than undergraduates.

Super-Ordinate Themes		Purpose and Intentionality: Personal, Interpersonal and Transpersonal		Curiosity, Exploration and Evaluation	Orientation of emotion: Its nature and intentionality	Unfolding Presence Episodes		Weirdness and Dissonance	Role of the Avatar			Gratitude: Other, benefit, help	Culture and foreknowledge
Sub-themes		Purpose and Intentionality	Uncertainty over purpose			Unfolding Spatial Presence	Social Presence as an unfolding episode		Object, Body or Tool	Evaluating the reality	Evaluating the reality: Humanisation		
Cookie	Monster	Y	Y	Y	Y	Y	Y	?	Y	Y	Y	Y	Y
David	Beckham	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hysteric	Monkey	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bob	Virtual	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N*	Y
Peter	Parker	Y	N	Y	Y	Y	Y	?	Y	N	Y	N*	Y
Shelly	Brown	Y	Y	Y	Y	Y	Y	N	Y	N	N	N*	Y
Belle	May	Y	Y	Y	Y	N	N	Y	Y	Y	N	N*	Y
Neil	Young	Y	Y	Y	Y	Y	Y	?	Y	Y	Y	N*	Y

Table 5-5: Summary of superordinate themes with immediate sub-theme

Y = theme exist, N = theme does not exist? = Aspects of the theme exist, blank = not relevant, N*= no helping

IPA focuses upon the meaning and interpretation drawing upon semi-structured interviews and not quantification as expected in positivist quantitative or even positivist qualitative research. It does however refer to increase and decrease in both emotion and presence. Instead the interviews are broken down into linguistic, conceptual and descriptive themes within the individual's context (see Section 4.7). Examples phrases indicative of levels are given in Table 5-6 but these are interpreted holistically within context and is not prescriptive quantification.

Level	Example Phrases	Intonations
Higher	more	Excitable, highly emphasised
Unchanged	No comment, stated the same, used the same absolute phrase	Calm or no comment
Lower	less	Calmly stated or emphasised
High	Very, extremely	Excitable, highly expressed
Moderate	Some, no emphasis	Measured tone.
Low	Slightly, a little	Calm, side reflection

Table 5-6: Indicative phrases and intonations suggestive of levels.

Where questionnaires are used, these too are interpreted within the context of the individuals and analysed qualitatively. The significance of the meaning revealed is not limited to the size of

these pseudo-quantitative measures. For these questionnaires it is unlikely that there are even intervals between Likert scale intervals. The limitations are highlighted in Sections 5.2.6 and 5.3 for the ITC-SOPI questionnaire and avatar appearance questionnaire respectively.

5.4.2 Purpose and Intentionality: Personal, Interpersonal and Transpersonal

Purpose was associated with a range of actions from micro-tasks, such as pressing a button, to strategic goals. From this main study, three categories of purpose emerged: personal, interpersonal and transpersonal. Purpose and intentionality is relevant to both the gratitude and presence aspects of this research. For gratitude, these categories are similar to Hlava and Elfers' (2014) domains of connectedness of "feeling connected with; 1) a part of one-self, 2) an individual or group, or 3) something outside of oneself" respectively (2014, p. 449). It is further relevant to the enactive approach to presence, which focuses upon purposeful enaction, and other theories of presence which emphasise the role of intentionality (Riva & Mantovani, 2012). At this stage of the analysis more fundamental or foundational purposes, such as maintaining an organism's existence or autonomy, is not examined. This is in part due to staying close to the individual's interpretation as the unit of analysis. Intentionality was identified in two related but distinct senses: first, in terms of "aboutness", i.e. that intent is about or towards something, and secondly, in terms of will, e.g. they intend to get married.

At the task and micro-task level, individuals identified short term aspects, such as pressing the buttons and how to navigate. At the personal level, there was often a focus upon a personal desire to explore or win. Interpersonal purpose involved shared purpose, especially at the social level, and transpersonal purpose involved given external normally strategic purposes, such as the research aims or obligations outside of the study.

For all of the participants, purpose and intentionality imbued their experience and actions. First, there was a distinction between their personal purpose (that of oneself), and goals. Secondly, there was that of transpersonal purpose (that of outside one's self or connected individuals), of the research and accompanying tasks. Thirdly, there was the interpersonal purpose (between individuals or groups) associated with the participant's social interactions with the confederate and the researcher overseeing the study.

Name/Sub-theme		Purpose and Intentionality: Personal, Interpersonal, Transpersonal	Happier Exploring	Bored not exploring	Lack of variety is boring	Increased Presence Exploring
Cookie	Monster	Y	Y			
David	Beckham	Y	Y		Y	Y
Hysteric	Monkey	Y	Y			
Bob Virtual	Virtual	Y	Y			
Peter	Parker	Y	Y			Y
Shelly Brown	Brown	Y	Y			Y
Belle	May	Y		Y		N
Neil	Young	Y	Y			

Table 5-7: Summary of Purpose and Intentionality Theme

CATEGORIES OF PURPOSE

Personal Purpose

Personal purpose and intent are that of the individual self. Personal purpose and intentions were revealed in all cases, even when first entering the virtual environment, indicating that participants brought with them personal foreknowledge, expectations and interests. All participants were curious and wanted to explore, but their personal purpose and intentions differed. David Beckham, for instance, recounted a personal prior interest in people, objects and variety and had a personal purpose to understand these aspects of the virtual environment. To this end, he intended to look around and explore, a common feature discussed in the theme Curiosity, Exploration and Evaluation.

> *David Beckham:*
> *I wanted to look around to see what it looked like, see who was in the rooms,*
> *what was (sic) the various objects were like. See how many different unique*
> *objects there were. (Quote 5-1:DB)*

Shelly Brown, for instance, expressed a strong emotion in her voice when relating to places as real places such as a city or country. This emphasised an emotional desire associated with an intent to explore the island.

> *Shelly Brown: I was excited. It was something new to me, so I was interested.*
> *(Quote 5-2:SB)*

> *Shelly Brown: and because it was an island it sounded appealing, so I just*
> *wanted to go around. (Quote 5-3:SB)*

The role of emotion, or at least affective states, was associated with all examples of purpose and intent and is revealed further in the other themes.

Yet others, such as Bob Virtual, were more focused on the task and what they were meant to do.

> *Bob Virtual:*
> *I don't know, it's just kind of fun to try something new and I was just curious to see*
> *what I was meant to do and how it would go and who this other person was. Yeah*
> *at the same time I had time issues.*
> *(Quote 5-4:BV)*

All participants described personal purpose in association with personal intent, either carried out or not, and, in the above cases, the theme of curiosity, exploration and evaluation and emotion. The detail of these emerges throughout the other themes. All the participants revealed that they experienced personal purpose balanced with both transpersonal and interpersonal purpose.

Balancing the Transpersonal

Transpersonal purpose relates to a purpose from outside of oneself or the relationship between oneself and others. There was a balance between the personal and transpersonal purpose in all cases. The most explicit transpersonal purposes revealed by all participants were those of the research aims and the required tasks within the virtual environment, such as pushing the boxes or buttons. The participants could not alter transpersonal purpose, as it was externally driven. This constraint was reflected in the MEC-SPQ questionnaires (see Table 5-11) where all participants rated the ability to change the course of events as low (2) or less. However, whilst all participants were briefed, not all aspects of the research aims were revealed.

> *David Beckham:*
> *I wondered what you were doing, whether I was supposed to interact with you,*
> *or not, or whether you were just disappearing to set things up. (Quote 5-5:DB)*

Cookie Monster balanced his own purpose and intent to explore with concerns that this would impact upon the study.

> *Cookie Monster:*
> *Yeah, I thought it was interesting, I was curious what would happen if I walked off the edge of the cliff, but I thought for the sake of the, you know, I just, I wasn't worried about any harm to myself, it was more to do with the fact that I thought that might cock-up the trial, or whatever. (Quote 5-6:CM)*

This balance could break down, as illustrated by Neil Young whose thwarted personal desire to carry out the exercise prompted impatience, closely associated with emotions such as frustration, irritability or anger. Neil had the personal desire to carry out the virtual study and in-world actions and explore, but to carry out such actions in-world he needed to request help from the externally (to the virtual environment) based researcher.

> *Neil Young:*
> *I was like, oh! This is the exercise. Although I was interested to find out a bit more, I recognised like the help points and the notice boards and things from the training environment previously.*
>
> *Interviewer:*
> *Okay.*
>
> *Neil Young:*
> *So I just started having a look at the boards and then, I don't know why, I felt quite impatient to get a cube and push it around and there wasn't one there, which is why I wanted help because I wanted a cube to push around. (Quote 5-7:NY).*

Cookie Monster further highlighted such a breakdown by later abandoning his care not to damage the trial (Quote 5-6:CM) during a period of anger and violence where he spent about 4 minutes (based upon the timings of the video playback) attacking the equipment (the button that needed to be pressed at the end of the study) shown in Figure 5.6.

a) Start of attack   b) End of attack

Figure 5-6: Movement of Help button (Green) during attack by Cookie Monster (In Blue)

Similarly, Shelly Brown, more gently, broke the instructions and continued on to explore, so leaving the park early to go into the main room where the tasks and meeting with the confederate were planned.

Intentionality, as with emotion, was reported throughout Shelley's virtual experience. This occurred both at the micro level, e.g. controlling the avatar movement, but also the strategic level, with the desire to follow the study tasks and her personal desire to explore the virtual environment presented in the theme 'Curiosity, Exploration and Evaluation'. Shelly Brown also recognised that there was an up and coming task and she was being given instructions. This led her either to push the boundaries, e.g. exploring the building, or to ignore instructions, e.g. waiting. At one level the park was a place to prepare for the task, at another it led to an open door - a sign she found inviting.

> *Shelly Brown: When the music stopped there were instructions to go to the room I did not go because. So, it says I have eight minutes*
>
> *Interviewer: yea*
>
> *Shelly Brown: and then that I will go to another place.*
>
> *Interviewer: yep*
>
> *Shelly Brown: but I think I went to the place before the eight minutes*
> *Interviewer: yes (smile)*

> *Shelly Brown: because yes and then I did not see a box, so I became confused. so*
> *that it when I oh I might have to wait for this (sic) instructions so, but I saw a*
> *way in to the building, so I thought I would go in. (Quote 5-8:SB)*

In these situations, the purpose has been focused upon the virtual experience. Bob Virtual was influenced by a transpersonal purpose of an obligation to make an important meeting, outside of the research venue. Meeting this obligation led to a personal-purpose balancing the transpersonal purposes, not associated with the research, with those of the research aims set by the researcher. Missing the meeting was associated with anxiety and frequent breaks in presence in the early stages of her virtual experience. This is an example of an emotion, anxiety, associated with an external concern, leading to a purposeful action that resulted in a break in presence and immersion by acting to focus upon the external clock.

At the task level there was a purposeful action to explore the clock, evaluate it, and potentially choose to leave (an intent) the study altogether.

> *Interviewer: So, you were saying that, when you were there, and then you snap*
> *out of it, can you clarify what you meant by that?*
>
> *Bob Virtual: Well it's partly because I'm a bit conscious of the time that I kept*
> *checking the clock that I wasn't running late and that kind of takes you out of it*
> *doesn't it? (Quote 5-9:BV)*

Once there was a greater level of immersion, spatial and social presence, Bob Virtual reported less concern with her externally driven purpose: a need to check the time. Instead, her purpose focused more upon the confederate and the tasks involved. The themes associated with this are discussed below.

Issues relating to power were identified here, in the first pilot (Section 5.1) and in Hysteric Monkey's communication with the confederate (see Section 5.4.4) where inequality is discussed further.

All participants were aware that the research study's aims provided a wider purpose beyond themselves or the other participants. In one case, that of David Beckham, there was also a desire to understand the trans-personal purpose of the research study and his expectations were revealed when he first caught a glimpse of the researcher's avatar:

David Beckham:

I wondered what you were doing, whether I was supposed to interact with you,
or not, or whether you were just disappearing to set things up. (Quote 5-10:DB)

Similarly, during the main task he wondered, erroneously, if he and the confederate ought to be competing together. At the task level his intention was to press the buttons quickly, with a personal purpose of winning.

David Beckham:

I have a bit of a competitive streak, so I wondered if we were competing against
each other, so I was trying to press the buttons as quick as possible. (Quote
5-11:DB)

Others also felt competitive, although Bob Virtual's personal desire to win was overcome by the transpersonal study aims. Bob Virtual's comment also reveals the connection with the interpersonal relationship with the researcher, common to all the participants.

Bob Virtual:

When something like this, a test comes up, I'm like, okay, I didn't care what you,
whether, what you were testing, I just wanted to win. (Quote 5-12:BV)

A key aspect is that, in these instances, the transpersonal purposes originated outside of the virtual environment and could not be adjusted by the individual.

Balancing the Interpersonal

Interpersonal purpose is that shared between individuals and groups. In this study, the other individuals are experienced as: an avatar for the confederate, and both as an avatar and in natural body form for the researcher. This is a significant factor discussed in the avatar themes, social presence themes and gratitude themes.

One example of interpersonal purpose occurred during the social interaction between the confederate and David during the gratitude-inducing episode where the confederate helped David. David discussed the strategic role of helping, a key aspect of benefit-induced gratitude, when he looked to see if the confederate needed help during the main task.

David Beckham:

I think so, yeah, I think it's just, perhaps to illicit a positive relationship with
someone, you should offer your help. (Quote 5-13:DB)

Not just helping but feeling gratitude towards the helper was also purposive, revealed by doubts over whether the confederate was human or an artificial intelligence bot:

> David Beckham:
> Intrigued, it did make me wonder whether my gratitude towards them was not wasted... (Quote 5-14:DB)

Thus, in the gratitude episode, purpose was not just that of the helper, but of the helped. Such purpose is inter-personal, and there is mutual dependency.

Bob Virtual, on several occasions, emphasised the joint endeavour and joint-sense-making. This was first illustrated by her concern to involve the confederate in the task, and later by celebrating, after being helped, that there was a joint task completion.

This is consistent with the high level of social interaction during that task, suggestive of higher levels of social presence.

> Interviewer: And how did you feel when that happened then? When you thought.
>
> Bob Virtual: Good.
>
> Interviewer: Good?
>
> Bob Virtual: Yeah. 'Cos either way, we'd done it, so you know. (Quote 5-15:BV)

Purpose was important throughout, especially focused upon action, either personal-purpose and trans-personal purpose, especially when coupled to the purpose of the research aims. Purpose could be focused both within the virtual environment and study and external to the virtual environment.

Purpose was associated with curiosity, external demands and desire to follow an externally imposed purpose from the study. Bob Virtual had chosen to help with study (intent); although her motives were not explored in this study.

> *Bob Virtual:*
> *… at first, I didn't really know what I was doing, I was still sort of like looking and also literally looking around the room, like, am I meant to be doing something, I don't know. You were just like looking now, so I was like I guess, I'll use the on-line environment to come here to get it now. So, at first, I wasn't so into it. (Quote 5-16:BV)*

Purpose and intentionality imbued all aspects of the participants' actions. The section also highlighted the balance between personal, transpersonal and interpersonal. It is closely associated with curiosity, exploration and evaluation. It is also is associated with a range of emotions, such as excitement or frustration and emotions, or affective states, such boredom. Bob Virtual highlighted an example of an association with presence. Issues relating to power were identified and are also examined in Sections 5.2 and 5.5.4.

UNCERTAINTY OVER PURPOSE

For all participants, there was uncertainty over purpose. This caused anxiety and frustration. In addition to emotions such as excitement, other significant emotions involved anxiety, such as about messing up the tasks, and uncertainty.

> *Interviewer: During the actual training session itself you wanted to explore the whole island?*
>
> *Shelly Brown: That's it (laugh) erm and then I messed it up, so I decided I would just finish.*
> *(Quote 5-17:SB)*

Shelly Brown discussed two aspects of anxiety: that associated with messing up and that associated with the task. Her anxiety about messing up led to her disengaging from activities such as exploring (Quote 5-17:SB), whilst her anxiety about the unknown upcoming tasks triggered her engagement with preparatory activities.

> *Shelly Brown: Yes (laughs) erm, I just know that I had to do something, like to do a task so I was kind of not being nervous but being anxious what I would be asked to do with this place. erm, that is what I was thinking, I was just preparing myself*

> *Interviewer: Anxious?*

> *Shelly Brown: Yes. (Quote 5-18:SB)*

Others sought clarity, such as Belle May (Quote 5-31:BM) who asked the researcher directly. A third approach was to ascribe purpose, demonstrated by David Beckham who assumed that there was a measure of success at winning the task when there was none (Quote 5-11:DB).

5.4.3 Curiosity, Exploration and Evaluation episodes: happier and often greater Spatial Presence

Purpose and Intentionality were associated with curiosity, exploration and evaluation. Curiosity and exploration were associated with greater happiness, and often there was a co-occurrence with a greater sense of Spatial presence. The early phases of the experience were associated with mild level of curiosity and other emotions. Two exceptions were Shelly Brown and Belle May. Shelly Brown was highly excited from the very beginning, very curious and exploring, whilst Belle May felt no presence within the virtual environment. In general, the intensity of emotions recounted, such as happiness, lay within a normal range of intensity.

Name		On going cycles of curiosity, exploration evaluation and action	Curiosity and Exploration associated with greater happiness.	Lack of variety	Increases in Presence
Cookie	Monster	Y		Y	
David	Beckham	Y	Y	Y	Y
Hysteric	Monkey	Y		Y	
Bob	Virtual	Y	Y	Y	
Peter	Parker	Y		Y	Y
Shelly	Brown	Y	Y	Y	Y
Belle	May	Y		Y	
Neil	Young	Y		Y	Y

Table 5-8: Summary of Curiosity and Exploration Theme

On-going cycles of: curiosity, exploration, evaluation and action.

All participants were involved in an on-going cycle of curiosity, exploration and evaluation. Almost all activity involved curiosity, followed by exploration, evaluation and action. This involved both the physical environment and social environment.

Neil Young exemplifies how curiosity, like purpose, existed prior to entering the initial stage, The Park, and exploring the virtual environment.

> *Neil Young:*
> *Before the park? The emotions that I felt?*
>
> *Interviewer: Yeah.*
>
> *Neil Young:*
> *I don't know, I was interested to, I don't know if that counts as an emotion, but interested to explore, being curious, yeah, I was curious to explore the environment. (Quote 5-19:NY)*

These tended to occur in episodes either structured by the phases of the study or more localised temporal interactions within the area of interest. David Beckham describes such an experience

during the opening park phase with an episode of his exploring and evaluating the Parkside buildings for variety.

> *David Beckham:*
> *Intrigued. I think I was just generally interested in the environment and having*
> *a look around. I was curious, that's why I'm going between building to building*
> *looking in, seeing whether they were all the same or different if some of them*
> *are unique, some of them aren't. (Quote 5-20:DB)*

This accords with his declared interest in people, objects and their variety (Quote 5-1:DB).

Bob Virtual, in a later phase, upon entering the room where the main exercises were carried out, similarly wanted to explore. This is in line with her interest in the doing the task (Quote 5-4:BV).

> *Bob Virtual:*
> *Well, obviously, I saw some signs and I saw the big chequer board and things, so*
> *I thought, cool, I've got to do something. So, I looked at the instructions and I*
> *was like, oh this seems to be simple, I'll try to actually do it, it didn't work.*
> *(Quote 5-21:BV)*

Such curiosity, exploration and evaluation also included social interactions and evaluation of the confederate and the avatars. Neil Young, for instance, like almost all participants, evaluated the confederate's avatar, following an exploration or examination. This was, in part, linked to curiosity about the implications of transpersonal research aims in this context.

> *Neil Young:*
> *Yeah, I think I wondered, not knowing exactly what you were trying to find out*
> *from the, from the experiment. I was like, is it my perception of someone who's*
> *being real, because she seemed quite real, but I was like, it could quite possibly*
> *not be. So, I guess that's what I wondered, but that's why I was thinking. (Quote*
> *5-22:NY)*

In contrast to Neil's interest, Shelly Brown carried out a negligible evaluation of the confederate, in line with her negligible interest in the social dimension as she "did not mind" (Quote 5-81:SB) the confederate being there. Shelly Brown's experience is discussed in more detail in the sub-theme of Social Presence (see Section 5.5.4)

Further evidence of such curiosity and exploration associated with purpose and intentionality is given in the Purpose and Intentionality theme including, Shelly Brown in Quote 5-2:SB,5-3:SB, Bob Virtual in Quote 5-4:BV and Cookie Monster in Quote 5-6:CM.

Curiosity and Exploration associated with greater happiness

Curiosity and exploration were frequently associated with greater happiness and, where there was a lack of it, negative emotional states, such as boredom. The most marked example is that of Shelly Brown who was excited and wanted to explore the virtual island (Quotes 5-2:SB, 5-3:SB). David Beckham, for instance, felt happy and content; in this case a positive experience associated with his exploration of the post box in the park.

An example of increased happiness was Bob Virtual's comments that exploration was associated with fun and niceness.

> *Bob Virtual:*
> *Other than that, I don't know, just fun, I don't know thought I'd just explore and see what I can do. (Quote 5-23:BV)*

Similarly, David Beckham felt happy when exploring a post box within the park.

> *David Beckham:*
> *Yeah, I like exploring things, so I guess, happy or content. I've a feeling I've gone up this way to look at this way and look at the post box and things. I did like the post box; I guess that could be a positive experience. (Quote 5-24:DB)*

> *David Beckham:*
> *Okay, happy I guess, curious, I don't know if curious counts as an emotion. (Quote 5-25:DB)*

The most extreme happiness associated with exploration in the early phase was that of Shelly Brown (Quotes 5-2:SB, 5-3:SB) and also in the later phases (Quote 5-8:SB) discussed in purpose and intentionality (see Section 5.5.2). Alongside this desire to explore was her sense of journey and associated pleasure.

> *Shelly Brown: erm … and yet at some point it just felt like I was there. The sign said the way in. (inaudible) felt like going somewhere nice.*
> *Interviewer: So you enjoyed it.*
> *Shelly Brown: Yes, yes, o yes, I did. (Quote 5-26:SB)*

This pleasurable sense of journey is contradicted in her questionnaire response reported in Section 5.4.4 where her overall sense of having been on a journey was only given a relatively low rating of 2/5 (Question A3) in the ITC-SOPI questionnaire (see Table 5-12 for summary).

For all the other participants, however, in the early park phase the emotions were reasonably measured. Peter was initially calm and there was some curiosity and exploration, as requested during the instructions.

> *Peter Parker: Just how I feel normally*
> *Interviewer: Which is?*
> *Peter Parker: Calm (Quote 5-27:PP)*

> *Peter Parker: I was in like island or small settlement type of thing and just I*
> *thought having a look through what's there was appropriate. It was asking me*
> *to do that, so I just had a look around all the buildings. (Quote 5-28:PP)*

This was even true where the background music was difficult to hear. The background music selected was from pieces identified as calm, emotion-inducing music.

> *Cookie Monster:*
> *I thought the music, the setting wasn't high enough, but I found the music hard*
> *to hear, but I was intrigued just to have a walk around and I think, I think it*
> *said to explore the park.*

> *Interviewer:*
> *And, were you, what was your mood at this stage?*
> *Cookie Monster:*
> *I was alright, I think, at that stage. (Quote 5-29:CM)*

Lack of Variety

All of the participants, except for Shelly Brown, noted the lack of variety within the park. Belle May experienced the negative emotional state of boredom when there was little scope for exploration.

> *Belle May:*
> *I think I was quite relaxed, just exploring, I was getting a bit bored on the grass,*
> *I was waiting for the music to stop and it did feel like it was going on forever.*
> *So, I guess I was just trying to fill that time by exploring around. (Quote*
> *5-30:BM)*

> *Belle May:*
> *I guess I was just wondering what I'd need to do. I was probably expecting at*
> *this point to maybe, 'cos a task was there, to maybe see the other person.*

> *Again, I think I was just waiting, for the next instruction. Again, feeling very*
> *much like I was just outside of the character. (Quote 5-31:BM)*

Bob Virtual noting the lack of variety, highlighted the pleasure associated with finding something of interest.

> *Bob Virtual:*
> *Well, I mean you're noticing everything because all the houses are the same, I*
> *did see that you had furniture in the first one and then not in the second, and I*
> *thought 'oh, that's a little bit different' and 'that's nice'. (Quote 5-32:BV)*

David Beckham expressed an early interest in both people and objects within the virtual environment, emphasising the importance of variety in Quote 5-1:DB. David related, in Quote 5-33:DB, that after an initial exploration the lack of variety of objects such as similar buildings and trees was unrealistic and provided little scope for exploration.

> *David Beckham:*
> *... At first there was things to see, things to explore, but once I'd seen it all and*
> *seen it was repeating and things, maybe I didn't feel like, so much, that it was a*
> *real environment. I became acutely aware that it's not a real environment...*
> *(Quote 5-33:DB)*

In contrast to increased positive feelings at times of exploration, where there was limited scope for curiosity and exploration, more negative feelings associated with boredom occurred. During his task David was happy carrying out tasks and being active. As the variety decreased, more negative feelings occurred.

> *David Beckham:*
> *I mean at first, I was finding it interesting, trying.... I was happy pressing all the*
> *blue buttons. It did get quite tedious after a while, so I guess that would change*
> *my feel, I wouldn't say necessarily sad, but I would feel more negatively as it*
> *went on. (Quote 5-34:DB)*

Here, David describes how both realism and exploration declined due a lack of variety. Similarly, where there was a lack of variety, the negative feelings of boredom would set in.

Increases in Presence

David experienced a peak in spatial presence upon seeing the researcher's avatar. This declined as the limited scope for exploration became apparent.

Interviewer:
Your feeling of actually being in a place, in the park?

David Beckham:
A little bit, I think perhaps when I saw your person walking around the corner,
that might have effected it (sic), otherwise, I think the more I explored, I saw it
was all the same and that you could only go so far, that perhaps changed my
feelings that perhaps I was there then. (Quote 5-35:DB)

Similarly, Peter Parker, who also caught a glimpse of the researcher's avatar, also felt more present with the virtual environment, although his most marked increases in presence occurred during the later exercises.

Peter Parker: Actually, saw your avatar behind one of the buildings.

Interviewer: I was parked there.

Peter Parker: So yeah, I felt engaged, I mean not as much as when I did the
other activities but to an extent yes. (Quote 5-36:PP)

Neil only felt slight levels of emotion "didn't feel uncomfortable" but mild curiosity about the environment as there was relatively little to explore within the park.

Neil Young:
I didn't feel, I didn't feel uncomfortable in any way, it felt, although I've spent
time in kind of virtual environments before so, I guess. No, I was just interested
to explore. (Quote 5-37:NY)

But then apart from that in the square itself, I was like well there's not all that
much here, so I was gonna go around a few of the buildings, (Quote 5-38:NY)

This theme identified the widespread prevalence of curiosity, exploration and evaluation amongst all participants.

This intentionality evidence identified that there can be an increase in positive emotions and happiness with increased curiosity and exploration. The reverse suggests that a lack of variety, with less to be curious about, tends towards negative, sad or the negative affective state, boredom. Boredom, like curiosity, stimulated exploration.

5.4.4 Unfolding Presence

This theme incorporates both spatial and social presence as dynamic episodes over time. Seven of the eight participants experienced both themes with one participant, Belle May, not experiencing any presence within the virtual environment (see Table 5-5).

This sub-theme is the core theme associated with spatial presence. There are three aspects to this theme: first, its unfolding nature (see Table 5-9) and the context in which this happens; secondly the theme's relationship to emotion and thirdly, its relationship to the other themes.

Name		Observer	Immersed	Spatially present	Embodied	Breaks in spatial presence
Cookie	Monster			Y		
David	Beckham	Y		Y		
Hysteric	Monkey	Y		Y		Y
Bob	Virtual	Y	Y	Y	Y	Y
Peter	Parker	Y		Y		
Shelly	Brown	N	Y	Y	Y	Y
Belle	May	N	N	N	N	N
Neil	Young	Y	Y	Y		

Table 5-9: Stages linked to spatial presence

First, as spatial presence unfolds: a) low presence tended to be more associated with feeling like an observer; b) presence is not binary between the virtual environment and the natural environment; c) presence often co-varies with activity and exploration but this is more associated with the curiosity; d) there can be sudden breaks in presence or shifts in awareness from the virtual environment to the external room. This seemed more likely when the level of presence and immersion were lower; e) presence does not always co-vary with emotion, f) it is possible to feel aspects of spatial presence in a 3D film (the participant, Belle May, did not do so in this study's environment) or absorbed as in a book. The participants providing evidence for these themes are in Table 5-10.

Name		Low presence as an observer	Spatial presence co-vary with activity esp curiosity	Spatial Presence not always increase with	Sudden breaks in presence	Presence not binary	Spatial presence reported in a film
Cookie	Monster	Y	Y	Y	Y		N/A
David	Beckham	Y	Y		N	?	N/A
Hysteric	Monkey	Y	Y	Y	Y	?	N/A
Bob	Virtual	Y	Y	Y	Y		N/A
Peter	Parker	Y	Y		?	Y	N/A
Shelly	Brown		Y		?	Y	N/A
Belle	May	N	N	N	N	N	Y
Neil	Young	Y	Y		N		N/A

Table 5-10: Aspects of Spatial Presence.

There appears to be a distinction between the emotions for social presence and those for spatial presence. Both were linked to the nature of the emotion, its intent and orientation. The analysis in this chapter is developed further in Chapter 6. Social presence appears to be closely related to social emotions between the various parties especially the confederate and the participant.

For Spatial presence, the topic of this sub-theme, the effects of emotion seem to be related to: a) whether the orientation of the emotion is internal or external to the virtual environment; b) whether the intent is associated with the emotion; c) the level of immersion; d) weirdness and contradictions, e.g. between two individuals or doubt over the reality of the avatar. There are additional aspects such as the impact of variety and realness with interest and possibly prior experience.

Describing Spatial Presence

Spatial presence is, in short, "the feeling of being there" and is identified as an unfolding experience over this study. It is focused upon the feelings of being in a space or place; usually distinguishing between the virtual and natural environments. Whilst Spatial presence focuses upon being 'there' it was associated and co-exists with being immersed or absorbed, possibly best understood as a "being in" aspect. Care had to be taken to unpick these two constructs. A key aspect associated with Spatial presence is the distinction between whether it is internal or external to the virtual environment; however, the participants' experience was not that of a simple binary. This non-binary concept may be more complex in mixed and augmented reality

scenarios. Peter Parker gave a succinct comment of his perception of what could be termed spatial presence. For other participants their description of spatial presence had to be pieced together from the details.

Peter Parker defined engaged in relation to the virtual environment and physical self:

> *Interviewer: Okay. By engaged, what do you mean by engaged?*
>
> *Peter Parker: I felt that I'm more within the environment than I am within my physical self. (Quote 5-39:PP)*

He is, thus, relating being in the virtual environment "there" relating this to his physical self, similar to Verapen's (2010) concept of spatial presence as "emplacement", where the self is emplaced in the virtual space. The view of "there" being a real place was explicitly picked up by Shelly Brown but less so by others.

> *Interviewer: And did this still a real place or non-real place or...*
>
> *Shelly Brown: Yes, yea, real place!*
>
> *Interviewer: Real place. (Quote 5-40:SB)*

The study revealed feelings of spatial presence as unfolding over the exercise. This was exemplified by Bob Virtual in identifying stages such that of an observer, a feeling of immersion, a feeling of being in a place and, at its most extreme, a feeling of being embodied in an avatar..

Spatial Presence experienced as an Observer

Over time, there was an increased sense of immersion that Bob Virtual, for example, compared to immersion in a book. She related her earlier experiences to a 'settling into a book' and there remained an awareness of the external environment and purpose.

> *Bob Virtual:*
> *I don't know, I guess it did change in the sense that when I first went got there I was like an observer, just entered looking around, but then once I got into that second area [The main room where the activity and meeting the confederate took place] I kind of, just like with a book, you have to kind of get into it and then once you are in it, you are absorbed in it. (Quote 5-41:BV)*

This relatively low level of presence at the beginning was typical of most of the participants. Hysteric Monkey, who wore a virtual headset, reported low levels of spatial presence (feeling of

being there): being more like an observer external to the environment in all but the actual exercise.

> *Interviewer:*
> *Okay, now the next thing is relating to experience of your feelings and sense of being somewhere, in there. First of all was in the park, did you actually feel as if you were in?*
>
> *Hysteric Monkey:*
> *I felt more like an observer than actually being in there.*
>
> *Interviewer:*
> *Okay, did that change over time? [in the context of a discussing the whole experience]*
>
> *Hysteric Monkey:*
> *I think the feeling didn't really change that much, no. Maybe it did a little bit when I was actually doing the exercise. (Quote 5-42:HM)*

During the early stage, Peter felt, on balance, more spatially present within the virtual environment during this calm phase, with relatively modest levels of active exploration and curiosity. Here he draws together being engaged, with spatial presence and being within his physical self and states that this was greater during the greater amount of activity during the task of pushing boxes.

> *Peter Parker: So yeah, I felt engaged, I mean not as much as when I did the other activities but to an extent yes. (Quote 5-43:PP)*

The increase in spatial presence during the main exercise was common, except for Belle May who never came to feel present in the virtual environment. The relationship between presence and other themes, especially Purpose and Intentionality and Curiosity, Exploration and Evaluation, is discussed further within these themes. Points in presence were commonly associated with increased activity, as described by David Beckham, Peter Parker and Neil Young amongst others. Spatial presence increased upon entering the main room (Bob Virtual described this as 'that second area' in Quote 5-41:BV). Some participants felt they were observers during these lower levels of presence. This is further discussed in allied themes relating to the avatar. In contrast, Shelly Brown experienced higher levels of presence early on and Belle May felt no sense of presence within the virtual environment throughout the study.

Presence co-varying with activity and exploration

The last section discussed how immersion and spatial presence tended, but not always, to increase with activity, such as when exploring through curiosity. The curiosity, exploration and evaluation theme (see Section 5.4.3) identified that positive emotions were associated with greater curiosity and associated exploration, an activity, thus presence and activity tended, but not always, co-vary. Whilst Peter Parker associated the term "engagment" and spatial presence (See sub-section Describing Spatial presence) immersion and presence can be distinguished.

Immersion in the Task

One aspect of the virtual experience is immersion within a task. This can be conflated with presence. Three participants explicitly distinguished between the absorption by the task and that of place or the person, the latter associated with spatial and social presence. This is consistent with concepts distinguishing between immersion (Brown & Cairns, 2004) and presence and wider concepts of flow (Csikzentmihalyi, 1990), a pleasurable feeling when lost in a task, and peak experience utilised in wider definitions of gratitude. This distinction was expressed most clearly by Shelly Brown and Neil Young who distinguished task from people and place respectively.

Neil distinguished between his spatial presence associated with the practical task but acknowledged that he was more involved when with people.

> *Neil Young: I found, although when I was stuck in the gazebo it's like how do I get*
> *out of this thing. But I found that I felt more involved with it when I like saw other*
> *people and started talking with, or what I felt to be other people. (Quote 5-44:NY)*

Whilst the role of task is separated from place and person, exploring place and communicating with people are still purposeful and intentional actions (see Section 5.4.2).

Similarly, Shelly Brown, whilst drawn in, immersed and losing awareness of both the task and the place, still felt able to distinguish between the feeling of being in a place and in the task, which she described as "someone on a computer" or "in the task".

> *Shelly Brown: Yes because I was drawing my, whole of my emotions to the place*
> *like I was there, yes I was feeling there. And then I have to do something in a bit,*
> *no place, someone on the computer. (Quote 5-45:SB)*

Shelly Brown was highly immersed during the task; she concentrated to the extent that she lost an awareness of other things, including movement of her natural hand, which had Galvanic Skin Resistance (GSR) probes attached.

Shelly Brown: Another thing I noticed myself doing I was concentrating on the task so much that you know at beginning. I was resting my hand on the table and then my hand was like this because I don't know because danger may be all I was just so focusing upon the task that I did not realise I was moving my hand.

Interviewer: How aware were you of other things around you?

Shelly Brown: No, I was just in the task. I was just focusing on like just doing it. (Quote 5-46:SB)

This high level of immersion in the doing of the task she described as a state of "just in the task" (Quote 5-46:SB).

Neil distinguished between the spatial presence of focusing upon a task, such as on how to extricate himself, and the greater levels of presence and involvement associated with meeting people.

Neil Young: I found, although when I was stuck in the gazebo it's like how do I get out of this thing. But I found that I felt more involved with it when I like saw other people and started talking with, or what I felt to be other people. (Quote 5-47:NY)

Previous sections have highlighted a distinction between immersion and presence including its relationship to activities. There was also evidence of presence associated with media.

Media Presence

Whilst Belle May did not feel present during her time in the study, she revealed that she could feel a sense of presence or absorption during 3D films to the extent that she wanted to touch.

Belle May:
Although when I have watched like virtual films, I have very much felt like I've been in them, I guess that's the 3D effect.

Interviewer: Films, oh, 3D films?
Belle May: Yeah.

Interviewer: So, what are those things like?

Belle May: Like Avatar. [The name of the film]

Interviewer: Avatar?

Belle May: There are some other ones. Yeah you do want to reach out on those...
(Quote 5-48:BM)

Presence, and embodiment, outside of this study was not focused upon in the interviews, so the prevalence across the themes and the relationship to emotion in this situation were not further explored. The closest similar experience was that of Bob Virtual's reference to absorption in a book (Quote 5-41:BV). Whilst the focus of this thesis is upon virtual reality, understood as a computer-generated environment with an avatar, any account of presence needs to consider experiences outside of virtual environments.

Breaks of Presence in the Virtual World

Breaks of Spatial presence within the virtual world were noted for their sudden 'snap' into the natural environment. The key common aspects here relate to focus and awareness. For Spatial presence, the break occurred when there was a change of focus out of the virtual environment or place. Associated with this was a change in intention and purpose. Breaks of presence occurred in four circumstances: first, navigation problems such as the controller becoming apparent (see Section 5.5.4 Navigation Problems, Dynamic Coupling and non-transparency and Section 5.5.5); secondly, contradictions between bodily aspects, such as sitting whilst the avatar is walking; thirdly, an awareness of both the external researcher in the natural room and the researcher's avatar. The fourth type was associated with on-going anxiety that the external purpose, such as an important engagement following the study and interview, would be missed, which led to regular checking of a clock on the external interface.

Bob Virtual:
So yeah, so basically what happened is that I sometimes just checked the bottom of the screen and I was like, 'oh, yeah, I'm actually just in a room'.
(Quote 5-49:BV)

All of these situations were associated with emotion, even if relatively mild. Navigation is typically associated with frustration and a dissonance between, for example, being seated whilst walking in the virtual environment (see Quote 5-51:HM). Such dissonance and weirdness can itself be associated with psychological discomfort (see Section 5.4.6). Not all navigation problems led to breakdowns, some led to a focus upon the internal cause, e.g. caught in a gazebo (see Section 5.4.3). For the fourth type, anxiety was associated with the external trans-personal purpose and, again, led to a focus and intent directed to the external environment.

Navigation Problems, Dynamic Coupling and non-transparency

Navigation problems were one of the major causes of breaks of presence within the virtual environment. Navigation includes familiarity with the controls and the skills the controller needed. Where there is a problem this was frequently associated with the negative emotion of frustration. It is well a well-documented concern within virtual reality scenarios (Brown & Cairns, 2004; Lombard & Ditton, 1997). In this study, it was one of the causes leading to breaks of presence.

Shelly Brown had feelings of embodiment and of being in a real place, but these were not continuous, and could be disrupted by navigation matters, such as using the keyboard. Shelly Brown attributed this to a lack of familiarity with navigating the avatar. Even so, she described this as affecting half of her attention, not all of it.

> *Shelly Brown: Erm I had to concentrate on the navigation like the keys.*

> *Interviewer: Yes.*

> *Shelly Brown: I am not used to this, so I was focusing half of my attention onto this and just moving. (Quote 5-50:SB)*

One aspect of spatial presence and immersion, when purely in the virtual environment, is a loss of awareness of the non-virtual experience. Hysteric Monkey attributed part of this to virtual walking difficulties whilst sitting on a natural world chair that constrained his movement, along with the use of a hand-held controller. This is evidenced by his early experience not involving the exercise.

> *Interviewer:*
> *Okay and were you aware of the outside virtual space? Outside of the virtual space.*

> *Hysteric Monkey:*
> *Yeah, yeah, definitely. Well you have this handheld to control stuff, so that's already out of the virtual space, so you are still using your hands for the controller to do stuff. The chair as well, because you feel your movement on the chair and stuff like that, [my emphasis] so yeah, I was aware of other things around me. (Quote 5-51:HM)*

> *Hysteric Monkey:*
> *Walking around was a little bit difficult, I think because you are sitting down, and you can't really move a lot in the direction that you want to walk. So, you*

are mainly limited to like, looking at like, this angle, I don't know how many

degrees it is but, it can look a little bit, but if you actually want to change

direction or go backwards then it's quite difficult to do so. (Quote 5-52:HM)

Ordinarily people do not notice the chair they are sitting in, but Hysteric Monkey did (Quote 5-51:HM). The enactive approach adopts a phenomenological approach and a view of phenomenological space as understood by Heidegger (Heidegger, 1927/1962) and Merleau-Ponty (1945/1962). In Heidegger's parlance, this chair would be in the "thrownness" of everyday life or "ready-to-hand" and transparent to the sitter. Here, there has been a breakdown in this everydayness during these navigation difficulties.

Navigation issues were not always related to a dissonance between the controller and the natural body but could also be related to the result of the navigation, such as that experienced by Neil Young. However, the frustration, in this case, led to a focus upon being stuck in the Gazebo and an intent to get out of the building.

Neil Young:

Then, yeah, then I suppose I felt a little bit frustrated when I found myself

trapped in the gazebo. I was certainly curious, 'cos otherwise I wouldn't have

gone and got myself inside…. (Quote 5-53:NY).

The relevance of these breaks of presence to the relationship between emotion and spatial presence is discussed next.

Name/Subtheme		Helping/ VR equipment	Attention Allocation	Spatial Situation Model	Spatial Presence: Self Location	Spatial Presence: Possible Actions	Cognitive Involvement	Suspension of Disbelief	Domain Specific Interest	Visual Spatial Imagery
Cookie	Monster	HH	3.50	2.88	2.88	2.50	2.88	3.29*	3.50	4.00
David	Beckham	HH2	3.25	3.75	3.25	2.13	3.13	3.50	3.63	3.63
	Mean		3.37	3.31	3.06	2.31	3.00	3.4	3.56	3.81
Hysteric	Monkey	HN2	4.00	3.13	1.88	2.88	2.50	3.50	3.88	3.63
	Mean									
Bob	Virtual	LH2	4.25	4.75	4.00	3.25	2.00	1.25	1.13	5.00
Peter	Parker	LH	4.63	5.00	4.13	3.88	4.00	1.71*	3.13	4.75
Shelly	Brown	LH	4.63	2.88	3.38	3.75	2.50	1.86*	2.00	4.63
	Mean		4.5	4.21	3.8	3.62	2.42	2.41	2.09	4.79
Belle	May	LN	2.50	1.63	1.00	1.38	1.00	1.71*	1.00	1.38
Neil	Young	LN	4.00	3.75	2.75	3.75	2.63	3.00*	3.63	3.88
	Mean		2.5+4 3.25	2.69	1.87	2.56	2.31	2.35	2.31	3.32

Table 5-11: Summary of MEC-SPQ Spatial Presence Questionnaires

5-point Likert Scale, 5 is high. Suspension of Disbelief is high if critical of errors and discrepancies, 2nd and 8th questions are reverse scored. Results marked * 6th question not completed.

Name		Helping/ VR equipment	Spatial Presence	Engagement	Ecological Validity	Negative Effects	Emotion (B30)
Cookie	Monster	HH	2.53	2.54	2.60	4.00	3
David	Beckham	HH2	1.89	2.23	1.60	3.00	2
	Mean		2.21	2.39	2.1	3.5	2.5
Hysteric	Monkey	HN2	2.58	3.15	1.40	2.67	2
Bob	Virtual	LH2	2.68	2.69	2.60	1.17	1
Peter	Parker	LH	3.26	3.38	3.80	1.00	1
Shelly	Brown	LH	2.89	3.23	2.60	1.17	2
	Mean		2.94	3.1	3.00	1.11	1.33
Belle	May	LN	1.32	1.23	1.00	1.00	1
Neil	Young	LN	3.05	3.00	3.20	1.83	2
	Mean		2.19	2.11	2.10	1.41	1.5

Table 5-12: ITC-SOPI Presence Questionnaire Summary means and Question B30 on how responded emotionally. 5-point Likert Scale, 5 is high.

Spatial Presence Relationship to Emotion

Spatial Presence not always increased with emotion

Of the seven participants who experienced spatial presence, five experienced increases in emotion associated with increases in presence, felt within the virtual environments, but for three participants increased emotion were associated with a decreased presence (see Table 5-10). Increased emotion associated with decreased spatial presence was highlighted in the secondary questionnaire analysis but they did not highlight where increased emotion was related to increased presence or the nuances involved.

The interviews suggested that Shelly Brown was the most spatially present (see Table 5-6 for the criteria), yet the questionnaires suggested Peter Parker. Comparing Peter Parker's against Shelly Brown's spatial presence measures gives: 3.26 against 2.89, 4.13 against 3.38, 3.88 against 3.75. These are using the ITC-SOPI measure (Table 5-12) and the spatial presence as location and actions of the MEC-SPQ questionnaire respectively (Table 5-12). The mean emotion rating of the three most spatially present individuals was 1.44 as against 2.0 for the least spatially present, averaged across all three measures of spatial presence (see Tables 5-11 and 5-12). This would suggest more spatially present individuals are associated with less emotion rather than more. As

with variations between interview assessments of presence, there is also a discrepancy between this questionnaire measures of emotion and emotion revealed during the interviews (see Section 5.4.5). The interviews, in this thesis, have captured more of the nuances and details of presence and emotion involved though.

The reduction in spatial presence with increased was identified in three situations. Earlier in this section, breaks in presence are examined with an increased feeling of emotion whilst feeling located in the virtual environment. Navigation issues, also examined earlier, could lead to breaks of presence or reduced presence, for example with Shelly Brown. Similarly, uncomfortable feelings, felt whilst spatially present within the virtual environment, were associated with feelings of weirdness and contradictions between an internal and external avatar for instance (see Section 5.4.6). The orientation of emotion is around the experienced location of the body (see Section 5.4.5) which when felt as located within the virtual environment may form a sense of spatial presence.

The next sub-section examines evidence that emotion can increase the sense of spatial presence.

Feeling of Being in a Real Place: Drawn in emotionally.

Shelly Brown described strong emotional feelings associated with the real place, suggesting it is the emotions that lead to the virtual place feeling like a real place (Spatially Present). This built upon her earlier references to exploring a city and country in terms of a real place (Quote 5-40:SB). She expressed this experience of real place explicitly as:

> Interviewer: *And did this still a real place or non-real place?"*
> Shelly Brown*: Yes, yes real place, I was drawing with all my emotions to the*
> *place like I was there, yes I was [feeling there]. (Quote 5-54:SB)*

She explicitly related the relationship between her emotions to the computer-generated place and implicitly in the excitement and passion of her interview answer. Shelly Brown described how she was not consciously aware of when she felt in the real place, lost awareness of how long she had been there and the pleasure she felt whilst there.

> *Shelly Brown: erm… and yet at some point it just felt like I was there. The sign [to*
> *the building where the task was held] said the way in. (inaudible) felt like going*
> *somewhere nice. "(Quote 5-55:SB)*

Shelly Brown was concerned about being anxious of messing up, associated with less exploration and less Spatial presence (Quote 5-132:SB) although she did want to act by reaching out. This is discussed in the Purpose and Intentionality and Curiosity, Exploration and Evaluation themes (Sections 5.5.2 and 5.5.3).

Lack of variety considered less realistic, less Spatial Presence, less happiness and with less desire to explore

Spatial presence did not always change with emotion when meeting others. This was highlighted in the social context where Peter Parker, despite feeling an increase in excitement at meeting the confederate, did not feel a step change in spatial presence. When comparing his feelings with his time in the park, Peter stated:

> *Peter Parker: Well I, still felt calm. Just, I don't know I guess some form of*
> *excitement since like I was alone before that so kind of like the feeling of*
> *somebody at an alone island would get when he gets company. Like Robinson*
> *Crusoe and Friday; was it? (Quote 5-56:DB)*

In contrast, there was a slight increase when he met the researcher's avatar. This was reflected with Hysteric Monkey too, where, despite notable levels of social anxiety upon meeting the confederate, like Peter, this did not increase until the activity itself began.

> *Interviewer:*
> *Okay, did that change over time?? [responding to comments of little feeling of*
> *being there across the whole experience]*
>
> *Hysteric Monkey:*
> *I think the feeling didn't really change that much, no. Maybe it when I was*
> *actually doing the exercise (Quote 5-57:HM)*

In contrast, Neil Young reported feeling more involved when talking to other people.

> *Neil Young:*
> *Rather than walking around and touching things with my hands and stuff like*
> *that. I found, although when I was stuck in the gazebo it's like how do I get out*
> *of this thing? But I found that I felt more involved with it when I like saw other*
> *people and started talking with, or what I felt to be other people.*
> *(Quote 5-58:NY)*

The distinction may be between feeling present and feeling involved or immersed. It is at this stage that Bob Virtual started to feel more absorbed, as if with a book, rather than explicitly spatially present.

No Presence and little Emotional connection

Where there was no sense of presence there was little emotion and little personal connection. For instance, Belle May had little sense of presence and little associated emotion.

> *Belle May:*
> *I was outside of the character, but I was controlling what she was doing.*
> *Interviewer:*
> *Okay. And, in terms of, from saying outside of the character, you felt very much outside of this as an environment, you were in this room?*
> *Belle May:*
> *Yeah, I was in this room, that's why I kept asking you. (Quote 5-59:BM)*

and

> *Interviewer:*
> *Okay. Were you feeling anxious at all? Relaxed?*
> *Belle May:*
> *No.*
> *Interviewer:*
> *No?*
> *Belle May:*
> *So, I guess that's calm, relaxed.*
> *Belle May:*
> *I guess I didn't really feel like it was real, so that's maybe why I didn't have those emotions, even when I wasn't really getting very fast with the task. Because it didn't feel real it wasn't worrying me. I was missing some of the information on the screen, but I wasn't anxious, I was just trying to get through what I could. (Quote 5-60:BM)*

Spatial Presence not always change in social meeting

Spatial presence did not always change with emotion when meeting others. This was highlighted in the social context where Peter Parker, despite feeling an increase in excitement at meeting the confederate, did not feel a step change in spatial presence. When comparing his feelings with his time in the park, Peter stated:

> *Peter Parker: Well I, still felt calm. Just, I don't know I guess some form of excitement since like I was alone before that so kind of like the feeling of somebody at an alone island would get when he gets company. Like Robinson Crusoe and Friday; was it? (Quote 5-61:DB)*

In contrast, there was a slight increase when he met the researcher's avatar. This was reflected with Hysteric Monkey too, where, despite notable levels of social anxiety upon meeting the confederate, like Peter, this did not increase until the activity itself began.

> *Interviewer:*
> *Okay, did that change over time?? [responding to comments of little feeling of being there across the whole experience]*
>
> *Hysteric Monkey:*
> *I think the feeling didn't really change that much, no. Maybe it when I was actually doing the exercise (Quote 5-62:HM)*

In contrast, Neil Young reported feeling more involved when talking to other people.

> *Neil Young:*
> *Rather than walking around and touching things with my hands and stuff like that. I found, although when I was stuck in the gazebo it's like how do I get out of this thing? But I found that I felt more involved with it when I like saw other people and started talking with, or what I felt to be other people. (Quote 5-63:NY)*

The distinction may be between feeling present and feeling involved or immersed. It is at this stage that Bob Virtual started to feel more absorbed, as if with a book, rather than explicitly spatially present.

SOCIAL PRESENCE AS DYNAMIC UNFOLDING EPISODES

Social presence is the feeling of being with another. Social presence, in this study, was identified as a dynamically unfolding within social episodes over time. In this study, the relationship examined is between others, represented as avatars within a virtual world, as opposed to over a web forum or the telephone or face-to-face. This study focuses primarily upon the relationship between the participant and a confederate and, to a lesser extent, the relationship between the participant and researcher. Social presence was revealed as an unfolding episode involving social interactions. The primary social interactions between the participant and confederate involved an initial meeting and greeting episode, the set activity involving either box pushing or button pushing and a final gratitude-helping episode. Associated with this interaction is role of the avatar themes (Section 5.4.7) during the same phases. These social interactions involved social emotions including gratitude, the specific emotion focused upon in this thesis. During the interview's aspects considered were the nature and level of involvement and interaction, and the level and nature of emotional connection, as well as explicit questions.

The evidence for social presence was drawn from the participants' interpreted experiences of social presence, revealed predominantly from the interview. In order to maintain an openness to the lay participants' interpretation of their experience, whilst not being tied to specific social presence theories, a prototype categorisation approach to determining if an experience amounts to social presence was adopted, similar to that used by Lambert, Graham and Fincham (2009) when analysing varieties of gratitude as described by lay people using natural language. Prototype category membership is a fuzzy collection of many central features rather than complete conformity to necessary and sufficient criteria. For social presence, these criteria drew upon existing definitions of social presence, as described in Sections 2.2 and 3.1. These include aspects such as participants' awareness of the confederate as another person in an interaction; the extent of the user's emotional connection; empathising; appreciating the intent, regardless of being correct, of the other; the extent to which there is a meaningful relationship with the confederate and the extent to which 'the other' was experienced as a real social actor.

Name/sub-theme			Dynamic Unfolding Episode	Social Presence Ulitmatly Reducing Social Presence	Social Presence and Empathy over time over	On-going Awaewness of Other	Shared Purpose Feels Good	Confederate Genuine
Cookie	Monster	HH	?	N	N	Y	N	Y
David	Beckham	HH2	Y	Y	Y	Y	Y	?
Hysteric	Monkey	HN2	Y	Y	?	Y	?	Y
Bob	Virtual	LH2	Y	N	Y	Y	Y	Y
Peter	Parker	LH	Y	Y	?	Y	?	Y
Shelly	Brown	LH	?	?	?	Y	?	Y
Belle	May	LN	N	N	N	N	N	Y
Neil	Young	LN	Y	N	Y	Y	Y	Y

Table 5-13: Key points associated with Social Presence

This section introduces the social presence subthemes based first, around the initial meeting and secondly, around the arranged exercise. The final gratitude-helping aspect is addressed in the Gratitude: Other, Benefit, Help theme in Section 5.4.8.

Name		Help/ VR Experience	Sensation characters aware of me	I felt I was in the same space as characters / objects	Strong Sense characters and objects solid	How Genuine was the confederate Behaviour
Cookie	Monster	HH	4	3	3	5
David	Beckham	HH2	3	2	1	2
	Mean		3.5	2.5	2.0	3.5
Hysteric	Monkey	HN2	4	2	3	4
Bob	Virtual	LH2	3	3	2	3
Peter	Parker	LH	4	4	2	5
Shelly Brown	Brown	LH	5	3	2	5
	Mean		4	3.0	2.0	4.3
Belle	May	LN	2	2	1	4
Neil	Young	LN	4	3	4	4
	Mean		3	2.5	2.5	4

Table 5-14: Social Presence related questions from ITC-SOPI plus How Genuine was the confederate? 5 Point Likert Scale (5 High).

Meeting

Evidence of social presence between the participant and the confederate begins from when they first meet. Further, in this section, social presence was unfolding over the activity and in Section 5.4.8 during the gratitude-helping episode. Evidence of the dynamic and unfolding nature of social presence associated with emotion is highlighted by the experience of Hysteric Monkey. In this case, social presence increased but the emotions engendered led to reduced social presence as a consequence of problems in communication.

Increasing dynamic social presence ultimately reducing social presence.

For Hysteric Monkey, the social presence episode started when he first met and was drawn to the confederate. However, he experienced a common difficulty for all those participants who used the Oculus Rift virtual reality headsets: being unable to communicate in the same typing mode as the confederate. The confederate used text to chat to the participant, yet participants wearing virtual reality headsets were not able to see, and hence type, unless an accomplished touch typist. All participants were able to communicate via speech and had earphones and a microphone.

> *Peter Parker:*
>
> *Hi, hello, how are you, and stuff like that. But I was unable to get too much*
> *involved with the other person because I was not able to type very well.*
> *(Quote 5-64:PP)*

Here, the social norms, with an obligation to speak, and the inability to take part were triggering feelings of discomfort, weirdness and anxiety (nervousness), despite the initial interest in the confederate. The confederate was perceived as having greater power due to her ability to type.

> *Hysteric Monkey:*
>
> *Yeah, so I notice her and, but I probably was a little bit more interested because*
> *it was a girl, a female character, but, then it felt really awkward because she*
> *was typing, and I had to speak, so I was like speaking but there was no*
> *response. (Quote 5-65:HM)*

> *Hysteric Monkey:*
>
> *I do think if I could actually talk to the other participant that I would have tried*
> *to interact more, it wouldn't have made me feel so uncomfortable and weird*
> *and nervous. Or if I could have typed just as long as we would have been on*
> *equal footing with communication, that would have made the experience better*
> *for me. (Quote 5-66:HM)*

The sense of inequality that arose was mentioned explicitly by the participant and he felt the less equal party. This led to feelings of weirdness and discomfort about the situation leading him to disengage. It was this situation and dynamic interaction, not communication per se, that led to disengagement.

> *Hysteric Monkey:*
>
> *It was only a text kind of response, so it felt really awkward and made me*
> *uncertain. You know, I didn't really want to talk anymore because of it,*
> *because yeah, I didn't feel equal, it was, if she can hear me but I can't hear her,*
> *that yeah, made me feel uncomfortable about the situation. And so after that I*
> *think I tried to focus more on what the exercise would be, just go to the*
> *exercise, focus on that and I think I didn't even try to interact with the*
> *character anymore after that. (Quote 5-67:HM)*

This disengagement was supported in his questionnaire responses in reporting a high level of feeling (4) that the confederate was aware of him, but that anxiety, through the difficulty communicating, led to a low (2) feeling of being in the same space as the confederate, given in Table 5.14.

This is similar to patterns of psychological and physical disengagement which are reflected outside of the virtual reality context. Major and colleagues (1998) discuss how inequality was interpreted as due to racial prejudice and unequal treatment, resulting in lower self-esteem. This led to a psychological disengagement. Harris (2012) associates this with situations based upon similar threats to the self and lowered self-esteem leading to psychological disengagement, and eventual physical disengagement, from groups. The principal difference here, is the source of the inequality associated with conflicting of modes of communication in a virtual reality context**.**

Increased Immersion upon meeting

For those participants who connected and were interested in people there was increased immersion upon meeting. Neil Young referred to being "more involved"

The meeting itself involved a desire by Neil to interact, and the usage of the social norms that occur at a meeting, i.e. saying hello etc. If the confederate had not started this then Neil would have done so.

> *Neil Young:*
> *Rather than walking around and touching things with my hands and stuff like that. I found, although when I was stuck in the gazebo it's like how do I get out of this thing. But I found that I felt more involved with it when I like saw other people and started talking with, or what I felt to be other people. (Quote 5-68:NY)*

Social Presence and Empathy unfold over time

For those 5 participants who connected with the confederate, the evidence was that empathy, a core aspect of social presence, developed over time. The episode starts upon their initial meeting and can continue throughout the set exercises. Neil, for instance, pointed out that, despite initially being pleased and wanting to interact upon meeting, it would take a while for increased empathy and relating to others, associated with social presence, to develop; it evolves over time.

> *Neil Young:*
> *There wasn't too much time, you know, I don't think of myself as an overly competitive, maybe I am, I don't know, I didn't feel there was time to really kind of interact and build up a rapport. (Quote 5-69:NY)*

David Beckham demonstrated empathetic concern that the participant may need help as the exercise unfolded.

> *David Beckham: to see how they were doing, making sure that, well not making*
> *sure, but if they were struggling in some way I would have seen if there was a*
> *way to help them. I don't know if I would have been able to. (Quote 5-70:DB)*

Social Presence with Interactive Activity

The unfolding nature of social presence continued during the activity as a dynamic interaction between the participant and the confederate. Of the participants who connected, almost all switched to referring to the confederate either by name or as 'she' rather than 'it' or 'the character'. There was an on-going awareness of the confederate as an avatar.

Socially Present: On-going Awareness within Virtual Environment

An aspect of social presence is the awareness of another sentient being in the same space, and this involves an awareness of the other. There was widespread evidence that there was such awareness, suggestive of social presence.

Despite this increase in immersion, Bob Virtual still viewed the scene from an external birds-eye perspective of her avatar and felt located around her physical body. She was viewing her avatar via a laptop from a third person perspective. She managed her avatar by treating the interface as a camera on the scene and felt low levels of spatial presence. Her sense of social presence was developing but still limited, as she now had a feeling of being with the confederate's representative avatar in a virtual rather than a real space.

> *Bob Virtual:*
> *…I did keep thinking about her avatar as being her, an avatar, so I didn't think*
> *that I'm in the same room as this person, I was more like we're both in this*
> *space together but not, you know it's not the same as an actual space is it?*
> *Because I was like birds-eye viewing this person, this avatar myself.*
> *(Quote 5-71:BV)*

During the exercise, Bob Virtual wanted to chat, illustrating an on-going awareness and identifying the avatar in human terms.

> *Bob Virtual:*
> *Yeah, I mean, yeah, a little bit, I mean I like to have at least little comments or something. I mean I did make like a comment in the middle, like is this ever gonna end? I don't know, it's kind of nice to have little comments 'cos then if they answer them back, you can kind of, then you can tell what kind of person it is, can't you?*

> *Interviewer:*
> *Is that important to you?*

> *Bob Virtual: So yeah, I looked over to Jessica a couple of times and I saw they were also clicking, it didn't seem to be going very fast though. But whatever that is I'm winning. (Quote 5-72:BV)*

Similarly, Peter, Shelly Brown and David peeked at the confederate's avatar. Peter Parker, having lost awareness of the non-virtual environment, remained socially present with the confederate in the room of the virtual environment.

> *Peter Parker: Yes I think so once we started moving the cubes around. Actually, it became more interesting, so I became completely involved with it. So I did not (sic) paying attention to what I was doing outside of that. (Quote 5-73:PP)*

> *Peter Parker: At some point when I was moving the box around and I thought I might be doing the right thing because, because the instructions they move pretty quickly so I decided to take a sneak peek and see what the other person was doing. So I had a look and she was just moving the box around so I just carried on doing as what the instructions were doing, were saying. (Quote 5-74:PP)*

He sought confirmation by evaluating what she was doing to confirm that he was doing the same. This helped offset his unhappiness with not being, what he assumed, were the goals.

There was an on-going social awareness of the confederate, but no desire to engage directly or talk to the confederate. This was especially during the box pushing exercise when the participant and confederate came close together but the instructions given by the boxes overlapped commanding attention and could be confusing.

> *Shelly Brown: …But what confused me was when I was moving the box and it said … erm… when you move it to the right, that's under testing [a test run of the exercise?], touch. But maybe they were touching it before me? So, in the chat place I was seeing where they have to move theirs so wasn't sure if this was mine or this was theirs." (Quote 5-75:SB)*

Similarly, David too kept checking for the presence of the confederate as avatar.

> *David Beckham: I was wondering how they were controlling action using a headset. I have a bit of a competitive streak, so I wondered if we were competing against each other, so I was trying to press the buttons as quick as possible. I was looking across to see how they were doing, making sure that, well not making sure, but if they were struggling in some way I would have seen if there was a way to help them. I don't know if I would have been able to. (Quote 5-76:DB)*

These examples illustrate that awareness of the confederate as an avatar was on-going throughout the exercise, not just upon meeting. In these examples, the avatars felt able to physically observe the confederate's avatar, but it could also occur when separated.

Loneliness and desire to interact on forced separation

With Neil Young, there was a sense of separation and loneliness due to the physical barrier (a small fence) and a need to focus upon the cube being pushed around, and his focus upon the individual task at hand (pushing a box). This made him feel less co-present with the other person, yet there was on-going awareness and emotional connection in relation to the confederate. This was associated with the negative feelings of being alone.

> *Neil Young: But when I was doing the exercise itself I suppose I felt quite alone again, because there was the barrier between the chess boards and in my field of vision at all time. I didn't see anyone else, but I think I was concentrating on the back of the cube, I suppose. (Quote 5-77:NY)*

Social Interaction and Shared Purpose feels good

Social Interaction involves Shared or Inter-Personal Purpose. Neil highlighted how social interaction, and that the fact that he and the confederate appeared to share a purpose by carrying out the same goal, felt good. This was balanced, however, by a desire to compete with her, and reluctance to engage too much, so keeping his poker face. This limited the level of physical interaction, yet the competition was in relation to her presence. During this period of communication, he felt connected with her.

Neil Young:

I think I felt quite reserved, I think, which I guess can often not be the case in these environments because you feel that it isn't really you, you're kind of removed from it. I felt quite reserved, I was quite cagey in my responses to them, when they were speaking to me. But also, it was good to be interacting with someone, I think, and reassuring them that we were both kind of trying the other, like the same task. (Quote 5-78:NY)

Bob Virtual, on several occasions, emphasised the joint endeavour and sense-making; first illustrated by her concern to involve the confederate in the task, and later by celebrating that, after being helped, there was a joint task completion.

This is consistent with the high level of social interaction during that task, suggestive of higher levels of social presence.

Interviewer:

And how did you feel when that happened then? When you thought…

Bob Virtual:
Good.

Interviewer:
Good?
Bob Virtual:
Yeah. 'Cos either way, we'd done it, so you know. (Quote 5-79:BV)

No Social Presence or Social Emotions towards the confederate's Avatar

Two significant exceptions to social presence and associated emotions were Belle May and Shelly Brown. Belle May never became immersed in the virtual environment, possibly finding it too weird (see section 5.4.6 theme Weirdness and Dissonance), with her purpose, intentionality and social emotions focused upon the researcher within the room.

> *Interviewer:*
>
> *Eventually, Jessica came in, how did, what were your first feelings when Jessica came in?*
>
> *Belle May:*
>
> *I don't really think I felt anything any different, I was just thinking that we were both gonna get told what to do. I think I was very task focused. Obviously, she said, she initiated contact with my character, I guess. (Quote 5-80:BM)*

This is consistent with the ITC-SOPI questionnaire being rated as low (2) or very low (1) for all the questions mentioning characters (see Table 5-14) including those of whether she was in the same space or that the character was aware of her. It is unclear whether the term character was interpreted as avatar in this situation. The major contradictory evidence was the highly positive ranking of very high (7) in the gratitude questionnaire possibly related the conversation with the confederate. The gratitude questionnaire referred to the participant, whilst the ITC-SOPI referred to the character (it is focused up presence); hence, Belle May might be distinguishing between the character and the real person in her responses, but there is no explicit evidence.

Mixed evidence of Social Presence and Muted Feelings towards the confederate.

Shelly Brown, in contrast to Belle May, was highly immersed and spatially present with her excitement towards the physical and spatial environment or the anxiety and focus upon the tasks relatively muted, and she did not "mind" the confederate being there.

> *Interviewer: your feelings about the towards the other participants?*
> *Shelly Brown: Oh I was very deliberative. Like in general?*
> *Interviewer: In general (confirming)*
> *Shelly Brown: I didn't **mind** them being there… "(Quote 5-81:SB)*

This was supported to an extent by the questionnaires, in that she only felt moderately positive towards the confederate, but other aspects contradicted the image of little emotional and actual engagement. Here, she rated the confederate highly (5) (Table 5-14) for the character being aware of her; moderately (3) for being in the same space; the highest and at the median respectively, and her behaviour as genuine (4). She was involved in the gratitude-helping episode. A limitation of such questionnaires is that it covers her experience as a whole so is difficult to relate to specific episodes although this is mitigated by being used as ancillary to the interviews.

5.4.5   Orientation of emotion: its nature and intentionality

This study suggests that it is the orientation, nature and intentionality of emotion that influences presence, rather than presence itself. In particular, social emotions orientated towards an in-world social interaction will influence social presence within the virtual world, whilst emotion such as non-social anxiety orientated externally will tend to influence presence within or external to the environment. Thus, emotion within the virtual environment *per se* does not necessarily lead to increased presence. It is beyond the scope of this thesis to examine fully the factors and issues around every specific emotion experienced, or which could have been experienced, but it does identify that is too simplistic to bracket all emotions together and that these three broad characteristics were important in understanding the relationship between emotion and presence.

The orientation of emotion embraces the 'aboutness' i.e. that emotion is about or towards something including the direction of an emotion through both space and time relative to the participant. For example, Bob Virtual was anxious about being late for a meeting (about) due to take place following (time) her virtual experience, and which was external to the virtual environment (spatial). From the perspective of the participant, such orientation may be experienced as focusing upon something. In this case, spatial refers to the phenomenological space, i.e. that is experienced. This orientation has to be considered within the context of emotion as a dynamic episode. A visual analogy is that of a lava lamp's orientation through time; although this is much simpler and driven by external factors. The location of the individual is from inside the bubble though. The nature refers to the type of emotion, e.g. anxiety or social emotion, including gratitude. The intentional dimension relates that aspect of emotion influencing the actions to take, e.g. anxiety about missing the forthcoming meeting leads to actual or potential actions to abandon the virtual experience and leave to go to the meeting or to checking the clock which is external to the virtual environment.

EMOTIONAL EPISODES

The emotions exhibited themselves as dynamic episodes rather than discrete, instantaneous things. One example of this was the anger of Neil Young which built and varied over time; it was still anger and it was possible to identify the orientation although, as a dynamic episode, this may vary.

ORIENTATION

In all cases, emotion was directed to something, for example, excitement about the virtual environment and associated with exploration of the island. (5-3:SB). The orientation could be both internal and external to the virtual environment, such as anxiety about missing an appointment following the virtual experience of Bob Virtual.

NATURE

The nature was important, for instance, social emotions such as social anxiety influenced social presence rather than spatial presence. Spatial presence tended to be related to emotions such as the excitement of exploring, for example Shelly Brown (see Section 5.4.4 and 5.4.3), rather than social emotions. there is little evidence of social emotions are associated spatial presence is , with the possible exception of, Neil Young (Quote 5-63:NY), but this may just be involvement (see Section 5.4.4). In contrast Social presence was associated with social emotions such as empathy (Quote 5-54:DB).

INTENTIONALITY

The emotions were related to the intentions of the participants. The emotions were closely tied in with curiosity and exploration which, in turn, are related to acting out intentions. It is notable that emotions are also related to presence.

QUESTIONNAIRES FAIL TO DETECT ACCOUNTS OF EMOTION

There is a contradiction between the numerous examples of emotion reported in the interviews by participants and their responses on this subject in the ITC-SOPI questionnaire: highly disagreed, disagreed and, in one case, neutral about having responded emotionally (see Table 5-12). It is unclear why this is the case and it warrants further study outside of this thesis. It does, however, raise some questions about the reliability of studies using this question (B30 in Table 5-10) as a measure of emotion. It is possible that these emotions were part of the participants' everyday pre-reflective activities and, hence, without the interview this was not readily apparent to them when completing the interview.

.

Name		Help/VR Experience	I responded emotionally
Cookie	Monster	HH	3
David	Beckham	HH2	2
	Mean		2.5
Hysteric	Monkey	HN2	2
Bob	Virtual	LH2	1
Peter	Parker	LH	1
Shelly	Brown	LH	2
	Mean		1.33
Belle	May	LN	1
Neil	Young	LN	2
	Mean		1.5

Table 5-15: ITC-SOPI question into responding emotionally. 5-point Likert (5 High)

ANXIETY ABOUT MESSING UP FROM UNCERTAINTY

In addition to emotions such as excitement, other significant emotions involved anxiety about messing up the tasks and the study.

> *Interviewer: During the actual training session itself you wanted to explore the*
> *whole island?*
> *Shelly Brown: That's it. (laugh) erm and then I messed it up so I decided I*
> *would just finish.*
> *(Quote 5-82:SB)*

Shelly Brown discussed two aspects of anxiety, that associated with messing up and that associated with the task. Her anxiety about messing up led to her disengaging from activities such as exploring (Quote 5-82:SB) whilst her anxiety about the unknown upcoming tasks triggered her engagement with preparatory activities.

> *Shelly Brown: yes (laughs) erm, I just know that I had to do something, like to*
> *do a task so I was kind of not being nervous but being anxious what I would be*

asked to do with this place. erm, that is what I was thinking, I was just preparing myself

Interviewer: Anxious?

Shelly Brown: Yes. (Quote 5-83:SB)

This anxiety about messing up was also related to the benefit of emotion gratitude (see Section 5.4.8).

5.4.6 Weirdness and Dissonance

Weirdness, as reported here, suggests a marked dissonance between the expected or familiar and that experienced. This was most notable for two participants, but, at a lesser level, all participants reported aspects that warranted or provoked their curiosity and further exploration to evaluate the situation. For some, the whole virtual environment or gaming was weird and not real; there being a dissonance between the real world and unreal world. It could, but not necessarily, lead to distraction, breaks or limitations to high levels of immersion or presence. At the level of provoking curiosity and exploration, it could enhance immersion and presence, as discussed in the curiosity, exploration and evaluation theme (Section 5.5.3).

Name/Sub-theme		Researcher Avatar v Natural and presence	Dissonance blocking immersion and presence	Weirdness and embodiment	Dissonance between external and internal body	Dissonance, Weirdness and Disengagement ending
Cookie	Monster	?				
David	Beckham	Y				Y
Hysteric	Monkey	Y			Y	Y
Bob	Virtual	Y		Y		
Peter	Parker	?				
Shelly	Brown					
Belle	May		Y			Y
Neil	Young	?				

Table 5-16: Identifiable instances of weirdness and dissonance

Breaks of Presence: Natural and Virtual Researcher

In contrast to settling in over time, for Bob Virtual, two types of distraction, especially in the early stages, led to sudden breaks in presence when her attention, or object horizon, shifted to external objects. The first type was the 'weird' or 'funny' experience with a dissonance between the researcher's avatar and the external natural researcher. The researcher was located close by as illustrated in Figure 5.5 b. The first point was that she was aware of the researcher and her attention suddenly switched or "snapped" to the external natural researcher, with an accompanying break in immersion and presence. Bob Virtual regularly referred to her virtual reality experiences as weird or funny.

> *Bob Virtual: So I wasn't so conscious of you sitting just right behind me, and I was still interacting with you on that thing, so I felt like I was quite in it and then sometimes I'd be like snapped....I'd snap out of it for a moment and I'd be like, 'oh yeah, wait, I'm actually....like Tom's [The researcher who was before her as an avatar] like right behind me', it's kind of funny. It's quite funny to notice that actually, yeah. (Quote 5-84:BV)*

Dissonance blocking immersion and presence

Belle May also discussed this dissonance between the researcher and researcher's avatar. However, her attention remained firmly focused upon the physical natural world researcher indicated by her wanting face-to-face non-virtual communication with the natural rather than virtual researcher. Her proximity to the researcher is shown in Figure 5.5.

> *Belle May:*
> *I think one thing that I did think as I was doing it was it felt very strange you typing what I was going to do to me. That felt really strange, because I just wanted you to tell me what we were doing, I didn't want you to type it. So it felt like a long time that I was kind of stood there, knowing what was being, what I'd have to do, but equally I had quite a lot of time to look at the instructions anyway by this point. (Quote 5-85:BM)*

Belle May found virtual environments to be not real and associated these with weird games. This she attributed to not relating to the virtual environment.

> *Belle May:*
> *And that seems like a world that's not real, or a bit far-fetched for me. Yeah.*
> *(Quote 5-86:BM)*

The weirdness also impacted upon Belle May in her emotional connection to, lack of identity of, and dress associated with, her avatar (see Section 5.4.7, Quote 5-89:BM). This weirdness also was highlighted in her being unable to take seriously the problems within the virtual environment.

> *Belle May: I guess I didn't really feel like it was real, so that's maybe why I*
> *didn't have those emotions, even when I wasn't really getting very fast with the*
> *task. Because it didn't feel real it wasn't worrying me. I was missing some of*
> *the information on the screen, but I wasn't anxious, I was just trying to get*
> *through what I could.*
> *(Quote 5-87:BM)*

Thus, in this case, the weirdness and dissonance had not only led to no immersion and presence, but also limited the level of emotion and anxiety experienced by others. Her experience was not totally emotion free as discussed in the Section 5.4.1. However, as discussed in the unfolding presence theme (Section 5.4.4), such an inconsistency between reality and a 3D film did not prevent immersion and spatial presence.

Weirdness and embodiment

The weirdness did not stop Bob Virtual from becoming highly immersed and embodied. Bob Virtual, in fact, found the very experience of being embodied weird. Thus, finding an experience weird by itself is insufficient to prevent immersion.

Dissonance between external body and internal body

Whilst not described explicitly as weird, there was a dissonance reported between the avatar walking and the human sitting. This is addressed in the Unfolding Presence (see Section 5.5.4) did lead to a breakdown in presence and an awareness of the chair, as opposed to the researcher, by Hysteric Monkey.

Dissonance Weirdness and Disengagement ending Social Presence

As described in Section 5.4.4 (social presence as a dynamic unfolding episode sub-theme), Hysteric Monkey felt weird when finding communication with the confederate impossible. This was associated with discomfort and nervousness and led to a physical and psychological disengagement by him from the confederate so reducing the weirdness and discomfort.

5.4.7 Role of the Avatar

All of the participants used the avatar as an object, body and tool, that is to manipulate aspects within the virtual environment(see Table 5-5). This applies to the orientation of emotion around the perceived body (see Section 5.4.5), a sensed of embodiment (see Section 5.4.4) or social interaction between avatars (see Sections 5.4.2, 5.4.4 and 5.4.8). Even where participants felt as observers the avatar was used as a tool to act within the virtual environment (see Sections 5.4.2, 5.4.3 and 5.4.4).

In addition, a further two sub-themes were identified; evaluating the reality behind the avatar and evaluating if the avatar is human.

Name/Sub-theme		Identify with Own Avatar	Dissonance blocking immersion and presence	Weirdness and embodiment	Dissonance between external and internal body	Dissonance, Weirdness and Disengagement ending
Cookie	Monster	Y				
David	Beckham	Y				Y
Hysteric	Monkey	Y			Y	Y
Bob	Virtual	Y		Y		
Peter	Parker	Y				
Shelly	Brown	Y				
Belle	May	N	Y			Y
Neil	Young	Y				

Table 5-17: Role of the Avatar Sub-themes

EVALUATING THE REALITY BEHIND THE AVATAR

A distinctive aspect of virtual reality is the avatar that enables the biological human to interact within it and lies at the heart of being and acting within virtual environments. This theme focuses upon the evaluation of the biological human, especially the confederate, involved in the social interactions fundamental to social presence and emotions such as gratitude, the topic of this thesis. Various aspects of the evaluation emerged from the interviews including identity, role, appearance, and the personal characteristics associated with an avatar body.

Self

The identity of participants fell into two parts: recognition of the avatar as being their avatar and identifying with the avatar. All the participants readily recognised their own avatar, for example, as David as himself said *"There, that's me."* whilst commenting upon a video of his activity in the park, as opposed to saying, 'that's my avatar'. The more complex element was identifying with the avatar.

At the start, the participants had to choose from a selection of avatars matching the avatars evaluated in Section 5.2. For one participant, Bob Virtual, appearance and self-identity were linked, which came to the fore when she chose a male avatar. All participants were asked to select an avatar of the same gender, but she misheard this instruction. The researcher chose not to intervene due to concerns that correcting may be seen as chastising and distorting the experience, but the researcher did ask about this during the interview.

> *Bob Virtual: So, I did think about it and the avatar was like, I don't know, not*
> *like, but there is limited option for me to choose in terms of avatars so basically*
> *all of the women weren't really my sort of type, I couldn't really identify with*
> *them, in terms of what they were wearing, how they looked and I have the*
> *same, when she then came on it was like, yeah, I don't know, it's not my type to*
> *look at or something. (Quote 5-88:BV)*

There were only three mentions of clothing: by Bob Virtual, Belle May in the main study and by Test 2 during the first pilot. For Bob Virtual, the clothing of the avatar was unimportant due to her not associating with the avatar via its clothing. In the first pilot, Test 2 was unimpressed by her "frumpy" clothing (see Section 5.1.7) and led in part to the avatar appearance evaluation.

Belle May to a practical view that others had just picked the same characters and hence happened to wear the same clothing.

> *I just thought outside of that, that myself and her had just chosen the character*
> *that wasn't as girly, just the same clothing.*
> *Interviewer:*
> *Yeah.*
>
> *Belle May:*
> *And so, I wasn't thinking, oh, we've picked the same, we're dressed the same I*
> *was thinking we'd picked the same. If that makes sense? (Quote 5-89:BM)*

The researcher

All the participants readily identified the researcher's avatar as that of the researcher, describing the researcher's avatar as *"your person"* (Quote 5-35:DB), suggesting ownership of the avatar when he caught a glimpse of the avatar during the initial park phase. There was no close physical resemblance between the researcher and his avatar, apart from ethnicity, gender and western dress. The researcher's avatar had the same natural name as the researcher who conducted and supervised the study. This was noted by David Beckham in Quote 5-89:DB, although on one occasion he referred to the researcher's avatar as 'a possession' of the researcher.

When discussing the confederate's avatar's name David Beckham said:

> *I didn't know if it [the confederate's name] was a real name or… because*
> *obviously you entered your name [referring to the researcher's avatar], but I*
> *didn't know if that was the avatar name or a proper name as well. I assumed it*
> *was just an avatar name.*
> *(Quote 5-90:DB)*

All participants also recognised the role of researcher as the organiser or supervisor of the study.

The Confederate

Evaluating the identity of the confederate's avatar was more problematic for almost all the participants except for Belle May and Shelly Brown. For instance,

> *David Beckham: I didn't know what they looked like. If they were even male or*
> *female, they could have chosen whichever avatar they wanted. So, could have*
> *been any person, I guess I assumed they were in the room next door. Based on*
> *what you'd said earlier.*
> *(Quote 5-91:DB)*

Similarly, Bob Virtual also evaluated the confederate's name, noting that this was the name of a Marvel character. It was, in fact, co-incidence as the researcher who named the confederate's avatar, did not realise that this was the name of a Marvel character. This name evaluation was not explicitly mentioned by any other participant.

> *Bob Virtual:*
>
> *Jessica Jones [the name of the confederate's avatar], yeah, so I was like oh, what does this mean? Could be that is actually a man because it might like the Marvel more, I don't know, but then I was like, but I like Marvel, so maybe not. So, I did think about it and the avatar was like, I don't know, not like, but there is limited option for me to choose in terms of avatars so basically all of the women weren't really my sort of type, I couldn't really identify with them, in terms of what they were wearing, how they looked and I have the same, when she then came on it was like, yeah, I don't know, it's not my type to look at or something. (Quote 5-92:BV)*

There was an on-going and developing evaluation, and attempt to evaluate, the nature of the confederate. This was based upon the confederate's choice of avatar dress, actions and conversation. For example, Bob Virtual had herself rejected all the female avatars presented, as they did not represent her own identity, and adopted a male whose dress accorded better with this identity. The confederate's choice of clothing raised pejorative concerns, from Bob Virtual, about the confederate's identity, suggesting a potential out-group (not as her identity) evaluation. Her initial impression, however, was that she was nice, not very competent and passive due being late. This focus upon the clothing, identity and appearance, including the out-group evaluation, has strong parallels with Test 2's identity and potential out-group concerns discussed in Section 5.1.7. Whilst this may have an impact on the social emotions, potentially affecting gratitude, intergroup emotions are beyond the scope of this thesis.

> *Bob Virtual:*
>
> *I don't know, so I was like, oh, they chose that one, what does that say, I don't know what it says though, 'cos you just have to pick one, don't you, so. (Quote 5-93:BV)*

The curiosity and initial evaluations were accompanied by a slightly positive but neutral feeling and a slight increase in co-presence (spatial and social presence together).

David Beckham:
I guess curious still, positive.

Interviewer:
Positive? How would you describe her? Put it that way.

David Beckham:
Hard to tell because you've only just met someone, or you haven't really met them.

Interviewer:
No.

David Beckham: Fairly neutral I'd say. (Quote 5-94:DB)

As for glimpsing the researcher's avatar, her arrival triggered his curiosity and there was an increase in spatial presence and social presence.

Interviewer:
Okay, did you feel physically in the same place at the time, at this stage?

David Beckham:
A little bit, but not lots. I'd say, perhaps I was still aware that I was sat down in a room in the virtual environment, but I felt as though I was physically, I was there in the environment with them but not necessarily, I wouldn't be able to reach out and touch them. (Quote 5-95:DB)

The evaluation included aspects expected outside of a virtual environment; what is her role but also how real she was behind the avatar.

David assessed various criteria from how she ('they') walked to how she responded to his nodding to her.

I was trying to watch their walking patterns, see whether they were, at first, I wondered if it was you, but then I figured that I just couldn't hear the keyboard when the other person was typing. (Quote 5-96:DB)

This evaluation included her body movement to assess if she was wearing an Oculus Rift headset from the head movements. He had observed, either from prior experience or during this session, that the avatar's head movement mirrored that of a virtual reality headset if worn.

> *I wasn't sure if it was a real person or not, so and then I figured I'd speak and*
> *nod my head as well in case the head moved on the avatar. (Quote 5-97:DB)*

On the occasions he thought she was not real, his sense of presence was reduced, even during periods where they were communicating together.

> *…. So, on one hand yes, the communication took me more into the moment than*
> *perhaps when I was just wandering around the rooms just looking, but then if*
> *and then when my thought pattern went to, oh they are not real, it would take*
> *me back to out of the experience again, perhaps. (Quote 5-98:DB)*

Here is evidence of curiosity, exploration (visual assessment, nodding head) and evaluation triggered by the proximity and interaction with the avatar. The feeling of presence increased when first seeing avatars and especially during communication between the confederate and David. However, when suspicions that the confederate was considered not to be real became dominant, it led to a drop in a sense of immersion and presence, even during a social interaction. This on-going distrust and uncertainty meant that a significant amount of effort was focused upon evaluating her role and especially if she was genuine, in contrast to the researcher's avatar with his own name, which was taken at face value. This uncertainty included not only the possibility that the confederate was unreal, but also that the confederate was not who she purported to be.

Avatar invokes uncertainty but still engages socially and reacts emotionally as expected

David Beckham had an on-going uncertainty about whether the confederate's avatar was truly human or a form of artificial intelligence. This primarily arose in the closest personal interactions when first alone with the avatar exchanging personal greetings and at the final phase when the confederate assists and invokes gratitude.

Despite this uncertainty, he still engaged and felt more positive towards her after she greeted and showed interest in him and felt grateful towards her after being helped at the end. Nevertheless, the uncertainty did alter the social and emotional experience.

The confederate saying 'Hello', by typing, to David Beckham triggered a desire for a period of exchange. David felt a need to respond, but felt he had no way to respond as he could not type and was uncertain as to whether she could hear him. He did, however, maintain the interaction and both spoke and nodded his head in response. The confederate's saying of 'hello' made him

feel more positive towards her. During this period, he spoke of her as 'she' rather than in a disembodied sense, emphasising his humanisation of the avatar, although there was still doubt. He tested this by seeing if she responded to his nod which he felt she may have done.

> David Beckham:
>
> .... So, on one hand yes, the communication took me more into the moment than perhaps when I was just wandering around the rooms just looking, but then if and then when my thought pattern went to, oh they are not real, it would take me back to out of the experience again, perhaps. So, it followed what my thought pattern in my head was. (Quote 5-99:DB)

Whilst there was pleasure at being in company, there was limited emotion towards Jessica (the confederate) during the early communication.

> Bob Virtual:
>
> Well if we haven't got any... like if someone says 'Hi' on line, it's just like two letters instead of .... (inaudible but think nothing there), you can't see what their, what sort of 'Hi' it is. Whether is just like 'hello' type of thing, well I'll maybe say hello. But yeah, but it's more like a, functional or whether it's more like 'Hi!'. Yeah, I guess you could if you type it differently, I don't know. I don't feel very much emotion with something like this, as a thing in between. (Quote 5-100:BV)

Minimal Social Presence and Interest in the Confederate

Cookie Monster showed minimal interest or positive emotion towards either the researcher's avatar or the confederate.

> Interviewer:
> How did you feel towards the other participant, when she arrived?
>
> Cookie Monster:
> I was all right really, I suppose for me it would probably have been better if I'd been able to speak to them. I did think about saying something but then I thought how do I, I'd got keys to move, I've got a mouse to push the button and how do I actually type a message. And I thought that was probably a bit too much for me to.... (Quote 5-101:CM)

This was hampered by his difficulty in communicating, both in terms of hearing and talking via typing. His desire to type rather than to speak was associated with following the lead of the

researcher's avatar in typing messages, which he did not find easy to read. This highlighted a contradiction in his account: expecting the confederate to speak rather than type yet wanting to type rather than speak as this had become the established communication mode. He acknowledged, however, that it would have been "nice" to communicate but left this to her to initiate. This expectation of greeting (a social norm) never fully manifested itself.

The social-interaction considered was 'play violence' towards the confederate, and even the researcher's avatar, with a desire to attack and kick both the confederate and the researcher.

> *Cookie Monster:*
> *So maybe she did say hello, I don't know. There was a point where I thought it*
> *might be quite nice to give her a karate chop or something. In a mischievous*
> *kind of way. Did think about beating you up as well, mate. (Quote 5-102:CM)*

This, he attributed to the norms in the way gaming characters interact, suggesting a dehumanisation of the avatar which, whilst associated with a real individual, was as an object within a gaming context.

> *Cookie Monster:*
> *Well I think it's probably just the game element, isn't it, normally when you*
> *interact with people you, games tend to involve, well from my experience. I*
> *don't play games any more really, but you know generally it's competitive, or*
> *you know, not violent, but you know, fighting or something, you know, that's*
> *the kind of normal interactions isn't it?*
> *(Quote 5-103:CM)*

This was the same towards the avatar, associated with a known individual, the researcher and towards a generic human, the other participant. To this extent, there was little pro-social emotion binding the characters together. There appeared, however, to be no personal animosity towards the researcher following the interview, suggesting a separation between the researcher-as-avatar and researcher-as-real human. There remains some uncertainty in the mind of the researcher as to how much connection there was, and this extended beyond the scope of this thesis.

EVALUATING THE REALITY BEHIND THE AVATAR: HUMANISATION

There are two aspects to humanisation in this study: first, is there a real person behind the avatar or not and secondly, is the avatar as a human? No participants doubted that the researcher's avatar had the real researcher behind it, but many did doubt this for the confederate. This has implications with social presence, typically associating the avatar with a sentient living being.

The interviews also suggested doubts of the human nature behind the avatar could affect the feeling of emotions such as gratitude and empathy towards the confederate.

Acceptance of a real person behind the avatar

Belle May never doubted that the confederate was human, but still felt she could not be sure about the nature of the person.

> *Belle May:*
> *And she said 'Hi' and she seemed quite friendly, I wasn't sure if she was putting*
> *happy or sad faces, but... (Quote 5-104:BM)*

However, as discussed in earlier themes, Belle May never felt presence and considered that this was all a game, so she never came to experience an avatar as human. This is consistent with her questionnaire response which rated how 'genuine' the confederate was as high (4) (see Table 5-14).

Unlike Belle May, Shelly Brown always regarded the confederate as human, but also felt that about the confederate's avatar, indicated by her always referring to the confederate and her avatar as if human by her use of "*someone*" or "*them*" rather than 'it'. She attributed roles to the confederate, first as an official helper and latterly as another participant.

> *Shelly Brown:*
> *So I thought this was someone come to help me out. I did not realise it was*
> *another participant until the monitor, when you said go to the right and the*
> *other participant goes to the left. (Quote 5-105:SB)*

This was despite her muted feelings and disinterest or not-minding others being there (Quote 5-81:SB).

All the other participants had some doubts about whether confederate was truly human. Peter Parker was no exception, but after evaluating her polite observations, evaluated her as human (ranked 5 in Table 5-14).

> *Peter Parker:*
> *At some point I felt it's not a real person but then again, I got back to the*
> *moment we're actually because of the name I picked for my avatar "Peter*
> *Parker" she made comment about Spiderman, so I thought there is no way that*
> *is not a human, so to speak. Or it's either some really good software behind it.*
> *(Both laugh) (Quote 5-106:PP)*

Despite this evaluation that she was human, as a result, there remained a doubt about whether her help was genuine.

> *Peter Parker:*
> *Since she helped me at the end as well, or appeared to be helping me, with the button thing. (Quote 5-107:PP)*

Neil focused upon the plausibility of her actions:

> *Neil Young:*
> *I was like, is it my perception of someone who's being real, because she seemed quite real, but I was like, it could quite possibly not be. So, I guess that's what I wondered, but that's why I was thinking. (Quote 5-108:NY)*

Cookie Monster, whilst accepting that the avatars were associated with humans, said he attributed norms in the way that gaming characters interact, suggesting a dehumanisation of the avatar which, whilst associated with real individuals, were as real-individuals objects within a gaming context. This led to social-interaction considered as 'play violence' towards both the confederate and even the researcher's avatar with a desire to attack and kick both the confederate and researcher.

> *Cookie Monster:*
> *So maybe she did say hello, I don't know. There was a point where I thought it might be quite nice to give her a karate chop or something. In a mischievous kind of way. Did think about beating you up as well, mate. (Quote 5-109:CM)*

> *Cookie Monster:*
> *Well I think it's probably just the game element, isn't it, normally when you interact with people you, games tend to involve, well from my experience. I don't play games any more really, but you know generally it's competitive, or you know, not violent, but you know, fighting or something, you know, that's the kind of normal interactions isn't it?*
> *(Quote 5-110:CM)*

This was the same towards both the avatar associated with a known individual, the researcher, and towards a generic human, the other participant. To this extent, there was little pro-social emotion binding the characters together. There appeared however to be no personal animosity towards the researcher following the interview, suggesting a separation between the researcher-as-avatar and researcher-as-real human.

Avatar Humanisation: relationship to presence and emotion

Where there was little humanisation of the avatar there was relatively little emotion in relation to the remote confederate. Like Belle May, Bob Virtual, for the most part, expected a real human upon meeting. She referred to the meeting with the confederate but found the virtual environment and avatar as impersonal. She referred to the avatar, and whole virtual environment, using a de-humanised term, "thing in between", and highlighted the limitations upon the emotional aspect:

> *Bob Virtual: …Yeah, I guess you could if you type it differently, I don't know. I*
> *don't feel very much emotion with something like this, as a thing in between.*
> *(Quote 5-111:BV)*

This accords with Belle May's lack of emotional connection with the other participant discussed in 5.4.4 (Quote 5-58:BM).

Unlike the exceptional case of Belle May, Bob Virtual experienced a changed by the time of the activity where there was more social interaction, with Bob Virtual now interested in the person and referring to the avatar as if human. Bob Virtual now desired greater social engagement; all signs of increased social presence.

> *Bob Virtual:*
> *Well it's partly because I'm a bit conscious of the time that I kept checking the*
> *clock that I wasn't running late and that kind of takes you out of it doesn't it?*
> *Because other than that I was just, I don't know, I was kind of curious to just*
> *have a chat with Jessica [the confederate] and see if I could figure out who this*
> *person is, at the same time I was like, 'oh, let's just get it done'. (Quote*
> *5-112:BV)*

This association with an increase in social presence is confirmed when Bob Virtual felt she was in the same space as the confederate. However, at this time, this was a shared virtual space, reflecting limitations in Bob Virtual's own level of spatial presence which meant that she did not feel the virtual was real.

> *Interviewer:*
> *Okay. So, then the next bit is then coming back, and I'll just remind myself, so I*
> *don't get too distracted. Did you feel physically in the same space with Jessica?*
>
> *Bob Virtual:*
> *Not really, because I did keep thinking about her avatar as being her, an*
> *avatar, so I didn't think that I'm in the same room as this person, I was more*
> *like we're both in this space together but not, you know it's not the same as an*
> *actual space is it. (Quote 5-113:BV)*

In the case of David Beckham, doubts in the feeling that avatar was truly human coincided with a decrease in presence. David had on-going doubts about whether the confederate was an avatar; on those occasions of doubt, his sense of presence was reduced, even during periods where they were communicating together.

> *David Beckham:*
> *…. So, on one hand yes, the communication took me more into the moment than*
> *perhaps when I was just wandering around the rooms just looking, but then if*
> *and then when my thought pattern went to, oh they are not real, it would take*
> *me back to out of the experience again, perhaps. (Quote 5-114:DB)*

David later discusses the negative impact upon his feelings of gratitude that doubts over the human nature of the confederate had. These negative impacts are within the context of overall high levels of gratitude and positive feelings from both the interviews and questionnaire suggesting, in this case, doubts about the avatar's humanity alone does not preclude a positive or social emotion with the avatar. Other factors are at play. David's experience, associated with conceptions of the avatar being real or not, is reflected in Peter's view that it was important to him that she was real, as he considered that this would make his experience more real.

> *Peter Parker:*
> *Well you kind of feel more like you're … it makes the whole overall experience*
> *more real. (Quote 5-115:PP)*

The variations between humanisation and de-humanisation are illustrated further in Hysteric Monkey's meeting episode with the confederate, discussed in the sub-theme "Social Presence as Dynamic Unfolding Episodes" (see Section 5.4.4).

The interview data are broadly reflected in the questionnaires' examination of how genuine participants perceived the confederate's behaviour to be (see Table 5.14). David Beckham's on-

going suspicion of artificial intelligence gave the greatest doubt in her as human, rating this as low (2), and those with least doubt (Belle May, Shelly Brown and Pater Parker) highest. This question does not, however, address how real or human the avatar is, but the confederate. It is unclear why Bob Virtual's avatar had the second lowest, moderate rating (3) here, given the high level of social interaction she had, but it may refer to her earlier experiences.

This theme highlights how there is a distinction between humanisation of the individual confederate behind the avatar and humanisation of the avatar. Increased humanisation of the avatar relates closely to increased levels of social presence and interaction, with suggestions that a de-humanised avatar limits the human emotional connection. Whilst perceptions of the humanity vary with emotion and social contact, doubts do not, of themselves, prevent high levels of positive feelings towards the other avatar.

Feelings of Embodiment and Touching

Shelly Brown's experience of being in a real place extended to her body, with a strong sense of wanting to interact physically and touch objects with her real limbs, both during her initial training and during the main task whilst pushing boxes and pressing the finish button. This she expressed with great passion and emphasis on wanting to use her real arm and hand in Quote SB5.4.7 as:

> *Shelly Brown:*
> *That's it. (laugh) erm and then I messed it up so I decided I would just finish,*
> *especially with the finish button, I was like, you know, wanting to touch it with*
> *my real, my arm, my hand*
>
> *Interviewer: you wanted actually wanted to reach out?*
>
> *Shelly Brown: yes (Quote 5-116:SB)*

The avatars and virtual world interface used in this study had a limited scripted ability to reach out when touching, which is associated with mouse/controller buttons or keys rather synchronisation with her biological hand and arm movements. Hence, her experience of physical embodiment was limited in its practical application.

Virtual Reality Induced Sickness and Symptoms

All the participants who used the Virtual Reality headsets, both the first and second-generation development kits (DK1, DK2), were affected by virtual reality sickness to a greater or lesser extent. Of the interviewed participants, Cookie Monster was the most affected, causing him to withdraw at the very last moment of the exercise. For Cookie Monster, these issues were caused by a misalignment of the headset centre and his direction of walking (the reasons are unclear).

He rated these negative effects as 4.00 on the ITC-SOPI questionnaire, whereas these were rated as moderate 3.00 and 2.67 for David Beckham and Hysteric Monkey, respectively (see Table 5-12).

> *Cookie Monster:*
> *That suddenly it was there, I found that a bit weird, but then I got to the point where I think I'd been walking around for so long and got a bit frustrated by always feeling like I was crab walking off to the left a little bit. But it just started to make me feel a bit unwell and I thought well, persevere with it, to try and move it but I couldn't figure out what it actually was that I was having to do, or whether I move it to point A and then I'd have to move it to point B. I thought I'm not gonna last, I'm not gonna... (Quote 5-117:CM)*

The participants who used a flat LCD monitor display had negligible side effects (see Table 5-12, with VR equipment references beginning L). Examining this in more depth is beyond the scope of this thesis, as this thesis is not concerned with VR Sickness itself, but may have an impact upon presence and emotion.

Avatar Embodiment and Touching

By the time of the gratitude-helping episode, Bob Virtual was highly immersed, spatially present and embodied, with a high level of social presence that developed during the time of the task of clicking buttons on a wall. This was an experience that was both surprising and difficult to evaluate.

> *Bob Virtual:*
> *Well, I mean, I was just like in front of that wall, clicking all these things and then looking sideways and even thinking about it I feel like I was looking sideways but obviously, I was just doing the mousy thing, but I think I was quite into it because otherwise it wouldn't feel that way, would it? I really felt like I kept looking over to the left, like, I don't even know how I did that with the clicking, how did I do that? Oh yeah, because we had, those were the, with the fingers you had, oh yeah, that's fine. So, I was like, how did I...*
> *(Quote 5-118:BV)*

Bob Virtual:

I guess not so much anymore, yeah probably. It's all so weird thinking back because I don't, you don't consciously remember yourself having this birds eye view of the character. I did have that when I first came in and stuff but then when I handed it in, I just remember that it was a mushroomy shape that I had to click. I don't remember my avatar being a part of that scene that I'm seeing. Yeah, it's weird isn't it, because maybe, maybe I didn't really think about.
(Quote 5-119:BV)

Shelly Brown's experience of being in a real place extended to her body with a strong sense of wanting to physically interact and touch objects with her real limbs, both during her initial training and during the main task whilst pushing boxes and pressing the finish button. This she expressed with great passion, and emphasis on wanting to use her real arm and hand as:

Shelly Brown: that's it. (laugh) erm and then I messed it up so I decided I would just finish, especially with the finish button, I was like, you know, wanting to touch it with my real, my arm, my hand

Interviewer: you wanted actually wanted to reach out?

Shelly Brown: Yes (Quote 5-120:SB)

The avatars and virtual world interface used in this study had a limited scripted ability to reach out when touching which is associated with mouse/controller buttons or keys rather than synchronisation with a biological hand and arm movements. Hence, her experience of physical embodiment was limited in its practical application.

5.4.8 Gratitude: Other, benefit, help

Five of the eight interviewed participants had benefit-induced gratitude triggered by an act of helping by the confederate. All five of the helped participants expressed gratitude in the interviews whilst none of the non-helped participants did (see Table 5-5). In terms of the GAC questionnaire, the median rating of those not helped was low (1), compared with high (5) (see Table 5-18) for the helped, when asked how grateful they felt towards the confederate. This supports the interview statements.

The interviews identified that gratitude was focused towards the helper in response to two aspects: being helped itself and the perceived benefit from the help. The latter had a particularly marked effect. The interviews identified gratitude as part of an unfolding, dynamic, social interaction between the participant and confederate, including triggering thanks. Interviews suggested that gratitude helped boost positive and appreciative feelings towards the participant from the interviews. These indicate increased social presence. Prior experience and evaluations of the confederate, and prior positive feelings may play a role derived from earlier actions. However, in contrast to the interviews, the questionnaire responses suggested a negligible effect of helping, in this study's context, upon positive feelings, independent from a closely tied gratitude and appreciation. The impact upon spatial presence seems limited, especially where there was already a very high level of spatial presence and embodiment. Doubts about how real the participant behind the avatar may mask or limit gratitude and induce negative emotions, but based upon the questionnaire responses, the genuine nature of the avatar's behaviour did not vary with gratitude. It should be noted that this is an idiographic study and the interviews may be picking up subtleties that the small number of questionnaire results cannot. These aspects are discussed in the following themes.

Orientation of gratitude: Other, Benefit and Help
Gratitude was described as having three aspects: it was focused towards another person, it was a response to attempting to help, it was in response to the actual benefit.

Both David and Shelly Brown reported feeling highly grateful and appreciative in the GAC questionnaire, although Shelly Brown's tone was not very exuberant, in contrast to much of her interview.

> *Shelley:*
> *That is why I was getting a bit confused. Erm… But then she helped me (laugh)*
> *so I was grateful. (emphases grateful tone). (Quote 5-121:SB)*

Participant	Group	How grateful	How appreciative	How positive	Confederate Act Genuine	Mean GAC Rating
Cookie Monster	HH	4	4	4	5	4.0
David Beckham	HH2	6	6	6	2	6.0
Bob Virtual	LH2	4	5	5	3	4.7
Peter Parker	LH	5	6	6	5	5.7
Shelly Brown	LH	6	6	4	5	5.3
Median		5	6	5	4	4.7
Mean		5	5.4	5	4	5.1
Belle May	LN	1	1	7	4	3.0
Neil Young	LN	1	1	4	4	2.0
Hysteric Monkey	HN2	3	5	4	4	4.0
Median		1	1	4	4	3.0
Mean		1.7	2.3	5	4	3.0

Table 5-18: Gratitude Questionnaire GAC (Gratitude Attribute Checklist – first 3 columns) and Confederates behaviour. GAC modified scale 7point, 7 high. Confederates behaviour 5 point, 5 high. Yellow helped

David reported feeling grateful to 'Other' as the confederate for the act of helping rather than for the help itself. David considered that, underpinning this, was the act of helping itself around the issue of the button. The key element, he felt, was bringing a positive relationship and doing something positive for him, whether real or not. This introduced two dimensions: first, there was still a benefit; secondly, he described gratitude as feeling:

> *David Beckham:*
> *I think I was, I think, well the issue that I couldn't press the button, but actually there was a positive reaction towards the person for helping me, regardless of whether it was pressing a button or, someone else, real or not, did something positive for me and had a positive communication with myself. So, I wasn't necessarily like, I needed help, or the button needed pushing, it was more like a positive relationship was brought there.*
> *(Quote 5-122:DB)*

This echoed a point made by Peter Parker who also reported the gratitude-helping was an increase in appreciative and positive feelings associated with helping, but Peter also experienced this increased whilst engaging in earlier conversation.

> *Peter Parker: Since she helped me at the end as well, or appeared to be helping me, with the button thing.*
>
> *Interviewer: How did you feel about that?*
>
> *Peter Parker: Positive towards her. Appreciative. (Quote 5-123:PP)*

The wording he used here, is identical to that in the gratitude questionnaires, however he did not refer to being grateful. This was reflected in the questionnaire (see Table 5-18), which showed that slightly lower levels of gratitude (5) were felt compared with high levels of appreciation and gratitude (6). The effect of earlier experiences on the positive view may be due to earlier interactions, or in the case of Shelly Brown, disinterest in the confederate may account for questionnaire's snapshot across the whole experience suggesting that the helping had no impact upon the positive experience for these individuals.

Despite David's emphasis upon the role of helping itself, he also attributed the role of the actual benefit's worth to himself; also reflected in the accounts of Shelly Brown and Bob Virtual. This was the same benefit as for Shelly Brown with an alleviation of a worry and negative feelings of being at fault:

> *Interviewer: How did you feel about that? You felt grateful? That was the word that came through.*
>
> *Shelly Brown: Yes, close just sitting there standing there and … erm … Getting worried again that I'd messed it up and she came and helped to me, so I was… grateful. (Quote 5-124:SB)*
>
> *David: Relieved. It's a positive experience. It makes you feel more happy that you've completed something, you've helped out. Perhaps that it wasn't your fault, the light wasn't going on or something. (Quote 5-125:SB)*

This gratitude, she described, as flowing from the confederate fixing her problem, so alleviating her worry about messing up, with no mention of an ulterior motive or association with the study's aims.

Bob Virtual was also grateful towards the confederate for the act of helping, but had low expectations that she could actually help, as he considered her naïve. There seemed to be explicit influence upon the feelings of social and spatial presence, which had already developed during the task. However, the act of helping had increased positive feelings towards her, suggestive of increased social presence.

> *Bob Virtual:*
> *Oh that, yeah, that was really nice. I don't know, it felt to me a bit like really sweet but a bit naïve, 'cos I was like…I'm not sure what you can do, 'cos we're both just… what more can you do in terms of clicking on an object, than I can do? But it was really sweet of her to come over, for sure, so I was like oh, she seems nice. (Quote 5-126:BV)*

This is in line with her early evaluation of the confederate as not being particularly able. She was only modestly grateful at this point and doubted the benefit. This is reflected in her giving the lowest questionnaire rating of gratitude of the helped, but still much higher than that for the non-helped.

Two weeks after the event, Bob Virtual expressed feeling gratitude of a greater intensity. Whilst the act of helping alone was reflected in the earlier interviews, Bob Virtual's second interview highlighted the importance of actual benefit for even higher levels of gratitude. In the second interview, a week after the study and questionnaire, Bob Virtual discovered that the confederate had actually helped. At this point, Bob Virtual voiced enthusiastic appreciation and gratitude and wished she had thanked her more at the time. She also re-evaluated the confederate's competency during this interview.

> *Interviewer:*
> *Okay, so at the time you didn't appreciate that?*
>
> *Bob Virtual:*
> *No, no, no too bad, I would have thanked her more. (Quote 5-127:BV)*

It is notable that this increased feeling of gratitude after two weeks revealed that the impact of the earlier gratitude-helping episode still existed over a long gap in time. It is unknown what impact this may have should they have met later and raises further questions over the temporal boundaries of episodes or triggers over potential further episodes.

A joint purpose of the gratitude-helping episode was emphasized by Bob Virtual who recounted that they jointly completed the task. Bob Virtual did acknowledge, however that she was the one wanting to be the expert.

> Interviewer:
> So how are you feeling now towards her?
> Bob Virtual:
> That's lovely, why did she manage to click it though? Yeah, no, that's really nice, that's great. I like being the expert, I like being the one that does the clicking.
> (Quote 5-128:BV)

And later:

> Interviewer:
> And how did you feel when that happened then? When you thought…
> Bob Virtual: Good.
> Interviewer: Good?
> Bob Virtual:
> Yeah. 'Cos either way, we'd done it, so you know. (Quote 5-129:BV)

The increased positive and appreciative feeling and improved social bonds combined with increased interaction are all indicators the gratitude is associated with increased levels of social presence. It is unclear to what extent changes in social presence affect gratitude, although prior social interaction with and evaluation of the avatar where there was increased social presence did have an impact.

Some Evidence of Increased Spatial Presence
There were mixed reports in terms of increases in spatial presence, however. David noted that, during this act of helping, he felt an increased feeling of being there, spatial presence, more so than when first meeting the confederate.

> Interviewer
> Did you feel particularly in that room at that stage?
>
> David Beckham:
> Probably, I think, probably more so I guess, than when the other person was communicating with me. But at the same time there was still that doubt as to whether they were a real person or not, so I think that undermined it slightly.
> (Quote 5-130:DB)

Similar to the initial meeting with the confederate, doubts over whether the confederate was human reduced the level of presence:

> *David Beckham:*
>
> *Grateful to the person, well, actually two emotions, or two thought patterns. One was that I was actually grateful that they helped …*
>
> *… But at the same time, I was, I think I was sort of wondering whether they were a real person or whether it was just an AI. (Quote 5-131:DB)*

Gratitude is not a one-way act of helping, it is a reciprocal interaction prompted in this case by helping. The doubt of the genuineness of the help, i.e. it was not a real person, led to an increase in emotion; feelings of insincerity and feeling bad about doubting the pure motives behind the help. This concern may reflect empathy and feeling for the helper.

> *David Beckham:*
>
> *Intrigued, it did make me wonder whether my gratitude towards them was not wasted, but bad because it changed my gratitude towards them to make it slightly more insincere. (Quote 5-132:DB)*

Whilst others did not report increased spatial presence, both Shelly Brown and especially Bob Virtual already had high levels of spatial presence and even embodiment. For David, the increase in the positive emotion gratitude was associated with increase in spatial presence, yet both were marred and reduced, in blunt terms, by the doubt about how real the person was behind the avatar. In this situation, overall presence also increased with increasing negative feelings of guilt. However, it also correlated with the perceived lower presence, rather than being associated with the negative emotions of guilt which correlated with a decrease in spatial presence. Social presence was also increasing with gratitude, indicated by David suggesting that the purpose of gratitude was to bring together people socially. During the process, David was not only engaging with the confederate, but also concerned about being insincere towards a real person; an indication of empathy. On balance, it appears that social presence is as variable as spatial presence, but it is unclear whether guilt over doubting increases empathy and a focus upon the confederate, and hence is an aspect of social presence.

Desire to respond and interact limited by the interface affecting communication

The gratitude-helping mechanism highlighted the desire to respond and interact which came to the fore not only during the exercise but also during the small talk with the confederate and the during the gratitude-helping exercise. However, the virtual interface hampered this.

Peter Parker:

Hi, hello, how are you, and stuff like that. But I was unable to get too much involved with the other person because I was not able to type very well. (Quote 5-133:PP)

Such a desire to interact indicates increased feelings of social presence. There is evidence that gratitude-helping episodes increase social presence, but less so spatial presence. There is little evidence that increased spatial presence itself increases gratitude, although, in some cases, gratitude may be slightly increased. There is uncertainty about the impact of social presence upon gratitude. There is strong evidence that gratitude was related to an unfolding episode stimulating interaction and increased social connection and human feelings, suggesting increased social presence.

5.4.9 Culture and foreknowledge

Culture and foreknowledge ran in the background of all these themes. In terms of the participants' backgrounds, there was relatively little variation in cultural background as the participants came from English speaking, Protestant which overlap and one from the Orthodox Cultural Grouping (Inglehart & Baker, 2000). In addition, all were postgraduate PhD students at an English-speaking University, and all seemed to have a willingness to help others carry out research.

In the Purposes and Intentionality theme (see Section 5.4.2), for instance, it was emphasised how individuals brought with them personal foreknowledge, such as gamers' expectations, about the virtual environment.

Throughout these themes the impact of the cultural context and foreknowledge of all the participants was highly influential. The cultural background, e.g. gaming or not, for instance, influenced whether they were interested in the visual aspects and compared it with other games as described by Bob Virtual. Neil Young adopted a view of the avatars as gaming characters explaining his decision to attack them. When the participant met the confederate and not being able to reciprocate a greeting in accord with social norms, social anxiety arose leading to a breakdown of the relationship. These seemed to imbue most if not all social activities.

5.5 Summary

This chapter presented the results and analysis of the pilot studies used in the development of the virtual environment and the main study itself.

5.5.1 The Development Studies

There were three studies, involving 52 participants, supporting the development of the research environment, tools and protocols. The first case study (n=1) focused upon the experience of the virtual environment and its exercises involved a thematic analysis of an unstructured interview and an ITC-SOPI questionnaire. Second a quantitative survey (n=37 after missing data affecting confidence levels were removed), following concerns raised in the first pilot, a survey into the degree of agreement (inter-rater agreement) of participants perceptions of avatar appearance upon attraction, trust, assertiveness, and comfort to be with in order to select a suitable avatar. The third pilot (n=3) included all the changes from the previous study especially the activity to stimulate gratitude in the virtual environment and the semi-structured interview protocol.

The first pilot identified issues relating to avatar appearance and was imbued with emotions such as; distrust, anger, anxiety and boredom (which broke any sense of presence), which raised concerns about obscuring gratitude. External demand effects, such as, the study was perceived as a psychological study. Control and Navigation factors made interacting and broke any sense of presence. Presence was identified using the ITC-SOPI questionnaire which was investigated in detail. This suggested limitations into its ability to discriminate enough between levels of presence, systematic bias against environments that did not involve multiple senses and an inability to identify the changes over time of presence which the interview could. In addition to further investigations in avatar appearance, it also highlighted that any study into gratitude would also need to include the other emotions surrounding it.

The avatar appearance survey suggested that there was very little common agreement over attraction, trust, assertiveness, comfort with Krippendorff's Alpha: very low (Overall α=0.0555), see Table 5.3, within the 95% confidence limits. The participants were able to discriminate between these factors with highly significant results between the relationship between attractiveness, and trust, assertiveness and comfort with significant correlations at $p < 0.01$ (using Spearmans rank correlations) as predicted by prior theory. A sample of n=83 was obtained by pooling together ratings across male avatars. This suggested that no avatar design was preferable to another in general.

The second gratitude and interview protocol identified that these were acceptable.

5.5.1 The Main IPA Study

The main study of this thesis identified eight superordinate themes using IPA. The themes identified are: purpose and intentionality; curiosity, exploration and evaluation episodes; unfolding presence; weirdness and dissonance; role of the avatar; gratitude: other, benefit, help; orientation of emotion: its nature and intentionality, and culture and foreknowledge (see Figure 5-7). The three themes purposes and intentionality; curiosity, exploration and evaluation and orientation of emotion: its nature and intentionality are very highly linked (on the circle in Figure 5-7).
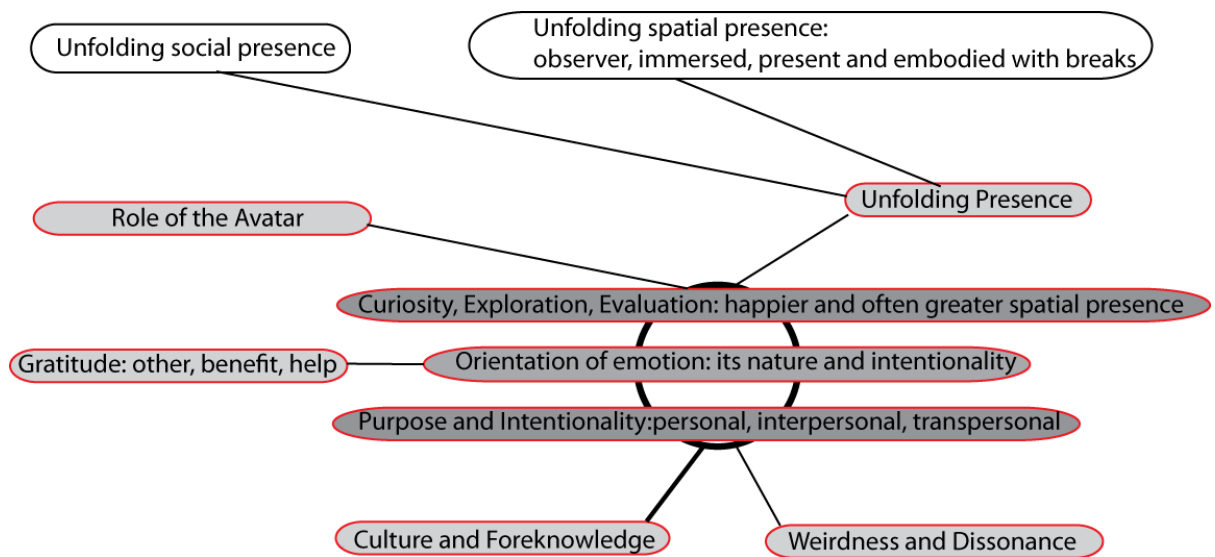
Figure 5-7: Superordinate Themes from the main study

This research found that, in this study, the relationship between emotion and presence was not as simple as that found in other studies, since presence did not always increase with emotion. The orientation of emotion, its intentionality and nature, e.g. as a social emotion, are especially important in linking with the other themes. It identified gratitude as part of an unfolding, dynamic, social interaction between the participant and confederate, including triggering thanks. Interviews suggested that gratitude helped boost positive and appreciative feelings. This gratitude was focused towards the helper in response to two aspects: being helped itself and the perceived benefit from the help. Social presence was revealed as an unfolding episode involving social interactions that were not always positive and the emotions generated such as social anxiety could lead to a breakdown in social presence.

Chapter 6 The Enactive Lens and Discussion

This chapter brings together the evidence gathered in this research and the theoretically developed approaches to provide a fresh insight into the relationship between emotion and presence. It does this by taking the accounts and findings obtained using IPA in chapter 5 (addressing the primary research question) and further analysis by recasting them from the enactive theoretical perspective of this thesis to provide a description and explanation of the participants' experiences. This is discussed and critically evaluated through engagement with other theories and empirical studies into the relationship between presence and emotion. The study identified that prior theory suggesting an increase in emotion leads to an increase in presence in all cases was not supported (Jiménez, James, Maureira, & Kniestedt, 2017; Bouchard, St-Jacques, Robillard, & Renaud, 2008; Gorini et al., 2009; Gorini, Capideville, De Leo, Mantovani, & Riva, 2011; Riva et al., 2007a). The enactive perspective introduced explanations that can account for this. This theoretical aspect addresses the secondary research questions.

In this chapter, first the relationship between emotions in general, excluding gratitude, and presence is examined in section 6.3, followed by the relationship between gratitude and presence in section 6.4.

6.1   The Enactive Lens

This research has adopted the enactive approach through the development of the EAP (see Chapter 3) used in conjunction with the enactive approach to emotion. To re-cap, the enactive approach emphasises the affective nature of cognition, at the level of the organism's sense-making, and involves the whole body not just the brain. Sense-making involves the brain-body's dynamic interaction with the world, such that an organism lives in a world of meaning or *umwelt* formed through this sense-making. Thus, the participants' interpretation of their lived experience in this research study reflects aspects of their world of meaning, as obtained using IPA in Chapter 5. This is now examined through the enactive lens and EAP.

There are considered to be two forms of presence: spatial and social. The enactive approach to spatial presence EAP (spatial) is defined in Section 3.3 as: *the felt experience of being there emerging from the purposeful, self-sustaining, actions (enaction) in a dynamic interaction between an autonomous embodied (natural and synthetic together) organism and its environment (natural and synthetic).* For social presence, EAP (social) is defined in Section 3.4 as: *the felt experience of being with other social agents emerging from the purposeful, self-sustaining, actions (enaction) in a dynamic interaction between autonomous, embodied (natural and synthetic together) social agents and their environment (natural and synthetic).*

The EAP (social) includes both the role of social cognition and otherness, and as for spatial presence a tendency to order. The EAP (spatial) emphasises the role of cognition (inclusive of

emotion) (see Figure 6-1). Spatial presence is illustrated in Figure 6-1 below. It reflects that the body can be experienced as a single phenomenological, body, termed symbodied (Veerapen 2012) as they depend on each other in this situation. The dotted lines indicate that organisms can adapt and modify the couplings with the environment and, indeed, similar couplings within the body.
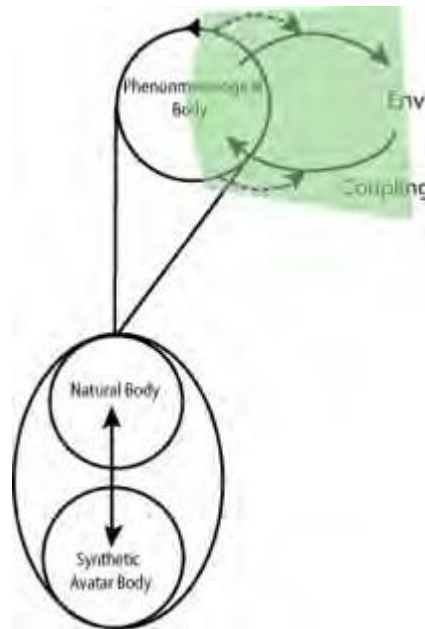
Figure 6-1: Enactive spatial presence.

These definitions emphasise the role of dynamic coupling between the mind-brain-body-environment with meaning emerging from the purposeful actions and how these may be adapted.

The key elements of the EAP (spatial) are that:

- presence emerges from purposeful, self-sustaining actions (enaction) as meaning (sense-making) in a dynamic reciprocal interaction between the autonomous organism and the environment, not as a simulated world in the brain
- the dynamic reciprocal interaction involves sensorimotor coupling, as a dynamical system, which may be adapted by the organism
- dynamical self-organizing patterns (of presence) form in the same way as emotional episodes and moods
- presence emerges from dynamic interactions with the somatic neural system
- the locus is around an embodied organism (natural and synthetic together in a symbiotic relationship): the symbembodied self
- the enaction is scaffolded in a dynamic interaction with environment
- it is a felt experience.

This has drawn upon Colombetti's (2014) approach to emotion which also emphasises sense-making (of the emotion) as dynamic coupling between brain-body (sensorimotor coupling) and the world as one dynamical system, which may be adapted by the organism and self-organising patterns within.

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Figure 6-2: Social presence involving joint sense-making within a greeting episode.

In social presence, coupling remains key, as for spatial presence, but focuses upon the shared meaning-making and shared intentionality. The coupling (see Figure 6-2 in a greeting episode) is not with the physical environment but involves joint sense-making and direct coupling between individuals who are both coupled with the greeting episode (formed through joint sense-making).

6.2   Emotion generally and presence

This section focuses upon the relationship between emotion generally, excluding gratitude (examined in Section 6.3), and presence. It further excludes presence as an emotion (Willans 2012).

This research found (see Chapter 5) that, in this study, the relationship between emotion and presence was not as simple as that found in other studies, since presence did not always increase with emotion. However, to the extent that areas of increased emotion often coincide with

increased presence, and where there was lesser emotion, there was less presence, it is in line with previous empirical studies (Jiménez et al., 2017; Bouchard et al., 2008; Gorini et al., 2009, 2011; Riva et al., 2007a).

This thesis suggests that the orientation of emotion, its intentionality and nature, e.g. as a social emotion, are especially important in linking with the other themes identified in Chapter 5. This section discusses this relationship between emotion generally, and presence, both spatially and socially (see sections 6.2.1 and 6.2.2 respectively). It includes an interpretation, from the enactive perspective, of the superordinate themes identified in Chapter 5.

6.2.1 Spatial Presence and Emotion

This section examines the relationship between spatial presence and emotion. It considers how this relates to the wider literature. Two examples of applying the EAP are examined: anxiety over missing an external meeting leading to breaking presence, and emotion leading to feeling more 'drawn in' and to increased feelings of spatial presence.

BOB VIRTUAL: ANXIETY OVER MISSING A MEETING

This case illustrates how emotions felt whilst within the virtual environment can lead to a break in spatial presence. Figure 6-3 illustrates how Bob Virtual, whilst within the virtual environment, felt anxiety towards being late for a meeting outside of that environment. There are various coupling actions associated with this emotional episode between the symbembodied (a phenomenological), body and the external environment and internally within the somato-sensory systems of the body. The boundaries of these actions mark the boundaries of the episodes, as it is through these actions that there is sense-making from which the emotion emerges.

The emotional episode became orientated towards being late for a future meeting external to the virtual environment. Another associated action was that of checking the clock (which was on the external interface to the virtual environment) to ensure things were on time. This is in line with the orientation of the emotional episode outside of the virtual environment; from the perspective of the participant, this would also involve focusing upon the clock. These according to the EAP, adopted from Veerapan (2010, 2011), shifted the body horizon from the avatar locus to the natural body locus, with a breakdown of the everyday experience of being within the virtual environment, hence breaking the feeling of being within the virtual environment (spatial presence). This is consistent with the superordinate theme 'orientation of emotion: its nature and intentionality' (see Section 5.5.8).
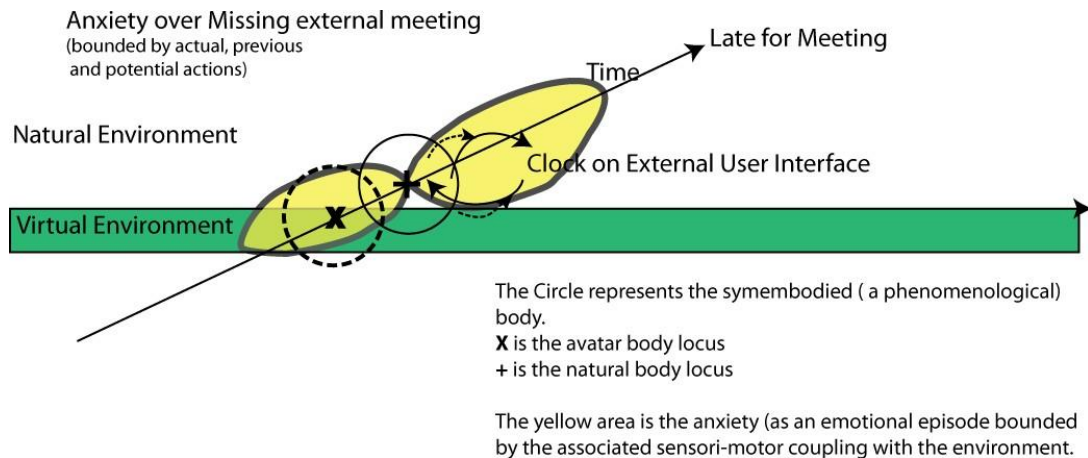
Figure 6-3: Break of spatial presence due to externally orientated anxiety over lateness (Bob Virtual).

The illustration shown in Figure 6-3 does not include couplings within the body and nervous system that would together form one sense-making system. Sudden breaks of presence are widely reported in presence research (Garau et al., 2008; Slater, 2002; Slater & Steed, 2000; Wirth, Hofer, & Schramm, 2012). These breaks occurred within the context of an ongoing, unfolding and deepening experience of presence (Section 5.5.4) in stages (see Figure 6-4). This is similar to the stages of increased immersion reported by Jennet et al (2008) and Brown and Cairns (2004). There were fewer breaks of presence, and associated emotion, as Bob Virtual became more immersed, present and embodied (see Figure 6-4), suggesting that the coupling within the virtual environment became more developed and had a greater influence than external distractions. This ongoing increase in presence may be explained as due to the design of the virtual environment, which introduces more activities at the later stages. Such activities would involve more coupling with aspects within the virtual environment, orientating the sense-making of presence. The actual feelings of presence and emotion, utilising the dynamical systems approach, within the EAP, arise internally as part of the overall dynamical system (Section 3.1 and 2.2). This aspect is beyond the scope of this thesis.
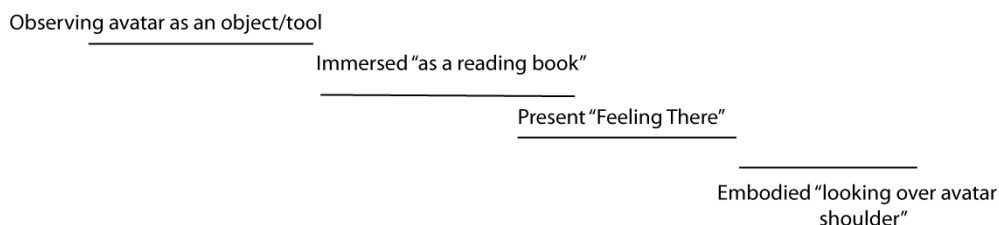
Figure 6-4: Increasing levels of immersion and presence.

The second example (illustrated in Figure 6-5) primarily illustrates a case where emotion is associated with increased presence. Shelley who was highly excited by the 'physical' environment and very curious described herself as being 'drawn in' by emotions with an increasing sense of spatial presence. From the enactive perspective, this would involve relatively tight coupling with the physical environment in which she was interested in interacting. Emotion associated with this action would be orientated towards further exploration, and coupling actions, associated with presence, would be closely aligned. These are actions of personal exploration, together with personal intentionality. In her case, this is a non-social emotion and the positive emotion (excitement) arguably involved tighter coupling and a desire to engage more. This example brings together the themes: orientation of emotion, its nature and intentionality; purpose and intentionality, curiosity exploration and evaluation.

The Circle represents the phenomenological, symembodied, body - dashed initial, solid later
✗ is the avatar body locus
+ is the natual body locus

The yellow area is the excitement (as an emotional episode bounded by the associated sensori-motor coupling).
Blue elipse is the presence (as an episode bounded by enactive sensori-motor coupling)
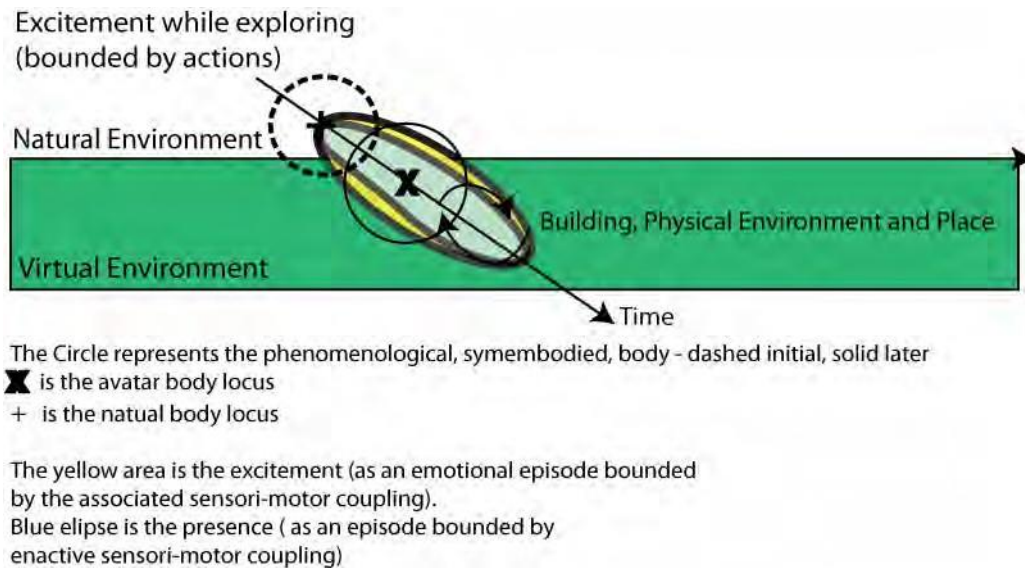
Figure 6-5: Feeling drawn in and more present whilst exploring (Shelly Brown).

The illustration in Figure 6-5 does not include couplings within the body and nervous system. In both cases, emotional episodes are situated within space, time and a context, located around the phenomenological body.

ORIENTATION OF EMOTION

The two examples illustrated in Figures 6-3 and 6-5 highlight the role of orientation of emotion in the relationship between emotion and spatial presence. The emotion is located around the phenomenological body; thus, orientation is experienced as focus by the individual.

Many theories of emotion and presence relate to the focus of emotion. This section critically examines such ideas of the relationship related to the orientation of emotion and spatial presence; especially those of Wirth, Hoffer and Schramm (2012). This thesis and Wirth et al. (2012) both agree that spatial presence within the virtual environment can be associated with

emotion orientated (this thesis) or focused upon (Wirth et al., 2012) where they identified a correlation between emotional involvement and spatial presence. The explanations however differ. Wirth et al. (2012) draw upon the approach by Lerner & Keltner (2000) that emotions are of differing valence which leads to different cognitive appraisals. They argue that emotions "motivate or urge to direct mental activities to the emotion eliciting event" and virtual environments are objective items "regarded as a media" (Wirth et al., 2012, p. 22). This directing of mental activities towards an objective virtual environment exhibits a subject-object relationship consistent with brain bound mental simulation and evaluation of the external environment. This contrasts with the mind-brain-body-environment of the enactive approach to emotion (Colombetti, 2007, 2008, 2014) and presence (see Chapter 3) . Wirth et al. (2012) focused upon emotions drawing in as per rather than emotions felt whilst within a virtual environment drawing out as in this thesis. Wirth et al. (2012) also did not address the differing nature of the emotions, especially the distinction between social and non-social emotions where the social emotions in this thesis suggests were focused almost solely upon social presence.

Questionnaire data obtained in this thesis relating to the attention allocation aspects and spatial presence were also consistent with those of Wirth et al. (2012). Again, explanations differ. The questionnaire data was consistent with the interview data. This used the same MEC-SPQ (Vorderer et al., 2004) questionnaire as Wirth and colleagues (2012), and focuses upon their model of spatial presence. Wirth et al. (2012) considered two aspects of spatial presence: the feeling of being located there and acting there. A further measure included attention allocation. The eight participants in this thesis with the highest ratings for attention allocation (4 or more) also had the highest levels of spatial presence (median 3.8 and 3.62 for the location and action elements respectively). However, the other participants had ratings of only 2.0 and 1.8 (medians) for the location and action aspects of spatial presence (see Chapter 5 Table 5-13).

This thesis also found some support for Wirth and colleagues' (2012) questions that they use to support the view of a mental spatial situation model, such as: 'I was able to make a good estimate of how far apart things were from each other'. There is further evidence agreeing with the findings regarding visual imagination. However, interpreting such traits as evidence of an internal mental model does not necessarily follow.

From the enactive perspective, individuals still have traits; so, for example, strength in spatial skills may be associated with sensing-making of spatial presence involving an orientation towards increased coupling with the physical virtual environment as shown in Figure 6-5. Evidence supporting this is that participants with high spatial presence ratings reported a positive interest in an aspect of the virtual environment. Their positive purpose is associated with a personal intentionality (Section 5.5.2) to focus and hence, from the enactive perspective, there would be increased coupling. This is consistent with Freeman and colleagues (2005) quantitative studies suggesting that *"[Spatial] presence and emotion are related only for arousing*

material" (p213), using the ITC-SOPI questionnaire, and their suggestion that this needed to be "*personally relevant and significant" (p218)* which like Wirth (2012) they attribute to attentional allocation with little emphasis upon the role of intentionality.

INTENTIONALITY AND EMOTION

The frequent references to purpose and intentionality associated with emotion highlights the interaction between emotion, intentionality and agency (addressed mainly within the superordinate theme "curiosity, exploration and evaluation" in Section 5.5.3). This is illustrated in Figure 6-6.
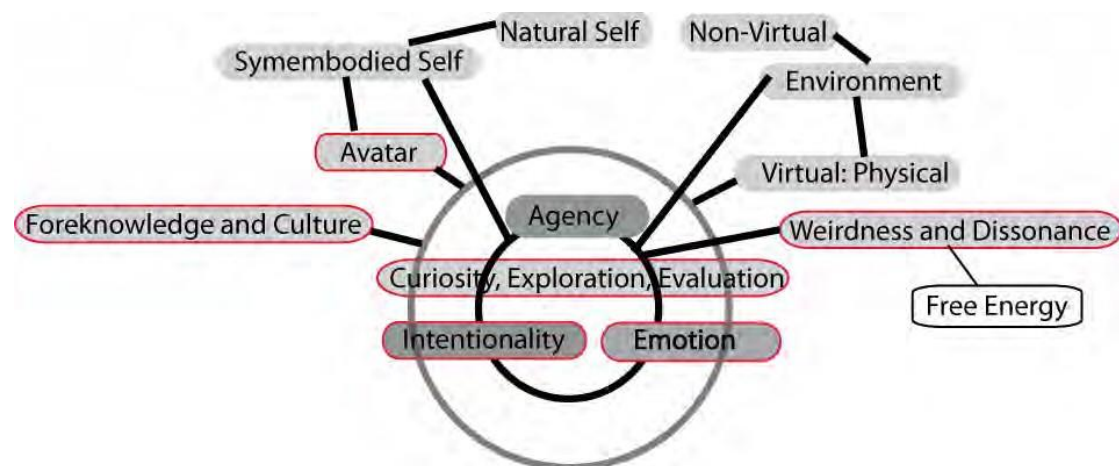
Figure 6-6: Spatial Presence and Emotion Elements.

Those boxes with red surrounds are superordinate themes; gratitude and social presence are omitted as they are not relevant here, and the overall diagram relates to spatial presence. There is a core of agency, intentionality and emotion along with the symembodied self and weirdness and dissonance. This shows associations not causal links.

This thesis identified that, prior to the virtual study, there were already expectations, foreknowledge, personal agenda and interests (see section 5.4.2) thus there was not just an intention to do something, to act; rather, those actions were purposeful, based upon earlier expectation or prior foreknowledge. Thus, those participants with experience of computer games were interested in comparing the physical environment of the 'game', whilst others were only interested in the physical aspects and had minimal interest in any social aspects.

This evidence of prior knowledge is consistent with the purposeful sense-making (see Section 6.2) i.e. it has an intentional structure.

One well developed and coherent approach to presence, comparable to the enactive approach, is that of Riva and colleagues (2014; 2014; 2004) (see section 2.6.4); an approach that also provides a linkage to the formation of self and relates to consciousness and emotion, adopting key principles of Damasio (1999). This is criticised for maintaining a role for a simulated brain and a dualist divide between cognition and emotion in Willans et al. (2015) when applying the enactive approach to emotion (EAE) for higher ordered functions. This led to devising an alternative EAP; the latest refinement is set out in Chapter 3.

Riva and Mantovani (2014) capture both space and time related together by intentionality. They define spatial presence as "*the pre-reflexive sensation of 'being' in an environment, real or virtual, which results from the capacity to carry out intuitively one's intentions within that environment".* (Riva et al., 2014, p14).
This they align with embodied movement or action of the self from which the sense of our immediate spatial sense emerges. From the perspective of virtual environments and avatars (regarded as a tool) they relate this to acting near in time and space (proximal) and to the far (distal) from the natural body and the current time; the avatar being a tool used indirectly far from the body in space(distal) to near as a handheld joystick (proximal). Such movement is intentional. Intentionality is also time focused and here they adopt Pacherie's (2006) dynamic theory of intentions, which is time-focused. They then relate her other two modes of intentionality, P-Intentions and F-Intentions: P focused upon the present and F on the future. These they reframe as: near (proximal) and far (distal).

Supportive of an enactive approach, Gallagher (2012) is critical of Pachiere's approach, pointing to ambiguities between P and F approaches and that the demarcation between near and far plans is not clear cut. He further argues that if thinking is considered a mental act, and as an act is intentional, there can be an infinite regression. Thompson (2007), from an enactive approach, argues precisely this from a phenomenological perspective that imagination, for instance, is a mental act. It is through action that sense-making is formed. The EAP avoids such problems. From the enactive approach all sense-making involves is a cognition-affect act.

The EAP incorporates a tight coupling with the world. Whilst from an enactive perspective meaning for any individual is located around them, they exist in a wider world of meaning. This thesis also identified purpose and intentionality including the personal (Pachiere's model is this) but there is also a wider purpose and intentionality, the transpersonal and interpersonal purpose, and intentionality that influences the endogenous intent at the personal level. The EAP addresses and incorporates this and accounts for individuals not just emplaced within a space but within a culture relative to others

Spatial presence, Riva and Waterworth (2004) argue, also incorporates with the formation of self-hood and emotion and consciousness utilising with work of Damasio (1999; 1996)and

Russell (2003). Damasio, a neuroscientist, focuses upon three levels of feeling and relates this to consciousness. At the first level, background affective state, this is like that of the simple amoeba which only lives in the immediate. The second state core-self has a basic level of consciousness that enables an awareness of feelings to allow feelings of core affect (valance and activity; Russell, 2009). Core effect is an underpinning basic mood that can be felt, above this background affective state. From this core affect form emotions through a process of attribution utilising psychological appraisal, and this thesis would argue Riva and Mantovani's (2014) focus is consistent with Barrett's (2012) *an emotion is an intention that is enacted when embodied conceptual knowledge is brought on line to shape the perception of a physical state.* (Barrett, 2012, p. 419) Attribution is a psychological appraisal (see Section 2.3.7) of current situation and attribution lead to emotional behaviour. Acts of categorisation; and the enactment of a socially constructed role. It includes social effects (Russell 2009, p 1274). Thus, spatial presence is closely related to emotion which accords with a close tie between presence and emotion. However, whilst this study has shown a relationship between spatial presence and emotion the enactive approach avoids the dualist criticisms these components of Riva's et al.'s (2004) approach as discussed in sections 2.3.1 and 2.3.7.

This thesis identified curiosity and exploration with increased happiness and increased spatial presence which is discussed in the next section. In contrast to Pacherie's (2006), time based approach to intentionality, this thesis identified the importance of intentionality in a more social context as personal, transpersonal and interpersonal, so identifying how embedded and in the world those studied were with a tension, for instance, between a transpersonal intentionality of the research study or the external meeting.

AGENCY AND PRESENCE; AGENCY AND EMOTION; CURIOSITY, EXPLORATION AND EVALUATION

The study identified links between agency and emotion and, agency and spatial presence. This included a relationship with immersion, absorption, and curiosity, exploration and evaluation.

A link between agency, emotion, immersion and absorption is suggested by Gallagher and Lopez (2007) who identify state curiosity, as the "*emotion of interest*" and Interest "*is associated with tendencies to explore and become absorbed in novel and complex stimul*i" (p. 237). Kashdan, Rose and Fincham (2004) describe curiosity as prompting *"proactive, intentional behaviors in response to stimuli and activity with the following properties: novelty, complexity, uncertainty, and conflict*" (p.291). According to Gallagher and Lopez (2007) absorption refers to a propensity to completely focus one's attention on tasks and is similar to the concept of flow states (p 236) which is a pleasurable state (Csikzentmihalyi, 1990).

These affective states and agency are associated with states of immersion and absorption, distinct from spatial presence. The study identified differing levels of presence as an episode unfolded, from being an external observer, through immersion as in a book, feeling physically

present in that space i.e. spatially present, then to feelings of embodiment in the avatar (see Figure 6-4). This is consistent with Brown and Cairns (2004) research, highlighting three stages: involvement, engrossment and total immersion. The research in this doctorate identified, elements of embodiment and spatial presence after these stages. The level of involvement aligns especially with the initial level of purpose and intentionality, and the associated level of attention.

A link between agency, intentionality and spatial presence is consistent with Riva's et al.'s (2004) research into presence. Riva and Mantovani, (2014), in their later presence studies, consider presence in terms of intentionality and the carrying out of intentionality, i.e. presence is action orientated, as is the EAP.

This study provides evidence towards supporting this, with curiosity and exploration not always associated with increases of presence. This accords with Seth et al. (2012) suggest that although there is a link between agency and spatial presence, there is also some independence. Seth and colleagues' (2012) suggests it is possible for spatial presence to vary in line with the levels of curiosity and exploration (agency) rather than the emotions that vary with agency. Schneider (2004) suggested that presence is greater with story-based games and also that participants felt more positive in story-based games where stories add additional elements of purpose and intent to actions. This is consistent with the results of this study in which increased levels of presence were associated with curiosity and exploration which were, in turn, coupled with intentionality and purpose. During periods of curiosity and exploration more positive feelings were expressed.

Spatial presence does itself have affective aspects and can be considered an emotion (Willans 2012) or cognitive feeling (Schubert, 2009) but researching into its emotional relationship with itself, rather than other emotions, is a tortology. That presence as enactive sense-making is again consistent with cognition and emotion being one in accord with the EAP.

The EAP suggests that the emotions, including curiosity, and spatial presence, may share common factors or, from a dynamical systems perspective, coupled attractors and controllers. The linkage between emotion and spatial presence relates to the orientation of emotion and its intentionality associated with shared coupling. The agency of curiosity and exploration associated with immersion and absorption would account for evidence that spatial presence may follow but is distinct from immersion. However, these elements need not be linked.
It is beyond the scope of this thesis to examine how this coupling relates at the internal bodily or neurological level proposed in Section 3.3.

6.2.2 Social Presence and Emotion

This section examines the relationship between social presence and emotion. It examines the increasing dynamic social presence ultimately reducing social presence during the initial meeting episode between Hysteric Monkey and the confederate (see Section 5.5.4) and involves a discussion with related theories.

HYSTERIC MONKEY: INCREASING DYNAMIC SOCIAL PRESENCE ULTIMATELY REDUCING SOCIAL PRESENCE

There was evidence (see Section 5.4.4) of an increase in social presence episode soon leading to social-anxiety which then reduced social presence. For Hysteric Monkey this arose when he could not reply. This is contrary to other social presence studies where increased emotion and increased social presence go together.

From the enactive perspective this episode is viewed as an ongoing episode and enactive interaction, the social presence can increase emotion, but this may be self-limiting and may eventually end the interaction altogether.
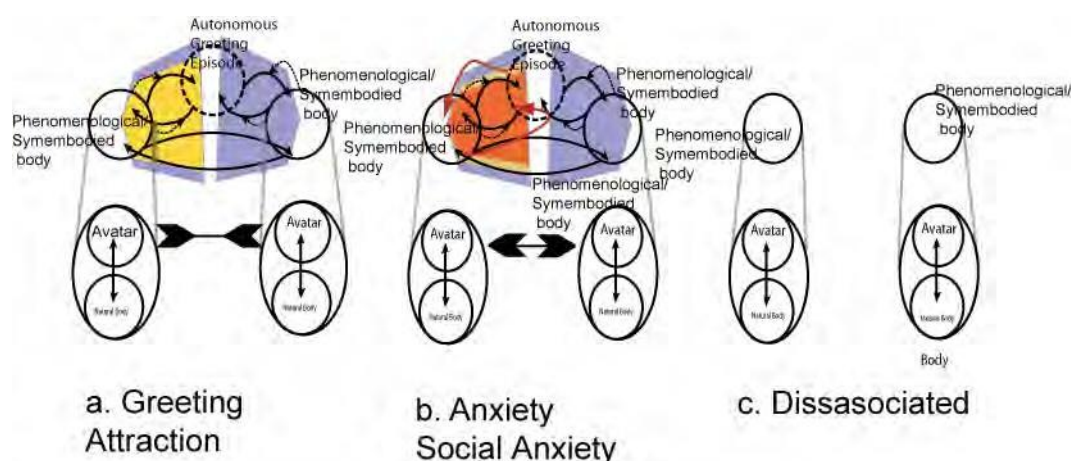
Figure 6-7: Hysteric Monkey (Left) greeting Confederate (Right).
Blue is social presence, yellow is physical attraction and orange is social-anxiety.

From an enactive perspective, Hysteric Monkey would have had an endogenous emergence of curiosity and physical attraction as the confederate's avatar was female. Going to meet the confederate was an act of personal intentionality. This emerges within Hysteric Monkey's phenomenological body and somato-neurological system dynamically coupled between him and the confederate to form a dynamical system (see Figure 6-7) who together form a greeting episode through their actions in an act of participatory sense-making involving inter-personal intentionality. This led to the feelings of interconnectedness. Colombetti and Torrence (2009), from an enactive perspective, consider the affective character of 'feeling connected'. This is similar to many aspects of social presence. In this view, such feelings evolve from participatory

sense-making in the enactive interactions or connections between the participant and confederate (Chapter 4). Two aspects relevant to 'feeling connected' and all such inter-subjective connection: sensing-in or 'sensual empathy' (as understood by Stein(1989/2016)) and "otherness" (Alterity). At one level this co-ordination is comparable to Riva and Mantovani's (2014) first level of social presence aligned to motor intentionality, and the "ability to imitate the other" (p.23) yet also this study emphasises co-ordination rather than imitation alone. In this it identifies a shared inter-personal in addition to personal intentionality, addressed by Pacherie's (2006) m-intentionality. Detailed examination of Pacherie's (2006) approach is not addressed in this thesis. Riva's second level "*recognize within the sensorial flow the intention direct towards him by "an Other similar to the self*" (Riva & Mantovani, 2014, p. 23). Unlike Riva and Mantovani's (2014) dependence upon a mental-simulation, the enactive approach also recognises this in the connectedness within "I experience myself as being observed and evaluated by another; this experience discloses the other as a radical alter, namely as the one"(Colombetti & Torrance, 2009, p. 10) from the phenomenological perspective which does not need an internal mental model. In addition, the EAP argues that the dynamic coupling Hysteric Monkey has, enables a synchronization of inference schemes (see Section 3.4.2) so can predict each other or "know" the others intentionality and links this to Kirchoff's free energy model. The embodied social presence Model (ESP) (Mennecke, Triplett, Hassall, & Conde, 2010) shares much with the EAP (social) and focuses upon the process and shared meaning making that Hysteric Monkey and the confederate engage in, their embodiment as digital avatars, and their actions and appearance, such as the impact of the confederate being female. It also emphasizes the role of place; Hysteric Monkey and the confederate are behaving in a place which is only implicit in the EAP. It does not however identify potential relationships with Free Energy. Nor does it explain factors such as dissonant connectedness.

The confederate types a greeting, but Hysteric Monkey cannot type a response as he is wearing a VR headset so cannot see the keyboard. In this situation, social norms, such as the obligation to speak when greeted, along with environmental aspects, including the inability to type when wearing a VR headset, led to an unequal power dynamic and threat. This leads to the emergence of social anxiety (Orange in Figure 6-7). Colombetti and Torrence (2009) argue that for some emotions, such as antipathy, a 'dissonant-connectedness' ends the coupling between the two individuals, and thus the participatory sense-making. This thesis argues that the social anxiety, felt by Hysteric Monkey involves such dissonant connectedness. As a result of the emergence of the social anxiety dynamical system with dissonant decoupling with the greeting episode and confederate so ending the participatory sense-making and leads to a complete breakaway from the confederate. The enactive approach to social presence proposed in this thesis includes a situated 'cultural scaffolding' (Griffiths & Scarantino, 2005). This includes cultural factors including the social norms, such as the obligation to speak when greeted, involved in this greeting that led to the unequal power dynamic and threat.

As Riva et al. (2014; 2004) does not emphasise coupling, the interpretation, of dissonant connectedness does not hold. Riva at al. (2014; 2004) includes the impact of culture by building upon Damasio's approach criticised in Section 2.1.2.

Similar patterns of psychological and physical disengagement are reflected outside of the virtual reality context. Major and colleagues (1998) discuss how inequality was interpreted as being due to racial prejudice and unequal treatment, resulting in lower self-esteem. This led to a psychological disengagement. Harris (2012) associates this with similar threats to the self and lowered self-esteem, leading to psychological disengagement and eventual physical disengagement from groups. The principal difference here is the source of the inequality associated with conflicting modes of communication in a virtual reality context.

From the enactive perspective, therefore, social presence is dependent not just upon the amount of interaction, nor the degree of empathising, but on an interaction that does not threaten and lead to emotions involving 'dissonant-connectedness'. Views of social presence dividing the psychological and behavioural aspects (albeit both are involved) impact such as Networked Minds (Biocca, Harms, & Gregg, 2001) or empathy fail to fully capture the importance of the nature of interaction and situated aspects of social presence. Hence, they do not account for this self-limiting phenomenon.

6.3   Gratitude and presence

This section examines any relationships between presence and gratitude, defined as " *the positive emotion one feels when another person has intentionally given, or attempted to give, one something of value"* (McCullough, Kilpatrick, Emmons, & Larson, 2001; McCullough & Tsang, 2004) from an enactive perspective. However, this study found that the act of helping also contributed; consistent with Algoe and colleagues' (2012) definition that includes the "*relationship with the benefactor (i.e. thoughtfulness of the benefactor toward the self)*" (p. 439).

The findings from the IPA analysis (see Chapter 5) suggest that gratitude was associated with increased social presence, but there was only mixed evidence of gratitude being associated with increased levels of spatial presence. No studies into the relationship between gratitude and either spatial presence or social presence were found for direct comparison. The findings are examined in more detail in sections 6.3.1 (social and gratitude) and 6.3.2 (spatial presence and gratitude) below.

6.3.1 Social Presence and Gratitude

This study found that gratitude was associated with increased social presence, but there was mixed evidence of this being associated with increased levels of spatial presence. This section expands upon this finding. Social presence according to the EAP (Social) consists of social cognition and understanding the others intentionality with order. An example of one participant, David Beckham is used.

DAVID BECKHAM

At the end of David Beckham's exercise, he went to press the red button to end it, but it did not work. The confederate helped, and it led to feelings of gratitude. This is as expected for benefit induced gratitude (Bartlett & DeSteno, 2006; McCullough et al., 2001). From EAP (social) perspective, this gratitude-helping episode involved the confederate and David Beckham being dynamically coupled together with joint sense-making to support a gratitude episode. Figure 6-8 shows the gratitude feelings of David Beckham in yellow. Those of the confederate were not examined. David Beckham, whilst fully able to end the relationship, noted that the strategic purpose of gratitude was to "illicit a positive or to bring a positive relationship". This tends to support positive relationship (Algoe, 2012; Hlava, Elfers, & Offringa, 2014) approaches to gratitude rather than transactional. The positive relationship suggests a closer coupling and dynamic interaction between the two, and maintenance of the gratitude-helping episode as an autonomous system (Figure 6-8 yellow arrows). Such coupling is a balance between the personal goals of each individual and the inter-personal goals of supporting the autonomous gratitude-helping episode. This further suggests an increase in social presence with gratitude as both are interacting more closely.
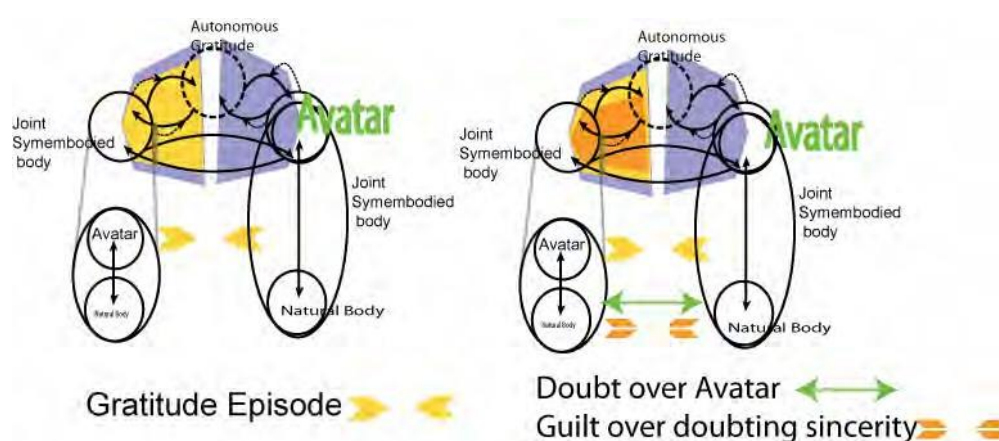

Figure 6-8: David Beckham Gratitude episode.

 Section 6.2.2 examined Colombetti and Torrence's (2009) view of the affective character of 'feeling connected' noting that this "feeling of connectedness" shares much with social presence.

Gratitude too involves connectedness. In contrast to social-anxiety's dissonant-connectedness (see Section 6.2.2), gratitude brings people together. This connectedness is a key aspect of the EAP(Social) both for social-cognition and a sense of otherness and empathy. Hlava and Elfers' (2014) emphasise that gratitude involves domains of connectedness of "feeling connected with: 1) a part of one-self, 2) an individual or group, or 3) something outside of oneself" respectively (2014, p. 449), which in David Beckham's case involves the first two kinds. Two aspects considered here that Colombetti and Torrence's (2009) consider are relevant are sensing-in or 'sensual empathy' (Stein, 1989/2016), and the other is "otherness" (Alterity).

In sensual empathy "we directly perceive the existence of the other as a bodily subject of experience" (Colombetti & Torrance, 2009) otherwise described as "a primordial givenness in 'bodily perception' of our own fields of sensation."(Stein, 1989/2016, p. 57). Yet David Beckham whilst he has access to his own natural and synthetic self (as a symbembodied self) only experiences the confederate via their synthetic self; an avatar. Stein argues for sensual-empathy that it matters the extent that we "deviate from the type 'human being' "(Stein, 1989/2016, p. 59). The avatar not only differs from the natural body but opens up new possibilities such as a chat bot, whilst at the same time is part of one extended joint symbembodied body of the other. For the most part, David Beckham was engaging with the confederate, but was concerned that his doubts were being insincere towards a real person; an indication of empathy and identification of being with a real sentient being further indicators of social presence.

One of the requirements from the EAP (social) otherness, involves the minimisation of mutual predictive error uncertainty (see Section 3.4.2). Doubt, an uncertainty, about the reality as a human increases this mutual predictive error uncertainty. This leads to an increase in Shannon-Entropy (a measure of disorder i.e. loss of information). This is associated with a decrease in the stability and degree of coupling associated with sensual-empathy. This is consistent with the relative reduction in coupling so reducing both gratitude and social-presence. His doubts diminished his sense of gratitude, although this was relative as he still rated 6 out of 7 on the GAC questionnaire.

It is unclear if guilt orientated towards the confederate, over doubting, increased empathy and the couplings with the confederate which potentially helped maintain the coupling and hence improve an aspect of social presence. This accords with Colombetti and Torrence's (2009) reference to the "the complex interplay of various degrees of connectedness that can be simultaneously experienced in participatory sense-making.".

One limitation is that social presence was the overlap with constructs of inter-subjectivity, feelings of connectedness or wider conceptualisations of empathy. Much of the evidence gathered related to interaction, feeling towards and empathy all of which is shared with these concepts, but the interviews did not explicit expressions of "I felt really with the other person".

This was highlighted by frequent reference to studies into inter-subjectivity and feelings of connectedness in both sections on social presence (sections 6.2.2 and 6.3.1). This may be due to nature of the IPA interviews which are limited in how closed a question they can channel participants into making without losing their interpretation; it may be that in trying to express their experience such a simple statement gets lost in the complexity of the experience. It may also, however be that there is an overlap in these constructs. This may be worthy of further research.

6.3.2 Spatial Presence and Gratitude

There was minimal evidence for an association between gratitude and spatial presence in this study, even though the avatars were interacting within a physical environment; only David Beckham noted a slight increase. This would accord with the distinction between the nature of emotion most markedly between social emotions and non-social emotions associated with social and spatial presence respectively.

6.4 Evaluation of the Enactive Approach to Presence

This section evaluates the EAP in terms of its explanatory value, ability to cast fresh insight into current understandings of emotion and presence. It addresses secondary RQ2. It considers three aspects, can the EAP explain a phenomenon within the study; Does the EAP provide some fresh insight and is the contrary or inconclusive evidence about its value. This section highlights aspects under each category but does not aim to replicate this discussion chapter.

6.4.1 Explanatory Value

The EAP was capable of providing explanations for the research phenomenon. However, it did have to draw upon other areas of enactive theory to do this. This highlighted one of its strengths as a theory built upon consistent philosophical underpinnings with a pre-existing theory by expanding upon the enactive approach.

One area of discussion in section 6.2.1 was its comparison with the approaches of Wirth et al. (2007, 2012) discussion on the orientation of emotion highlighted that many of their findings were replicated. With symembodied relationship between avatar and natural body and in supporting the enactive approach the EAP enabled an enactive explanation supporting the feeling of emotion inside the virtual environment orientated outside. Section 6.2.1 identified that Wirth et al. (2007, 2012) may

be able to also provide an explanation. This highlighted a key difference that is beyond the remit of this thesis.

The EAP can distinguish spatial presence from immersion in line with the main studies stages leading to presence (see Figure 6-4). From the EAP perspective it was unclear why there was not greater spatial presence during the gratitude and social-presence coupling as coupling with others embodied as avatars would still act as spatial reference points.

6.4.2 Fresh Insight

A second aspect is the EAP incorporates the tied aspects intentionality, agency, and emotion in that it is fundamentally about sense-making using purposeful (intentional), actions (agency) and that from the enactive perspective this sense-making includes emotion that was raised in Section 6.2.1.

The first implication of the EAP is that it emphasises presence, like emotion as an unfolding episode, for spatial presence this is illustrated in the two examples of Bob Virtual and Shelly Brown in section 6.2.1. The interaction with emotion in both cases unfolded over time. This is in contrast to media approaches to presence for instance that focus upon the subject-media relationship such as Wirth et al. (2012). As such, it places a greater emphasis upon the dynamics leading in this study to examine the dynamics of emotion and presence not emotion as instances e.g. a mood, a snake. Yet is still captures a feeling of presence at a given time, that applies to other theories of spatial presence too. This is an area for further investigation.

Applying the EAP poses questions about Wirth et al. (2012) assumptions in the MEC-SPQ (Vorderer et al., 2004) questionnaire where this study obtained the same results suggesting people with higher visual capabilities have greater levels of spatial presence as this can be addressed from an enactive perspective. Individual traits is not problematic for the enactive approach. The EAP includes the concept a scaffolding (Griffiths & Scarantino, 2005) incorporating cultural interests and foreknowledge. In contrast to Wirth et al. (2012) it challenges the concept of "suspension of disbelief" with its suggestion and focuses upon the coupling with the environment and readily incorporates this into intentionality. However, the focus of intentionality in Chapter 3 is in relation to social presence. This is an aspect which may need to be more explicitly incorporated as has been done by Riva and colleagues (2004, 2014).

This study identified relational aspects of intentionality, such as transpersonal, and not just intentionality linked to planning forward in time adopted by Riva et al. (2004, 2014) view of presence. Transpersonal and interpersonal intentionality fits with the EAP approach to participatory sense-

making. The EAP therefore enables criticisms of Pacherie's (2006) approach by Gallagher (2012) to be readily addressed with its enactive underpinnings (see Section 6.2.2).

For social presence this study highlighted the role of dissonant connectedness and presence as a dynamic unfolding episode (see Section 6.2.2). It had enabled an enactive analysis of inter-subjectivity to be applied and extracted relevant elements that alternative approaches have not.

6.4.3   Contrary or Inconclusive Evidence

The EAP has the same strengths and weaknesses as the enactive perspective generally and does not overcome theory of mind debates. One incident that illustrated this was when Bob Virtual only felt moderately grateful towards the confederate who she perceived as attempting to help. In a second interview, held due to illness during the first, it emerged that the confederate had in fact helped to which Bob Virtual then expressed greater gratitude one week after the confederate and Bob Virtual had been together. There was no expression of social presence apart, but the EAP explanation still lent on synchronous explanations. There are enactive explanations, such as phenomenological approaches to remembering and imagining (Thompson, 2007) or adaptive coupling within the brain (Froese, Paolo, & Ezequiel, 2011) but they are not conclusively proven. However, even in this contradiction the EAP is provoking insight and explanations of an otherwise innocuous aspect of the interview.

6.4.4   Summary

It identified areas where the EAP had explanatory value, as is the case in the bulk of this discussion chapter. It further identified areas where it had provided fresh insight such as dissonant-connectedness in social presence. This section identified some areas where the EAP was able to provide fresh insight that other theories had not and picked out one incident of potential gratitude whilst not in a synchronous gratitude episode which is the debate of how the enactive approach explains "off-line" cognition. Like other enactive approaches, it has to explain the off-line as well as the 'on-line' phenomenon. The EAP has enabled a wide range of other enactive and other phenomenological interpretations to be brought to bear.

6.5   Summary

This section drew from the results and analysis in Chapter 5 with its eight key super-ordinate themes: purpose and intentionality; curiosity, exploration and evaluation; orientation of emotion its nature and intentionality; unfolding presence episodes, weirdness and dissonance; role of the avatar; gratitude: other, benefit, help and culture and foreknowledge. These themes along with

evidence drawn from it in terms of illustrative scenarios were recasting these from an enactive perspective, including the novel EAP developed in this thesis, to provide a fresh perspective.

The relationship between emotion and spatial presence were not always a positively associated, as concluded from earlier studies, but included an example of an increase in emotion (anxiety at missing a meeting outside of the virtual experience) that led to a breakdown of presence. Emotions such as social anxiety could reduce and end social presence. From this perspective an increase in emotion, as experienced within a virtual environment, could lead to a decrease in spatial presence in contradiction to some proposed relationships between emotion and presence as well as cases where it was related to increases in presence.

For all areas there was a core relationship between agency (action), intentionality, and emotion (see Figure 6-6). This should not seem surprising given the intentional nature of emotion and that intent is about purposefully doing something and purposefully doing something is intentional; although the relationship between the emotional and cognitive aspects, and indeed the nature of intent, is the subject of debate. From the enactive perspective this relationship in purposefully doing something is understood as sense-making or cognition, for which emotion is a fundamental aspect. In the process of acting, or enaction, which is an inherent aspect of existence, sense-making organisms exist in a world of meaning and experience. The enactive approach adopted in this chapter draws upon dynamical systems theory with its concepts of self-causation, not just linear causation, and dynamical coupling between the brain-body-environment, and even exists within the brain-body itself. Thus, sense-making is emergent of many whole dynamical systems connecting brain-body-world as one located around the experienced body.

The EAP explanation suggests that spatial presence, involves coupling with the virtual environment, leading to a feeling being located around the avatar body (as part of a joined extended body) and how emotion orientated around the avatar/natural body could alter these couplings. Emotion is orientated and predominantly coupled to either an external aspect (such as missing external meeting and manifested as anxiety), or excitement over the physical environment would move this loci from the internal avatar to the external natural body (a break in presence) or bind more closely to the virtual environment located around the avatar so increasing presence. This explanation is suitable for both directly shared couplings, coupling between emotion and presence within the brain-body or both. Notably there seemed to be a distinction between the nature of the emotions, especially between those focused upon social interactions involved with the relationship between social presence and social emotions. This orientation of emotion was intrinsically related to intentionality. In this study intentionality embedded with the whole dynamical system, albeit originating within organisms, illuminated purely personal, interpersonal (social emotions) or transpersonal (external influence e.g. an imposed meeting. Such intentionality was embedded in the interaction and hence is relational and not just in terms of time focused planning. Such intentionality was associated with the

particular interests identified within the participants, such as one whose prior interest was focused upon the physical environment not people.

This replicated much of the prior evidence and was contrasted with existing theories. Theories such as Wirth and colleagues' (2012) view of the relationship between emotion and presence, involve a separation between emotion and cognition by explicitly adopting a simulation in the brain approach. They consider emotion as forming a motivational focus on the object of attention in the virtual world. Evidence in this thesis supported this in part, but also showed that emotion felt within the virtual environment could lead to breaks of spatial presence, and the EAP addressed this aspect without a dualist simulation in the brain. This chapter evaluated the questionnaires used by Wirth et al. (2012) were consistent with his findings. Limitations to this study and its scope, including not examining neurological evidence, ruled out demonstrating that the simulation of the mind approach was incorrect; just that an enactive approach is plausible. Similar comparisons were made with Riva and colleagues' (2007b, 2004; 2014) approach, but arguing that the dynamical approach was not limited to the most basic of interactions, and highlighting their lack of social distinctions in intentionality.

Social presence was also examined in the context of non-social emotions and no association with non-social emotions found. Parallels were drawn with enactive approaches to inter-subjectivity and empathy. The enactive approach to social presence and emotion considered social presence as an unfolding episode that could self-limit if an emotion, such as social anxiety, involved a dissonant connectedness. This insight is novel when compared with other approaches to social presence. Gratitude appeared to involve the opposite approach and was associated with increases in presence. However, uncertainty as to whether the avatar was truly human minimised feelings of emotion, but this engendered feelings of guilt at doubting the sincerity of the avatar. This was consistent with the enactive approaches sensing-in being related to the givenness in its likeness to a real body and the mutual uncertainty associated with free energy aspects of the EAP (social). There was an apparent overlap between social presence, enactive inter-subjective accounts of "feeling connectedness", consistent with Hlava and colleagues'(2014) approach to gratitude and empathy, suggesting that further clarification of the distinction between these constructs is needed. This may in part be due to limitations in the IPA approach which, in maintaining an open approach, made it difficult to pin down a tight and distinctive expression of social presence, such as 'I felt as if being with the participant', or it may be an unduly broad definition of empathy.

As for spatial presence, this offered a non-simulated account and a more dynamic autonomous joint sense-making approach to spatial presence than other approaches to social presence such as Riva and colleagues' (2014), and was more grounded in embodied aspects linked to free energy. The embodied approach to social presence (Mennecke et al., 2010) shared much was

more explicit in the role of place than the EAP where it is less obvious. This is an area for further development of the EAP.

Chapter 7 Conclusions

This Chapter brings together the key aspects of this thesis and explores the significance and implications of its findings and the enactive approach to presence developed. It clarifies the contribution before reviewing and critiquing the research approach and methodology. The chapter ends by looking forward to suggestions for further research and giving a personal reflection of the research experience.

The overall aim of the thesis is to: *provide a fresh insight into the experience of emotions within virtual reality environments.* Virtual Reality (VR) uses emotion-based therapies to alleviate anxiety, stress, and depression and, when used for gaming, involves excitement and enjoyment. VR is recognised as a potential " tool for empathy and cognitive enhancement" (Hall & Takahashi, 2017, p. 3). Gratitude, an empathetic emotion, has been associated with improving mental wellbeing (Emmons, 2008; Toepfer, Cichy, & Peters, 2012; Watkins, Woodward, Stone, & Kolts, 2003). A key feature of VR experiences is the feelings of being there (spatial presence) and being with others (social). This thesis adopts an enactive view where people inhabit a world experienced as meaningful and interpreted as they live it through mind-brain-body-world dynamic interactions; although it is beyond the scope of this thesis to focus upon neurological-bodily interactions. In order to capture this experience in rich contextual detail this thesis focused upon a qualitative approach rather than the narrower quantitative experiments dominating prior research in this field. This led to the primary research question:

- What are people's lived experiences of emotion, especially gratitude, and presence within virtual reality environments?

Quantitative research suggested that there is a causal relationship between emotion and presence, however the lack of rich data to clarify, and the lack of an enactive approach to presence informing the hypothesis prompted two further research questions examining the accounts obtained addressing the primary research question. These are:

- Secondary RQ1: What is the relationship between emotion, especially gratitude, and presence?

To evaluate the potential relevance of the growing enactive approach:

- Secondary RQ2: To what extent can accounts of the lived experiences of emotion, especially gratitude, and presence within virtual reality environments be explained using an enactive approach?

The Main IPA study in Section 5.4 identified eight super-ordinate themes: purpose and intentionality; curiosity, exploration and evaluation; orientation of emotion (nature and intentionality); unfolding presence episodes; weirdness and dissonance; role of the avatar; gratitude:

benefit, help; culture and foreknowledge. The first three are closely linked. Gratitude boosted positive feelings towards others and increased social presence even where the helping avatar's humanity was doubted. For spatial presence, emotion needed to be orientated towards the physical environment for increased spatial presence or social interactions for increased social presence. The novel enactive lens explained this by emphasising the role of coupling suggesting that social presence, for instance, is dependent upon dynamic coupling, including dissonant connectedness of emotions, which may enhance or reduce social presence.

There were two phases to the research in this thesis. A development phase and the main study. This chapter focuses upon the conclusions from the main study. 55 participants were involved in total. Of the eighteen participants interviewed, 14 were during the main study along with 37 surveyed (excluding incomplete responses) during the development phase. Only eight of the main study interviews were chosen due to the high-quality threshold needed for IPA (see Appendix J). The emotion and presence episodes researched for the main study take place in a virtual environment where two avatars, a participant and a confederate, interact. The confederate helped some participants complete a boring exercise, which triggered gratitude. The context slightly varied: helping or not helping; standard laptop display or using VR headsets.

This chapter addresses the conclusions from the theoretical development and main study findings and analysis including the discussion and enactive lens.

Shared Dualism and Meaning Underpinnings

Ch2: Literature Review

Emotion Theory

Gratitude

Presence Theory

Enactive Approach

Research Questions

Philosophical Consistency
- Phenomenology,
- representation of meaning (sense-making)
- 'lived' and embodied experience
- brain/body/world together

Shared approach to lived-experience, sense-making and phenomenology

Enactive Approach to Emotion

Ch3: Novel Enactive Approach to Presence (EAP)

Ch4: Research Design

Critical Realism

Interpretive Phenomenological Analysis (IPA)

Unfolding Episode in virtual environment

Help induced Gratitude

Participant

Task

Confederate

VR Headset/Laptop Help/No Help

Semi-structured interviews supplemented by questionnaires

Inductive IPA: Focus is Individual's interpretation of their 'lived'

Abductive Enactive Lens: Researcher's interpretation

Ch6: Enactive Lens and Discussion

Ch5: Feedback and Analysis

Themes

Enactive Lens

Discussion

Evaluated EAP
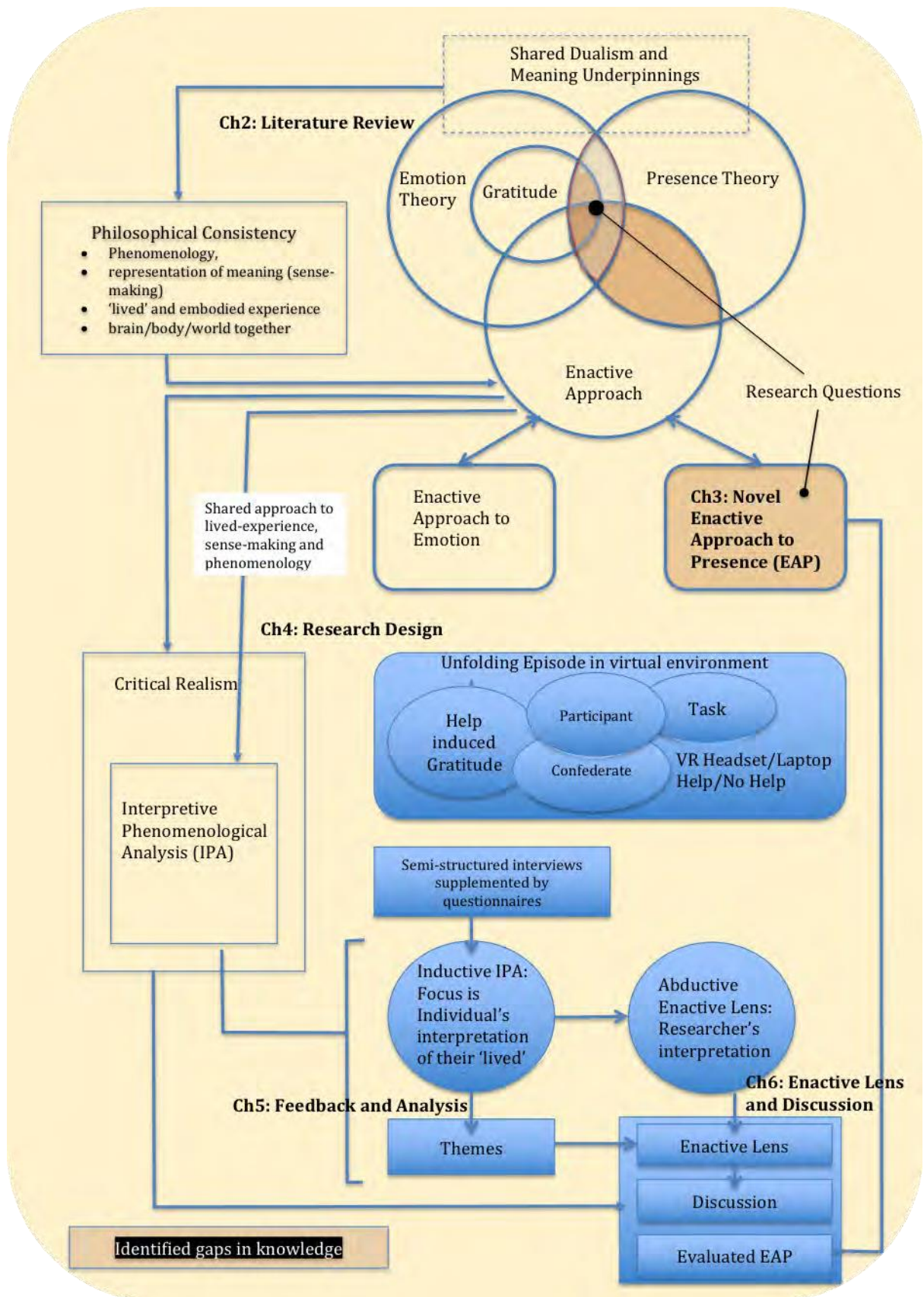
Identified gaps in knowledge

Figure 7-1:Thesis Structure

7.1 An Enactive Approach to Presence and Emotion

This thesis developed a novel enactive approach to presence (see Chapter 3) as a theoretical development based upon the enactive approach to emotion and prior theory and research into presence. Two elements were developed: that relating to spatial experience (the feeling of being there) and that relating to social experience (the feeling of being with others). This enabled both emotional responses to the physical environment and social emotions to be related to presence. It focuses upon presence as sensemaking through purposeful actions and dynamic interactions with the environment. It is a psychological and embodied approach to presence bringing together mind, brain, body and environment including shared sensemaking between individuals. This succeeded in providing a rigorous and thought out enactive approach suited a high-level theoretical lens through which the IPA findings could be analysed (see Chapter 6). This use as a theoretical tool has informed the key findings (see Section 7.2), is a potential tool for use by other researchers challenges existing conceptualisations and provides a basis for improving VR design in fields such as psychology, gaming, collaboration and immersive journalism (see Section 7.5). The locus of spatial presence is around a "symembodied" natural-avatar body and emerges as dynamic self-organising patterns and episodes that dynamically interact with the emotions. Social presence recognises: social-cognition, understanding the intentionality of others, the role of embodiment and dynamic coupling between individuals. As dynamic systems, social presence involves dynamic coupling from which autonomous social-interactions arise. There is thus dynamic coupling both via this autonomous social interaction and directly. It is beyond the scope of this thesis to explore the neurological brain-mind-body interactions, instead it focuses upon the phenomenological experience and embodied interactions.

The theoretical insight provides explanatory value informing alternative views of presence and social presence and highlights potential factors and influences affecting the relationship between emotion and presence. These findings and novel enactive interpretations and their implications are discussed in more detail later in this chapter.

7.2 Key findings and their implications

This section highlights the main findings of the study that address the research questions. These were derived from two sources: the main accounts of how the participants interpreted their experience (Primary Research Question in Section 5.4) and the analysis of these accounts through an enactive lens (Secondary Research Questions in Chapter 6).

These findings are broadly on three levels: the factual phenomena as experienced by the participants, higher level themes that emerge through IPA and, finally, there is a high-level explanatory section applying the enactive lens and engaging with the wider literature. Due to the

small number of participants compared to quantitative studies, and the inductive nature of IPA, these findings do not generalise across a statistical population but, rather, inform theory (generalise to theory), consistent with the research aim. Previously validated questionnaires into gratitude and spatial presence were used. However, these were interpreted at the level of the individual to supplement the rich qualitative interpretation of interviews which provide the detailed context questionnaires lack (see Section 4.5).

7.2.1 Experience of Emotion and Presence

The Main IPA study in Section 5.4 identified eight super-ordinate themes: Purpose and Intentionality; Curiosity, Exploration and Evaluation; Orientation of Emotion: its nature and intentionality; Unfolding presence episodes; Weirdness and Dissonance; Role of the Avatar; Gratitude: Other, benefit, help; Culture and foreknowledge. This based upon eight participants from fifteen interviewed that met the quality criteria required for an in-depth IPA study (see Section 4.5). The interview analyses were supported by a qualitative analysis of supporting questionnaires on presence and gratitude (ITC-SOPI, MEC-SPQ and the GAC questionnaire) at the level of the individual.

7.2.2 Emotion and Presence

This study challenges the view that increases in emotion lead to increases in presence, and vice versa, finding that these were only partially correct, as there were instances of increased emotion leading to decreases in presence (spatial and social) or action and emotion without reported presence.

PRESENCE AS AN UNFOLDING DYNAMIC EPISODE

In the main study seven out of eight participants revealed that social presence and spatial presence as an unfolding dynamic episode (see Section 5.4.4) identified within the IPA theme "Unfolding presence episodes".

Using the EAP for social presence suggests that social presence can be a dynamic self-destructive process such that can be associated with increased social presence and coupling; however, this can generate emotions with dissonant-coupling (such as social anxiety when meeting) leading to break down of coupling and social presence (see Section 6.2.2). One the eight participants (Belle May) never came to feel present in the virtual environment, and a second (Shelly Brown) felt highly spatially present but less socially present. Most of the references to levels of both emotion and presence in this thesis are relative and not readily comparable in absolute quantitative terms between participants (See Section 5.4.1).

SPATIAL PRESENCE

- This research found that increased emotion, as experienced whilst feeling within a virtual environment, was associated with both increased spatial presence and decreased spatial presence.

The IPA study linked this to three other key themes: Purpose and Intentionality; Curiosity, Exploration and Evaluation; Orientation of Emotion: its nature and intentionality involving a very close relationship between emotion, intentionality (personal, interpersonal and trans-personal) and agency (curiosity, exploration and evaluation) with agency frequently, but not always, associated with increased spatial presence. All participants actions were imbued with all three kinds of intentionality (see Section 5.4.2) and all associated with either positive or negative affect; seven felt happier exploring and one bored not exploring.

- This research found spatial presence was associated with emotion, intent, agency and variety

From the IPA study, it is unclear whether the increase in spatial presence is more associated with the emotion or the agency. However, for the seven participants who felt presence, when there was a lack of variety, the personal intent to explore along with its associated emotions, such as excitement, declined and there was a minimal to no feeling of spatial presence.

- This research found that the orientation of emotion was important for all participants experience of spatial presence.

This is illustrated by examples of how the orientation of emotion out of the virtual environment, about the avatar, due to an external meeting, could lead to breaks in spatial presence (Bob Virtual)(6.2.1), whilst orientation of excitement towards the virtual physical environment, led to a sense of being drawn in and increased spatial presence(Shelly Brown)(6.2.2). This was reflected to a less marked extent by the other participants who experienced spatial presence who had external or internal distractions.

Whilst the individual choices reflected personal intentionality, there was a balance with transpersonal intentional (external to the individual) for all participants. This balance is illustrated by the trans-personal intentionality imposed external obligations of attending the meeting (and associated anxiety) by Bob Virtual, and the personal intent to explore breaching the externally imposed timetable of the research by Shelly Brown. Frustration occurred for all participants when no purpose and intent was clear and clarification needed to be sought from the researcher.

- This research found that marked weirdness and dissonance could reduce presence

This variation in emotions orientation and presence was also related to the IPA theme "Weirdness and Dissonance". Weirdness is a marked dissonance between the expected and the experienced. The expected is related to the theme "Culture and foreknowledge". Weirdness and dissonance were accompanied reduced presence, as experienced by seven of the eight participants; most clearly by four of these participants and to a lesser extent by the remaining three. This included dissonance between the virtual avatar and the natural body of the researcher in the room and a dissonance between being sat down whilst the avatar was walking. A notable example of dissonance occurred for Belle May who never engaged or felt present in the virtual environment as it was weird and unreal in contrast to Shelly Brown who experienced little dissonance and was one of the most highly immersed, embodied participants with high levels of spatial presence.

This is an extension of existing studies, which focus attention upon the virtual environment, but is distinct in that emotional involvement felt within a virtual environment could be orientated externally e.g. anxiety over missing a meeting. This was consistent with a novel enactive explanation related to coupling.

- This research identified that presence and associated emotions were located around the avatar-natural body

The IPA 'Role of the Avatar' theme identified that the loci of the interactions were around an avatar-natural body. All the participants recognised their avatar as their own, initially as a remote tool but when immersed or present more as self. Belle May never felt immersed or present. Other than when there was a dissonance between the natural and avatar body the main implication for spatial presence was that the orientation of emotion and virtual actions were located around the body as experienced by the participant. There were more implications for social emotions and social presence.

- The study identified a distinction between social emotions related to social presence and non-social or physical environment focused emotions related to spatial presence.

This distinction was experienced by all participants and reflects the importance of the nature of the emotion. Of all of the participants experiencing presence one experienced a slight increase in spatial presence upon meeting socially.

ENACTIVE SPATIAL PRESENCE AND EMOTION

The thesis recast IPA themes using a non-dualist enactive approach using the novel EAP developed in Chapter 3. A non-fragmented illustration was given by two examples: the external meeting (Bob Virtual) and the exploration of the physical environment (Shelly Brown) (see

Sections 6.2.1 and 6.2.2). Both participants live in a world of meaning emerging from their dynamically coupled interactions between mind, brain, body and environment located around their body as they experience it. When this body was dynamically coupled to the virtual environment the body felt more emplaced within it around the avatar (a shift from external observer to immersed or even physically embodied in the avatar) leading to a feeling of being in the virtual environment (spatial presence) linked to the "Unfolding Presence Theme". The meaning (including all experiences) is driven from purposeful coupling and enaction. For Bob Virtual emotion, anxiety, experienced whilst spatially present in the virtual environment was orientated towards an external (trans-personal intent), increasing purposeful coupling with the external environment and greater awareness of the natural body's location outside of the virtual environment and an associated shift in feeling of being present in the virtual environment (a break in spatial presence). Thus, bringing together themes "Unfolding Presence, Orientation of Emotion: its nature and intent, Purpose and Intentionality (personal and transpersonal) and agency (Curiosity, Exploration and Evaluation). Foreknowledge of the meeting and the implications of missing it (Culture and Foreknowledge) together. For Shelly this shift in body horizon to the avatar and hence an increase in spatial presence was driven by emotion orientated, located around the avatar body, towards the physical virtual environment accompanied by her personal intent to explore (again linking emotion, intent and agency with the role of the avatar).

SOCIAL PRESENCE

Six of the eight participants experienced social presence as an unfolding episode, one no presence (Belle May) and one nominal levels (Shelly Brown) as evidenced in the interview but there was also some evidence in the questionnaires. Seven of the eight participants had an ongoing awareness of the confederate as an "Other", and the remaining one, Belle May, still acknowledged the confederate as another participant. All except one, David Beckham, who was unsure, felt the confederate was a genuine person by the end of the study. Most participants were uncertain for part of the time, with one not bothered and another who experienced no social presence.

- The study found that increased levels of caring for the other occurred with increased levels of social interaction and social presence.

For three to six participants ongoing interaction and social presence tended to lead to increased levels of caring, to varying degrees, often associated with empathy with time. Three participants felt that shared purpose felt good; this would suggest increased emotion with joint sense-making involving social interaction.

- The study found that both increases and decreases in levels of social presence were associated with increased levels of emotion, whilst emotions, such as social anxiety, could lead to its decrease and ending.

For example, one participant, Hysteric Monkey, experienced increased attraction and curiosity (both positive affects) towards the confederate which led to increased social presence. However, increased social anxiety and feelings of inequality over not being able to type a response to the confederate as expected by society and an associated sense of inequality (Culture and foreknowledge) was associated with a decrease in social presence and disengagement.

Four of the participants, doubted at some point that the confederate was a real person although ultimately only one participant felt the confederate was not a real person. The confederate's real humanity was felt to be important, although, participants did still act emotionally towards the confederate.

ENACTIVE SOCIAL PRESENCE AND EMOTION

As for the Enactive approach to spatial presence this section presents the interpretation of the IPA themes for social presence using the EAP framework.

- The study emphasises social presence (and spatial presence) as an unfolding dynamic episode, using the EAP it suggests that there can be a dynamic self-destructive process such that can be associated with increased social presence and coupling, however this can generate emotions with dissonant-coupling (such as social anxiety when meeting) leading to break down of coupling and social presence.

This study suggests that an important aspect of social presence is connectedness (especially associated with social cognition). The enactive approach to social cognition relates this to coupling. The study suggests that social emotions that increase connectedness, such as gratitude, do increase social presence. In contrast, emotions with dissonant-connectedness, such as an example of social anxiety in this study, led to social and psychological disconnectedness, with an associated break down in social presence. Whilst connectedness is associated with gratitude and similar pro-social emotions, it is also associated with social presence.

This suggests that to increase social presence, designers within VR should focus upon unfolding connectedness and look towards invoking pro-social emotions, such as gratitude. Social presence was inversely associated with weirdness and dissonance.

Gratitude in this sense is an empathetic emotion and this interpretation and impact upon social presence is also supported.

7.2.3 Gratitude and Presence

Key findings relating to gratitude were:

- Gratitude can be induced within a virtual environment and increased gratitude can be associated with increased social presence but doubts over the humanisation of the avatar may reduce this.
- There is only limited evidence that gratitude is associated with increased spatial presence.
- Gratitude helps boost positive and appreciative feelings towards others and associated with increased levels of social presence.

SPATIAL PRESENCE AND GRATITUDE

Prior research had identified a correlation between emotional involvement and spatial presence (Wirth, Hofer, & Schramm, 2012), yet there is only minimal evidence for an association between gratitude and spatial presence across all five helped participants in this study with only David Beckham noting a slight increase in spatial presence. Two of the five already had a high level of spatial presence so any increase here may not have been noticeable. If statistical generalisation applied to all individuals it would be expected to be identified across all five helped participants. This finding suggests that there are individuals in some contexts where this does not manifest itself. Wirth et. al (2012) suggests two elements here; domain-level-interest and attention-allocation where if people are interested in an area, they will be more likely to focus their attention on it; in this case the interaction in the virtual environment and their avatar and would tend to feel more spatially there. Not finding such a marked association with gratitude suggests that an emotionally engaging activity in a virtual environment may not be sufficient to make people feel spatially present as Wirth et. al (2012) predict.

SOCIAL PRESENCE AND GRATITUDE

However, all five helped participants did show interest and orientated themselves towards this social interaction. As idiographic research with a small sample size focused upon individuals rather than statistical norms this thesis cannot evaluate the prevalence of this finding. There may also be other, unreported, factors, masking this effect. It does however accord with the enactive approach focusing upon connectedness with others and the gratitude episode for social emotions which prior studies do not. This highlights the EAP distinction between the nature of emotion, most markedly between social emotions, and non-social emotions associated with social and spatial presence respectively (see Section 6.3 and 6.2.1).

- Gratitude can be induced within a virtual environment and increased gratitude can be associated with increased social presence but doubts over the humanisation of the avatar may reduce this.

This can be explained in terms of an enactive approach to presence and as for social coupling. The study found that findings suggesting that increases in emotion led to increases in presence, and vice versa, were only partially correct, as there were instances of increased emotion leading to decreases in presence (spatial and social) or action and emotion without reported presence. Emotions such as excitement orientated towards place in the physical environment and tend to be associated with increased spatial presence. The study suggested that the orientation of emotion was important and external orientation could lead to breaks in presence whilst orientation of excitement towards the virtual physical environment increases spatial presence. This was an extension of existing studies' emphasis upon focusing the attention upon the virtual environment but distinct in that emotional involvement within a virtual environment could be orientated externally e.g. anxiety over missing meeting. This was consistent with a novel enactive explanation related to coupling.

- Gratitude helps boost positive and appreciative feelings towards others and associated with increased levels of social presence.

There were three factors involved in feeling grateful: the attempt to help, the provision of an actual benefit and a person helping. The latter is not always reflected in the literature (McCullough, Emmons, & Tsang, 2001).
All five of the eight participants who were helped felt grateful towards the confederate whilst none of those not helped felt grateful. For all participants that felt gratitude there was an increase in positive and appreciative feelings towards them. This was also true in one case where the participant did not believe that the helper had actually provided a benefit. Three of the five helped participants expressed that the very act of helping made them feel grateful.

Doubts about the real humanity of the avatar hindered this, which reduced both gratitude and social presence. However, this very doubt led to guilt, in the case of David Beckham, which may have mitigated this. It was also confirmed that gratitude had a positive role in building up relationships. Gratitude, as a pro-social emotion, was the type of emotion that focused on the relationship between people involved in social presence.

ENACTIVE SOCIAL PRESENCE AND GRATITUDE

From the enactive approach, increased gratitude may depend on maintaining and increasing the connectedness with both parties closely coupled together. This connectedness, and close coupling of gratitude associated with sensual-empathy, may be reduced by mutual uncertainty. As mutual uncertainty is increased, the stability and coupling is decreased. It reduces the sensual-empathy. This would account for the relative reduction in the level of coupling, which would impact upon both gratitude and social-presence. There was little evidence of a link

between gratitude and spatial presence. Gratitude as an emotion does not orientate towards (or be coupled with) physical aspects involved in spatial presence.

There is also the issue of one participant (Bob Virtual) feeling more grateful a week after the event than during the virtual experience. This was revealed during a second interview, when the interviewer explained that the confederate had actually helped. This raises two points: the role of providing an actual experienced benefit and that the confederate and participant were not together during this second interview i.e. at the time when more gratitude was felt. This is important because it suggests that gratitude may not include synchronisation at the same time between helper and helped. There was no reference to social presence. This raises a key point between synchronous 'online' and detached 'off-line' cognition in the ongoing debate between the simulated mind proponents and enactive cognition proponents. Enactive explanations are possible such as phenomenological concepts of remembering and imagination (Thompson, 2007) but developing these is beyond the scope of this study.

7.3 Secondary findings and their implications

- confirmed prior results into the role of traits such as visual and spatial imagination and perceptions strengths and attention suggesting but the enactive approach suggests a different interpretation rejecting current presence theories emphasis upon an internal mental model.

The study confirmed prior results by Wirth et al.(2012) into the role of traits such as visual and spatial imagination and perceptions of strengths and attention measured by the MEQ-SPQ questionnaire (Vorderer et al., 2004). All the participants with the highest ratings for attention allocation also reported the highest levels of spatial presence (see Section 6.2.1). However, the enactive approach suggests a different interpretation, rejecting current presence theories' emphasis upon an internal mental model.

The only participant who felt no spatial or social presence within the virtual world, Belle May, claimed to feel "in there" in 3D films to the extent that she wanted to reach out. It is unclear why this participant, who also had the lowest ratings for aspects related to visual imagination (see Table 5-13), should differ in this regard. Prior theories of presence by Wirth et al. (2012) suggest that those with such a low visual imagination are unlikely to have the traits needed to 'feel in there' especially in a film.

- VR technology not always more immersive

This study acted as a reminder that VR headsets are not essential for high levels of immersion with the highest levels of spatial presence experienced were by participant Shelly Brown, using a laptop display. The three participants with the highest levels of spatial presence used laptop displays not VR headsets, as did the most disengaged participant.

7.4 Evaluation of the Enactive Approach to Presence

The evaluation of the EAP addresses Secondary RQ2. It examined three aspects: explanatory value, fresh insight and contrary or inconclusive evidence. It identified areas where the EAP had explanatory value, as is the case in the bulk of the discussion chapter. It offers an explanation for how an approach involving enactive dynamical coupling could account for changes of spatial presence, dependent upon the orientation of emotion, and suggests that this would relate to the intentionality. This drew together intentionality, agency and emotion. This challenges other interpretations (Wirth et al. 2007,2012) given in Section 6.2.1 based upon object-focused motivation of emotion onto the virtual media. For social presence it proposed a concept of dissonant-connectedness where increasing social presence could give rise to emotions with dissonant-connectedness leading to a reduction and in social presence and disengagement. Such a view emphasised the need to consider the dynamics of social presence as an episode, and the role of coupling. Its theoretical basis helped draw on enactive concepts of feeling-connectedness which other theories did not, thus introducing a fresh insight. The thesis also highlighted that the EAP, as an enactive approach, raised the same issues in terms of the off-line, on-line debate discussed by feeling gratitude outside of the synchronous events. Even here however, it is challenging assumptions and existing theories so demonstrating its power. Section 7.5.4 addresses the social and economic benefits of applying the EAP.

7.5 Contribution and Impact

This section highlights the novel contributions of the findings highlighted in Sections 7.2 and 7.3 and justifies why they are contributions. One important element is that the findings can be interpreted from an enactive perspective, enabling presence theory to be evaluated from an enactive perspective for the first time.

7.5.1 Novel Findings:

- The study emphasises social presence (and spatial presence) as an unfolding dynamic episode, using the EAP it suggests that there can be a dynamic self-destructive process such that can be associated with increased social presence and coupling, however this

can generate emotions with dissonant-coupling (such as social anxiety when meeting) leading to break down of coupling and social presence.

In contrast, whilst acknowledging the importance of context, the dynamic nature of social presence within a context is an under researched area. This highlights another characteristic of emotion affecting presence: culture and foreknowledge., such as social norms (see Section 6.2.2).

- The findings suggest a very close relationship between emotion, intentionality (personal, interpersonal and trans-personal) and agency (curiosity, exploration and evaluation) for both social and spatial presence, with agency frequently, but not always, associated with increased spatial presence.

This contributes in three ways: First, it extends intentionality to beyond the individual (Riva & Mantovani, 2014) and highlights the role of shared interpersonal intentionality and transpersonal intentionality yet is consistent with the findings of (Seth, 2014). Second, the use of EAP brings together more closely emotion, intentionality and action than hitherto including embodied approaches to social presence (Brian E. Mennecke, Triplett, Hassall, Conde, & Heer, 2011). Finally, it lays the foundation for considering joint-sense making important for enactive explanations (see Chapter 3).

- Gratitude can be induced within a virtual environment and increased gratitude can be associated with increased social presence but doubts over the humanisation of the avatar may reduce this

This contributes by demonstrating a virtual induction of gratitude. The literature review (Chapter 2) did not reveal any instances of gratitude induction within VR. It further suggests that non-human agents are able to stimulate benefit-induced-gratitude despite research emphasising this as an intentional act associated with living beings (see Section 2.3.1).

- This research found that increased emotion, as experienced whilst feeling within a virtual environment, was associated with both increased spatial presence and decreased spatial presence.

This extends prior studies suggesting that presence and emotion are correlated (see Section 2.5).

- This research found that the orientation of emotion about the body, as experienced, was important for all participants experience of spatial presence

Wirth et al. (2012) suggested that emotionality focused attention from an external perspective focus upon VR environments as objective media (see Section 6.2.1).

- The study identified a distinction between social emotions related to social presence and non-social or physical environment focused emotions related to spatial presence.

Prior studies have tended not to examine both social and spatial presence so no contrast here has been made.

- This research found that marked weirdness and dissonance could reduce presence

In this study, this involved a negative discomfort and move away from equilibrium. The role of weirdness in association with 'Bayesian Brain' approaches increase where meaning is adjusted. A Bayesian Brain interpretation of weirdness would be either to accept that the avatar was the researcher or that the real person was the avatar. Where weirdness has not been reconciled, emotional dissonance occurs. However, the enactive approach allows for generating such a model. This study does not address this issue which is an area for further research.

This is consistent with many aspects of the interoceptive model of conscious spatial presence suggestions of a relationship with presence and supportive of intentionality focused approaches to spatial presence, although the latter may not on face value account for actions not resulting in emotion. This is also consistent with the EAP, which then raises questions about internal 'Bayesian Brain' mechanism (operates in a similar manner to Bayesian Statistics) proposed by existing presence theorists. This suggests further avenues for research with these approaches, which lies beyond the scope of this study. It has been suggested by colleagues that the link between emotion and presence and the lack of feeling there by people with presence.

- confirmed prior results into the role of traits such as visual and spatial imagination and perceptions strengths and attention suggesting but the enactive approach suggests a different interpretation rejecting current presence theories emphasis upon an internal mental model

This study confirmed prior results by Wirth et al.(2012) into the role of traits but the enactive approach linked this to coupling, personal intentionality and the orientation of emotion (see Section 6.2.1).

- highlighted areas where culture and foreknowledge interacted consistent with other theories of situated presence.

For all participants the role of culture and foreknowledge (see Section 5.5.9) interacted across all themes consistent with other theories of situated presence Carassa et al.(2005). Culture and foreknowledge such as a meeting protocol and need to respond socially led to an emotion with

dissonant-coupling, to break away and an intentional act leading to a breakdown of social presence. Foreknowledge was closely related to intentionality linking back to emotion, intentionality and agency.

7.5.2 The Theoretical Body of Knowledge

The two areas of contributions are the development of a novel enactive approach to presence and the findings from the study. It has to be noted the aim as a qualitative based study is to inform theory rather than provide for empirical generalisation across a population.

A novel enactive approach to presence (EAP) has been developed and evaluated in this thesis although further research and development is needed. This foundational contribution enables researchers to investigate presence and emotion further from an enactive perspective. This approach did provide insightful explanations of the evidence in this study, especially for social presence, but its potential to challenge core arguments for needing an internal mental model was limited due to the scope of this study. The novelty and potential of this model has already been recognised by researchers utilising the enactive approach within VR who commented that published version as a "potentially fruitful direction for theoretical conception of presence and emotion for VR on the basis of the enactive approach" in an area that has received "little to no attention" (Jelić, Tieri, De Matteis, Babiloni, & Vecchiato, 2016).

From the literature review it appears to be the only study into the relationship between gratitude and presence in a virtual context. In addition, but lLess confidently, no study into gratitude appears to be found amongst the enactive literature.

7.5.3 Ways of Gaining New Understanding

The adoption of Interpretive Phenomenological Analysis for use within the field of virtual reality research into presence, especially where two aspects are being compared, appears to be novel. This has enabled greater insight into the dynamic and lived experience aspects of presence and emotion and has also enabled evaluation of the EAP. The outcomes of this were used in conjunction with the existing theories and the EAP enabled new insights into the relationship between emotion and presence.

7.5.4 Social and Economic Impact

This section highlights the social and economic benefits of this research including the impact upon designers of virtual reality experiences whether for psychology, therapy, gaming or immersive journalism. These benefits flow from both the foundational theoretical underpinnings and informing theory directly relevant to VR development and the Cyber-Psychology used for gaming, therapy (Gamito et al., 2007), education and immersive journalism (Kool, 2016). Some of

the social and economic benefits lie in the areas of health; collaboration; empathy machine development; collaborative activities; general VR development and research contribution.

HEALTH

One possible social benefit is to potentially improve mental well-being therapies using gratitude within virtual reality as gratitude has been associated with improving mental wellbeing (Emmons, 2008; Toepfer et al., 2012; Watkins et al., 2003). The literature review (Chapter 2) did not identify research into gratitude and presence, including engendering gratitude, within virtual reality. Demonstrating examples of successfully engendering the empathetic and pro-social emotion gratitude and identifying that artificial agents may be capable of stimulating gratitude within virtual environments (see Section 7.2.3) suggests that research into improving wellbeing through gratitude induction may be able to make use of virtual reality and that researching environments using both real individuals and artificial agents is possible.

COLLABORATIVE ACTIVITIES

This research informs improved development of collaborative activities in virtual environments. This in turn may aid educational uses of VR using Interaction Theory (Graham & Massyn, 2019), Communities of Practice (Wenger, 1999) , Inquiry or Scholars (Croxton, 2014; Kumar, Dawson, Black, Cavanaugh, & Sessums, 2011; Myers, Jeffery, Nimmagadda, Werthman, & Jordan, 2015) and collaborative virtual learning environments (Livingstone & Kemp, 2008; E. Prasolova-Førland & Divitini, 2002; Ekaterina Prasolova-Førland, 2002), bringing together business organisation staff who cannot meet face to face due to logistical issues or the desire to cut down on travel such as flights. A major contribution is an improved approach to social presence (the feeling of being together) using an enactive explanation and highlighting the role of designing scenarios and environments that take into account the dynamic nature of social presence and the role of emotion on the dynamic coupling and connectedness between individuals. There is even the potential to induce dissonant-connectedness to aid psychological disengagement of extremist terrorist groups, as suggested by Harris (2012).

EMPATHY MACHINE DESIGN

A major social and economic benefit of using virtual reality is its potential as 'ultimate empathy machine' This thesis, especially its EAP perspective, informs the debate and practical issues in this area. The social benefit is the potential for "fostering a society with informed perspectives of other communities and identities" (Hall & Takahashi, 2017, p. 3). It is argued by proponents that it does this by engendering compassion and sympathy for others, especially when related to empathy games or immersive journalism (Bollmer, 2017). Fisher (2017) argues, in relation to empathy machines, that one of the key aims of VR Designers is to engender an "emotionally

charged interpretation of life" (p. 233) which he terms an empathetic actuality. This thesis contributes to these aims by informing the design strategies recommended by Fisher (2017).

Fisher (2017) presents a range of design strategies: passive-witness, active-witness, embodied in space, embodied interaction, and locus of control in increasing orders of what he terms empathetic actualities. This thesis provides insight into further design considerations. The enactive approach to presence involves social cognition, understanding otherness, located around an embodied avatar-natural self (see Section 3.4), thus empathy is a key element and increased social presence increases empathy. However, enactive social presence is dependent "not just upon the amount of interaction, nor the degree of empathising, but on an interaction that does not threaten and lead to emotions involving 'dissonant-connectedness'" (see Section 6.2.2). This thesis suggests that using additional strategies focusing upon the dynamic relationship and coupling between individuals to increase the level of empathy, especially the level of connectedness.

There is some debate concerning the approach to empathy which may be informed by this thesis. One approach is to divide empathy between cognitive empathy and emotional empathy (a dualist approach rejected in this thesis)(Fisher, 2017) and the other is a phenomenological approach to empathy as sensual-empathy (Bollmer, 2017; E. Stein, 1989/2016) used in the EAP. The EAP accounts for a non-dualist sensual-empathy machine within VR.

RESEARCH BENEFITS

One example of a research benefit is the use of the EAP framework to support research into the fundamentals of how human social cognition unfolds; especially the approach-avoidance elements (Nuel, Fayant, & Alexopoulos, 2019) where VR is used as a research platform. Nuel et al. (2019) acknowledge that there are potential links between presence, action, emotion, intentionality and embodiment requiring further studies and suggest utilising the early version of the EAP framework as one possibility (Willans et al., 2015). This thesis has since gathered empirical data and further refined this framework, especially in the area of social presence where connectedness and dissonant-connectedness have significant parallels with approach-avoidance. Approach-avoidance has been associated with stress and anxiety (M. B. Stein & Paulus, 2009; Vogel & Schwabe, 2019) so informing research in this area may bring about well-being benefits aiding the reduction of anxiety, in addition to increasing understanding of the human condition. Further details on potential research and theoretical developments are given in Section 7.6.

7.6 *Further Research and Theoretical Development*

During this study areas where there is potential for further research, theoretical development and collaboration with others were identified. It may be worthwhile presenting the findings of this thesis to practitioners to identify areas of research needed not included below.

CAUSAL MECHANISMS UTILISING A CRITICAL REALIST APPROACH

The thesis utilised an inductive and abductive approach with a small sample size to inform theory. A natural extension would be to research into causal mechanisms utilising retroduction and the 6 step approach suggested by Danermark et al. (1997/2005). The six steps are: description; analytical resolution; abduction/theoretical redescription; retroduction; comparison between different theories and abstractions, and concretisation and contextualisation. This is still in line with a critical realist approach (see Section 4.4). Identifying causal mechanisms would enable further refinement of the EAP.

INTENTIONALITY

Promising areas for theoretical development of the EAP would be its approach to intentionality. The thesis identified the importance of person-related intentionality (personal, interpersonal, transpersonal) but was not explicitly detailed in areas such as personal future planning. It may be useful engaging with approaches to presence emphasising intentionality such as Riva et al's (2014; 2004) or Mennecke (2010) embodied social presence theory (ESP). Whilst the EAP incorporates place and embodied self for the individual it has not explicitly developed these. A fruitful approach may to utilise enactive and phenomenological approaches to inter-subjectivity drawn upon in the discussion chapter (see Chapter 6) to develop presence theories understanding of social interaction on presence.

The EAP raises questions about internal 'Bayesian Brain' mechanism proposed by existing theorists such as Riva (2014; 2004), Seth (2012), Barret (2015) and Friston (2012). This includes its relationship to the Free Energy Principle from the enactive perspective which was not investigated in this study. This suggests further avenues for research with these approaches. The study confirmed prior MEC-SPQ results into traits such as visual and spatial imagination, but the enactive approach suggests a different interpretation to Wirth (2012) by rejecting the internal mental model so further research into this area is needed. This study suggested that there may be a relationship between intentionality and traits i.e. some people were interested the visual aspects in any event. Allied to this would be research into the prevalence of any such characteristics, as this could limit the applicability of virtual reality or may suggest that designers find alternative ways of engaging with potential users.

VR GRATITUDE ANXIETY AND DEPRESSION TREATMENT

One of the possible future applications of this research is to consider further the effect of gratitude on wellbeing in virtual reality. A practical area of further study would be to design a game that could trigger gratitude and to study its effect upon well-being in comparison with other approaches.

One possible approach would be to adopt a mixed methods design: Qual + Quan (Creswell, 2013) to combine a quantitative measure of the intervention success with a qualitative insight into the context and envisaged factors. The quantitative element would be based on a randomised wait-list controlled trial (RWCT) testing two hypotheses: that the VR gratitude application reduces anxiety and that the VR gratitude application reduces depression. Measures of anxiety and depression could use the GAD-7 (Plummer, Manea, Trepel, & McMillan, 2016) and the PHQ-9 (Kroenke & Spitzer, 2002) as measures of the dependent variable which align with clinical definitions of anxiety and depression. The GAC questionnaire could be used as a measure of state-gratitude as the independent variable. Additional independent or mediating variables would relate to the interests or traits associated with social emotions, measures of usage time of the application, comments on distractions and a safety check focused upon cybersickness using the simulator sickness questionnaire (Kennedy, Lane, Berbaum, & Lilienthal, 1993) as this thesis found that the interest in social emotions varied by individual interest although measures to minimise these would be sought.

The quantitative research would be based again upon IPA to identify the patient experience of using the gratitude application and depression. This thesis has demonstrated the value of providing the rich-contextual data needed to understand the detailed dynamics and inform the interpretation of the RWCT findings. The participants would be a subset of those participants chosen for the RWCT split between the control and treatment groups. This insight may form hypotheses used in follow up research.

THEORETICAL DEVELOPMENT OF EAP THEORY

The EAP is a new approach and, as such, requires refinement. It is, however, built upon established theory, the enactive approach, and can draw upon other theorists in its further development. Applying it to further research will bring into focus an enactive perspective in a coherent way in order to disclose new areas of understanding. It is the researcher's intention to follow up some of these ideas, in collaboration with others.

APPROACH-AVOIDANCE RESEARCH

In Section 7.4 one potential use of the EAP is to examine further elements human social cognition and approach-avoidance (Nuel et al., 2019). Nuel et al. (2019) analysed the relationship using French versions ITC-SOPI questionnaire and looked at the relationship into broadly spatial presence (although the ITC-SOPI questionnaire includes elements associated with social and emotional aspects too but found only minor correlations between the approach-avoidance action and presence. This would be as expected based upon the findings in this research where a distinction between inter-personal interactions affecting social presence and social emotions and

the spatial interactions were involved. They have not, however examined social presence. A minor but not significant correlation in their findings could be the result of the few questions in the ITC-SOPI that have social implications. It may require the development of a social presence questionnaire examining asking questions relating to the dynamics, coupling and embodiment e.g. feelings towards the other based upon the findings in this thesis. A more natural measure of approach-avoidance may be based upon measurements of avatar location, orientation and positioning with respect to time. A self-report measure of breaks in presence or orientations away from the inter-personal interactions may be useful.

One of the difficulties Nuel et al. (2019) faced was in interpreting their findings. A qualitative study using framework analysis (with the EAP as the initial theoretical framework) or IPA may provide the rich detail needed here including the attitudes towards the other avatar.

7.7 Limitations and Scope

This thesis aims to inform theory rather than identifying causation in terms of statistical generalisation across a population. This is consistent with choosing a qualitative approach, IPA, which has a relatively few participants followed by an abductive approach.

In this thesis the unit of analysis focuses upon a dyadic relationship within Open Sim virtual environment utilising avatars that cannot show facial expressions, have limited body movements and do not utilise haptics to enable sensations of touch. The focus was upon the conscious experience of the participants as they interpreted it and did not explore the neurological aspects nor the embodied physical responses that may have highlighted non-conscious aspects of presence or emotion. This is acknowledged to be a limitation given the mind-brain-embodied-world nature of the enactive approach. This thesis does not investigate technological aspects of the virtual experience and does not focus upon wider cultural issues, a potential area for further research linking presence to society (see Section 2.4.3).

In focusing upon dyadic relationships, this study may not capture the role of inter-group emotions and identity (Brown & Capozza, 2006) where multiple people can participatory-sense make, and this is beyond the scope of this thesis. This issue is touched upon in the first pilot, where the participant was concerned over the use of Americanisms and the avatar's appearance. This was one of the reasons behind evaluating avatar appearance before the main study. In the main study, one participant, for instance, emphasised identifying with her avatar and the implications of dress choice by herself and the confederate upon group identity. Similarly, one of the most marked potential group distinctions is between human and non-human and the role of identifying the humanity of the avatar. Examination of the role of inter and intragroup emotions may further inform the proposal of autonomous emotional episodes utilised in the enactive approach.

7.8 Critique of the research approach and methodology

This section critically examines how the approach and study design supported answering the research questions, and the limitations this imposed. The study aimed to understand the relationship between emotion, gratitude and presence and then, secondarily, in order to do this, developed and evaluated an enactive approach to presence. It started by adopting a very human-orientated approach and aimed to understand the nature of emotion and presence and the underpinning assumptions of current theories. The research itself utilised IPA within a critical realist framework with the application of an enactive lens to the super-ordinate themes in a discussion with wider extant theories, in order to understand the relationships between presence and emotion. It further utilised questionnaires ideographically to gain extra insight and enable comparison with empirical studies. The research required the development of a bespoke virtual environment but did not study the underpinning technology. The study did not prove causation as that was beyond its scope.

The thesis began by critically examining what emotion and presence are, the surrounding debates, theoretical assumptions along with prior studies into the relationship between emotion and presence. It led to the development of a novel approach to presence; an enactive approach, and the assumptions over meaning shaped the rest of the study.

Broadly, the study design using IPA provided rich data, indeed richer than expected, about emotion and presence, that was lacking from prior empirical studies, as well as giving an insight that had not been identified in other studies. It was particularly valuable in capturing the on-going dynamics and breadth of human experience in detail for individual dyads. It also proved effective at gathering data on two or more aspects in order to examine the relationship between these two aspects. It does not capture the embodied, neurological or non-conscious elements of the enactive approach. It also proved to be a very intensive approach, especially when examining experiences of emotion, gratitude, spatial presence and social presence.

Whilst this study utilised the enactive approach, which involves the brain-body-world coupled as one system, it focused upon the body-world relationship. This places a constraint on fully validating the EAP, hence the focus is upon the explanatory power of the EAP. This is an area for further research. As the study involved a move from a calm environment to an active social environment, it was not clear whether it was the time in the environment that led to an increased sense of emotion or the activities, as it could have been. There were technical problems, especially with the virtual reality headsets. Whilst valuable information was gained, the pilots could possibly have tested this earlier. The physical proximity of the researcher to the participant in real life led to a dissonance between the researcher's avatar and the real

researcher, although, in this case, it tended to add to, rather than detract from, the understanding gained from the study. One difficulty here was the problem in obtaining suitable laboratory facilities. This would have been a serious issue if the study required experimental controlled conditions, however the interviews were able to accommodate any issues by making them and the impact explicit. The second interview protocol was probably not needed and was overly structured for IPA. It was also difficult to use when following the flow of the participant. The use of the questionnaires in an idiographic manner gave a valuable insight in comparing with empirical studies to individuals, but the approach to analysing them was difficult due to the lack of context. It was clearer to present questionnaire results in tables (see Chapter 5), but this may suggest a non-idiographic approach has been adopted.

7.9 Reflection on the Research Process

The initial research proposal for this thesis envisaged an empirical quantitative study in line with my prior research experience at the UK Met Office into meteorological phenomena. However, as the study evolved, and through a process of considerable learning and personal development, this research became primarily a qualitative IPA study.

Over the course of this research/learning process I have learned that research involves being open to new ideas including one's own preconceptions. From the literature review I learned the importance of challenging my underpinning assumptions, even about research itself. The literature review revealed distinctions in the assumptions of dualism in emotion theory and early arguments into the conceptual nature of presence. This challenged my assumption that an empirical quantitative approach was appropriate for this study which led to the adoption of the critical realist and the enactive approach and the use of IPA which has delivered rich results. Unexpectedly, in order to carry out the research, it was necessary to develop an enactive approach to presence if the enactive approach generally was to be utilised. Developing this new model was a positive and useful experience both for this thesis and personally. This highlighted the need to synthesise prior knowledge and develop new theoretical approaches.

I learned that the research process is not entirely objective, and it exists within the context of a research culture. The rejection of the empirical approach and adoption of the qualitative approach as the primary tool is one of the challenges within this study. Qualitative approaches highlight that research takes place within an external culture which has to be managed. In this case, the predominant culture favoured empirical studies as the primary reliable evidence and where qualitative studies existed, they were frequently seen as exploratory and tentative. Even where qualitative research is carried out there can be an emphasis upon objectivity, highlighted by two reviewers of my second interview protocol from differing discipline areas who

considered the same interview protocol as 'bordering upon a structured interview' (Reviewer1) and 'semi-structured' (Reviewer 2).

It was difficult to set aside all foreknowledge, especially given the detailed literature review and development of the enactive approach to presence beforehand. There was a choice to look at intentionality in terms of personal, interpersonal and transpersonal, possibly related to the influence of gratitude to presence theory rather than taking intentionality as a given. Extra sensitivity to intentionality may arise from foreknowledge about its role within phenomenology and the enactive approach. Nevertheless, I feel that these interpretations are fair and reasonable bearing in mind these experiences are pertinent to the secondary research questions. Once my underpinning assumptions of the world were challenged it opened my thinking to other approaches to addressing my research aims. Hence, there is reasonable debate over how useful using more narrow quantitative studies for this research over larger populations may be, especially, for instance, in evaluating: a) rarer cases as outliers and b) the tendencies among a known population to refine a VR game over its user base. The rigour of the IPA approach, and the amount and depth of information it gleaned, was impressive compared with many other approaches, such as thematic analysis.

Looking forward, the study has identified a number of areas for further research. The enactive approach to presence is a useful model which requires further development. In particular, clarification over the use of a mental model or not requires an understanding of the neurological aspects. The link between emotion, presence and agency merits further examination. Wider studies are needed into the prevalence of the findings in the population as a whole. Further research into the impact of culture and foreknowledge is needed, to explore areas such as such as cultural expectations when meeting. This may have an impact on developing experiences for use in differing cultures. More study is needed into the potential effect of traits such as visualisation skills. There is a gap in the literature regarding an enactive approach to gratitude, in particular, so this, like that of enactive presence, may be an under researched area.

7.10 Overall

Overall this thesis has led to the development of a useful novel enactive approach to presence that has been demonstrated as providing a worthwhile insight into the relationship between emotion, gratitude and presence. The IPA approach combined with the abductive enactive lens worked well . A range of novel findings and areas for further research and theoretical development has been identified. Overall, this thesis has achieved its aims, addressed all of its research questions and provided a new theoretical model to bring insight into an area of contemporary importance.

APPENDIX A: ETHICS CERTIFICATES

Certificate of Ethical Approval

Applicant:

Thomas Willans

Project Title:

emotions in the wild pilot1

This is to certify that the above named applicant has completed the Coventry University Ethical Approval process and their project has been confirmed and approved as Medium Risk

Date of approval:

14 November 2012

Project Reference Number:

P4419

Certificate of Ethical Approval

Applicant:

Thomas Willans

Project Title:

Pre-Pilot: Neutral Appearance of Avatar

This is to certify that the above named applicant has completed the Coventry University Ethical Approval process and their project has been confirmed and approved as Medium Risk

Date of approval:

19 November 2013

Project Reference Number:

P11207

Certificate of Ethical Approval

Applicant:

> Thomas Willans

Project Title:

> Emotion in Virtual Environments (Oculus Rift).

This is to certify that the above named applicant has completed the Coventry University Ethical Approval process and their project has been confirmed and approved as Medium Risk

Date of approval:

> 27 March 2014

Project Reference Number:

> P17503

Certificate of Ethical Approval

Applicant:

Thomas Willans

Project Title:

Emotion, including gratitude, and Enactive Presence in Virtual Reality (Oculus Rift)
Extension

This is to certify that the above named applicant has completed the Coventry
University Ethical Approval process and their project has been confirmed and
approved as Medium Risk

Date of approval:

25 July 2017

Project Reference Number:

P60562

19 November 2013

Tom Willans

Dear Tom

Re: Ethics Application: **13/308 Neutral appearance of Avatar**

I am pleased to advise that the Deputy Vice-Chancellor of Auckland University of Technology has approved your application for access to staff and or students of this University

Your application is now approved for a period of three years until 18 November 2016.

I advise that as part of the ethics approval process, you are required to submit to AUTEC the following:

- A brief annual progress report using form EA2, which is available online through http://www.aut.ac.nz/researchethics. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 18 November 2016;

- A brief report on the status of the project using form EA3, which is available online through http://www aut ac.nz/researchethics. This report is to be submitted either when the approval expires on 11/18/201618 November 2016 or on completion of the project, whichever comes sooner;

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are reminded that, as applicant, you are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

When communicating with us about this application, we ask that you use the application number and study title to enable us to provide you with prompt service. Should you have any further enquiries regarding this matter, you are welcome to contact me by email at ethics@aut.ac.nz or by telephone on 921 9999 at extension 6902.

On behalf of the AUTEC and ourselves, we wish you success with your research and look forward to reading about it in your reports.

Yours sincerely

Dr Rosemary Godbold

Executive Secretary

Auckland University of Technology Ethics Committee

Cc: willanst@uni.coventry.ac.uk

A u c k l a n d   U n i v e r s i t y   o f   T e c h n o l o g y   E t h i c s   C o m m i t t e e

W A 5 0 5 F   L e v e l   5   W A   B u i l d i n g   C i t y   C a m p u s

P r i v a t e   B a g   9 2 0 0 6   A u c k l a n d   1 1 4 2   P h :   6 4   9   9 2 1   9 9 9 9   e x t   8 3 1 6   e m a i l   e t h i c s @ a u t   a c   n z

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APPENDIX B: PUBLICATIONS

Due to copyright restrictions the publications included in the examined version of the thesis have been removed. As a result there is a gap in the page numbering between pages 262-279.

The publications omitted are:

Willans, Tom. (2012). Spatial Presence as a perceptual emotion: An expansion on cognitive feeling? In International Conference on Complex, Intelligent and Software Intensive Systems, 2012. CISIS '12 (pp. 899–904). Presented at the Sixth International Conference on Complex, Intelligent, and Software Intensive Systems, Palermo: IEEE.

Willans, Tom, Rivers, S., & Prasolova-Førland, E. (2015). Enactive Emotion and Presence in Virtual Environments. In S. Y. Tettegah & D. Esplege (Eds.), Emotions and Behaviors in Digital Environments (pp. 181–210). Academic Press.

APPENDIX C: CONTRIBUTOR STATEMENT

Contributor Statement for: Enactive Emotion and Presence in Virtual Environments. In Emotion, Technology and Behaviors.

Authors Tom Willans, Sue Rivers, Ekaterina Prasolova-Førland

Tom Willans is the principal author who wrote the book chapter and developed the ideas except for two contributions by Sue Rivers and Ekaterina Prasolova-Førland. These two contributions were edited by Tom Willans to fit with the overall argument of the chapter including the fit with the enactive approach. The chapter draws heavily from the literature review within Tom Willans' PhD into gratitude and presence within virtual worlds.

Tom contributed his knowledge of enactive emotion an overview of presence and emotion theory. He identified and proposed the key critique of existing presence theories including that of Riva dependent upon a non-enactive approach to emotion and the proposed enactive approach to presence.

Sue Rivers contributed a section on her autoethnographic study (Rivers 1998) into emotion in online learning environments in paragraph two of the introduction. Her use of metaphor as evidence of emotion was linked with research by Lakoff and Johnson (1980) into the use of metaphor in the formation of abstract concepts that is interpreted by Tom Willans as support of the enactive approach.

Ekaterina Prasolova-Førland contributed a section, in the introduction, highlighting approaches to presence in virtual environments by Hindmarsh, Fraser and Benford (2001) as a personal, social and environmental approach and the role of presence and engagement as view, action and position by O'Brian, Rodden and Trevor (2001). She further highlighted Jeffery and Marks' (2003) approach to social presence. Tom Willans then considered this from the enactive perspective. Ekaterina Prasolova-Førland is a Supervisor to the Tom Willans' PhD that led to this publication.

APPENDIX D: INTERVIEW PROTOCOL-BUTTON PRESS

Overview of the Protocol:

The aim of the semi-structured, in depth interview is to facilitate an understanding of the participants' experience of their virtual world activity focusing upon their feelings of gratitude and presence and related factors. The interview will be used in conjunction with video footage of the in-world activity to stimulate recall both of the participant and the interviewer. We want to understand how this episode unfolds over time, including the interaction with the confederate.

This protocol is intended as a guide to incorporate consistent ways of phrasing certain questions, how best to move from the general issues to more particular ones. The interviewer is to act as active listener (listening as an active co-participant) and some flexibility in the order may be needed to maintain the flow and identify pertinent data about the relationship between gratitude and presence and associated factors.

1. The participant will first be asked to talk through the video (interviewer to note down key events)
2. The semi-structured interview will involve cycling through at key points indicated by the bullet points for the following areas:
- Initial impressions
- Feelings in General
- Feelings towards the other participant
- Experience of Presence
- Experience of Gratitude
- The Environment
- Experience of Help (when the button is pressed)
3. A final question, thanks and debriefing will end the session.

The prompts aim to probe deeper. If the issue has not been addressed the prompt needs to be asked. If new, pertinent issues in line with the research questions arise, the interviewer is at liberty to explore these in addition to the questions below.

THE INTERVIEW QUESTIONS

General Introduction

RESEARCHER: The focus of this interview will be the emotions you felt during this experience and your sense of presence (being) in the environment, especially during the following key phases, entering the virtual environment, entering the main room, meeting the other participant and the final exercise.

Please view this video of your experiences during the exercise within the virtual world. You can stop the video at any time. I will ask you pause after key phases so that I can then ask you about your experience. Your task is to identify your feelings and the sense of where you were and why you felt that way about the task, environment and fellow participant. Try to focus upon your feelings and the sense of where you are. Is it OK for me to record this interview?

There is no right or wrong answer - this is the point of the research. If you do not recollect an incident I would rather you say so than create an explanation 'in hindsight'.

You can withdraw from this interview at any stage without any judgment from me. This is normal within such research.

Thank you for participating

Introductory Questions

1. Was there anything that stood out about your experience?

Initial Impressions

2. What were your initial impressions when entering the X

- park
- main room

Feelings in General

3. Can you talk me through your feelings over time when entering the main room?

Possible Prompts: (4.1 Tell me more?

4.2 Tell me about what led up to these feelings,

4.3 How strong were they?

4.4 Why did you feel that way?

If moving to a specific phase state: If we can return to X when […]

• park	• entering the main room,
• first meeting with other participant	• carrying out the box exercise,
• pressing the button	•

Feelings towards the other partipant

5. Can you talk me through your feelings about your fellow participant?
Prompts (5.1 How did you feel towards her at this point?

5.2 How would you describe her **(initial meeting only)**?

5.3 How, if at all, did you relate to her?

5.4 Did you feel physically with her?

5.5 Tell me more?)

• first meeting with other participant,	• carrying out the box exercise,
• pressing the button	•

Experience of Presence

6. What, if any, were your feelings or sense of being somewhere when X?

• park	• entering the main room,
• first meeting with other participant,	• carrying out the box exercise,
• pressing the button	•

if **yes**: 7 Can you talk me through this over your time until the end of the experiment?

Prompts (7.1 How strong was this feeling?

7.2 How did it change over time?

7.3 Where did you feel you were?

7.4 Were you aware of outside the virtual space?

7.5 Can you describe this feeling?)

8. Have you had similar feelings outside of the virtual environment? (ask upon the first reported occurrence of presence)

Prompts (8.1 How strong was it? 8.2 How did these compare to within?

8.3 Tell me more?)

If no: *Prompts (8.1 Where did you think you were?*

8.2 Where did you physically feel you were?)

Any critical event, including pressing the button:

9. How, if at all, did it change from before, whilst and after being helped?

• park	• entering the main room,
• first meeting with other participant,	• carrying out the box exercise,
• pressing the button	•

Experience of Gratitude

10 Did you feel grateful over your during your time X?

If yes: 11 Can you talk me though this?

Prompts (11.1 Why did you feel grateful?

        11.2 What were your grateful for?

        11.3 How strong was this feeling?

         11.4 Is there anything else affecting your feeling gratitude?)

    12 Have you ever felt more grateful, if so how did it compare? (first time gratitude).

• park	• entering the main room,
• first meeting with other participant,	• carrying out the box exercise,
• pressing the button	•

The Environment

13 What was your experience of the virtual space when X?

Prompts: (13.1 Could you navigate and act in it as you wanted?

        13.2 How focused were you?

        13.3 How real did it seem?

         13.4 How long were you in there for?)

If moving to a specific phase state: If we can return to X when [

• park	• entering the main room,
• first meeting with other participant,	• carrying out the box exercise,
• pressing the button	•

Experience of Help or No Help

14 Talk me through when you pressed the red button at the end.

15 How did you feel after being helped?

Prompt (15.1 What did the help mean to you?

     15.2 Did you expect to be helped?)

16 How, if at all, grateful did you feel at the end?

             If **yes**: Prompt: (What led to your feeling grateful? How strong were feelings,

             If **no but helped**: 16a Helping can sometimes lead to feeling grateful: Why on this occasion did this not happen?

Final Question

17 Is there anything else you would like to add about your experience?

Debriefing

Thank you for your help, it is much appreciated. May I get back to you if needed?

Followed by the debriefing.

Appendix E: Interview Guide: Box Pushing

Purpose:

The purpose of this unstructured interview is aimed at gaining an understanding of the feelings of benefit-triggered gratitude and presence and how they are related during various phases during an in-world virtual activity. It also wants to identify other issues that may affect the main study. The interview guide "is a list of things to be sure to ask about when talking to the person" as advised by Lofland and Lofland (1995/2006, p. 85) and recommended by Robson (2002, p. 281).

Introduction:

The interview is to be held following the virtual world activity. It will be used in conjunction with video footage of the in-world activity to stimulate recall both of the participant and the interviewer.

Video footage of the virtual engagement activity is to be played back shortly after the actual engagement activity.

Note: The key questions to be asked are to focus upon:

- What other feelings were felt?
- What is the feeling of presence (spatial and social) and where you are?
- What is the experience of gratitude?

The feelings examined are both within the participant and towards the other participant. Seek to identify any drivers, goals and objects. Importantly focus upon the feelings felt at the time.

Interview Schedule

RESEARCHER: The focus of this interview will be the emotions you felt during this experience and your sense of presence (being) in the environment, especially during the following key phases:

A) The entry point
B) The initial entry into the main room.
C) The initial meeting with the other participant
D) The feeling during the trial
E) The feeling during the main exercise
F) The problem at the end of the exercise

Please view this video of your experiences during the exercise within the virtual world. You can stop the video at any time. Your task is to identifies your feelings and the sense of where you were and why you felt that way about the task, environment and fellow participants. Try to focus upon your feelings and the sense of where you are. I will be recording this is that OK?

There is no right or wrong answer - this is the point of the research. If you do not recollect an incident I would rather you say little than create an explanation 'in hindsight'.

You can withdraw from this interview at any stage without any judgment from me. This is normal within such research.

A) The entry point

B) The initial entry into the main room.

C) The initial meeting with the other participant

D) The feeling during the trial

E) The feeling during the main exercise

F) The problem at the end of the exercise

At the end:
Do you have anything you would like to add?

Thank you for this interview. You have been a great help. I would like to remind you that you can withdraw from this study.

APPENDIX F: AVATARS USED

Male Avatars

Used as a check in the Avatar Appearance Survey

This item has been removed due to third party copyright. The unabridged version of the thesis can be viewed at the Lanchester library, Coventry University

Avatars in Use (Female). Avatar FWA3 was chosen for use as the confederate.

This item has been removed due to third party copyright. The unabridged version of the thesis can be viewed at the Lanchester library, Coventry University

Avatars in Use (Male)

This item has been removed due to third party copyright. The unabridged version of the thesis can be viewed at the Lanchester library, Coventry University

Appendix G: Avatar Appearance Survey Questions

Question	Justification	References
This avatar is good looking (AP1051) This avatar is ugly (AP1040)	One of the effects within avatars and humans the "attractive is good" effect. Attractiveness is also seen as promoting needed trust.	(Behrend, Toaddy, Thompson, & Sharek, 2012) (Principe & Langlois, 2013)
With this avatar I feel trustworthy This avatar can be trusted	Trust is an important element needed for pro-social emotion	Principe & Langlois (2013)
With this avatar others will feel comfortable with me This avatar is comfortable to be with	A general measure of rapport.	A general measure of rapport with the other avatars
With this avatar I feel assertive This avatar is assertive	Black clothing engenders more assertive behaviour. Are people aware of this in surveys? Does it affect others' perceptions	(Merola et al., 2006; Peña et al., 2009)
Opposite to with this avatar I feel assertive This avatar is assertive	White is supposed to be aiding more pro-social behaviour	(Merola et al., 2006; Peña et al., 2009)
This avatars clothing does not suit me	Initial case study raised concern that the participant clothing was frumpy	Initial Case Study (see 5.2.3).
This avatar does not possess the attributes I have This avatar is different from my actual self The avatar does not behave like my actual self	Whether identifying with the avatar is important (Virtual Self Discrepancy)	(Jin & Park, 2009)

From the literature review avatar appearance relates to a) how other avatars are perceived and b) how the own avatar is perceived. This is examining avatars appearance and the effect this may have.

Attractiveness Questions (Using subscales of the PSDQ questionnaire .(Marsh, 1996))

This avatar is good looking (AP1051).

Relationship to Self (virtual self-discrepancy based upon questionnaire by Jin (2012))

This avatar does not possess the attributes I have (VSDA).

This avatar is different from my actual self (VSDD)

The avatar does not behave like my actual self (VSDB)

This avatars clothing does not suit me (VSDC)

Feelings about the avatar (Merola et al., 2006; Peña et al., 2009)

Self:

With this avatar I feel trustworthy (SEFT)

With this avatar others will feel comfortable with me (SEFC)

With this avatar I feel assertive (SEFA)

Other e.g. The Researcher:

This avatar can be trusted (OFT)

This avatar is assertive (OFA)

This avatar is comfortable to be with (OFC)

APPENDIX H: MAXQDA ANALYSIS ILLUSTRATION
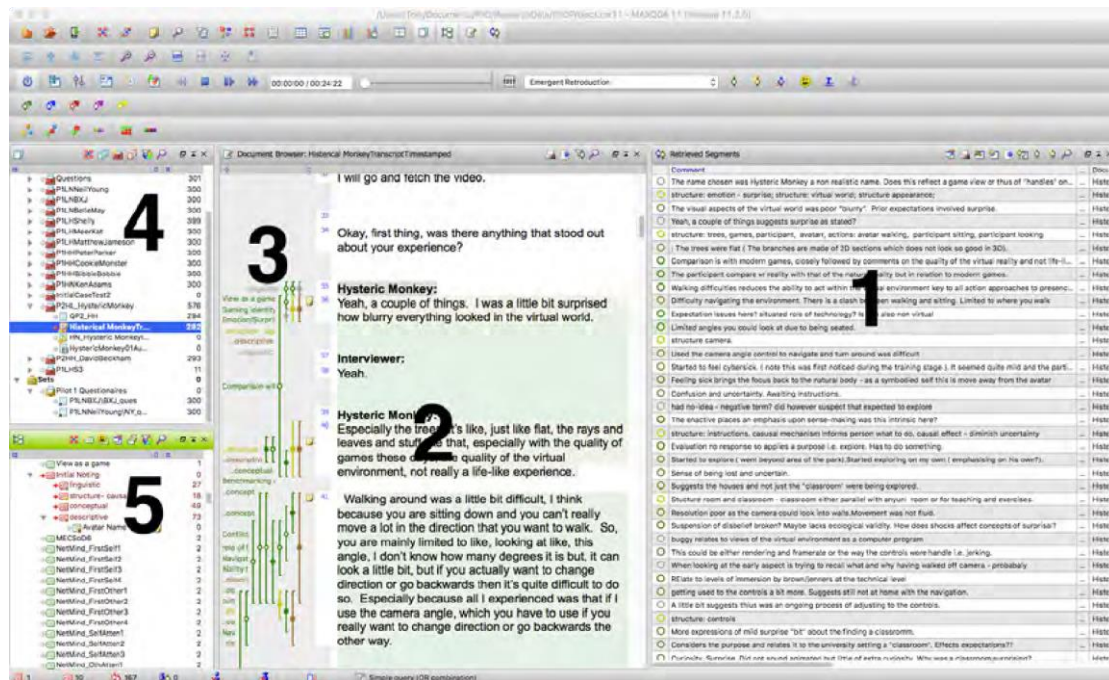
Analysis Process for Interviews in MaxQDA.

The Initial Noting (Steps 2) uses pseudo-codes for description, linguistic, conceptual and structure-causal mechanisms (5) the comments are displayed in column1 (1). These comments are lightly linked to the verbatim transcript (2) which is traceable to all the documents including the original notes and recording associated with the participant (4). Step 3 and 4 are highlighted developing further codes for themes and pseudo-codes for structures and comments that appear in column 3 and column 1 (alongside the original columns).
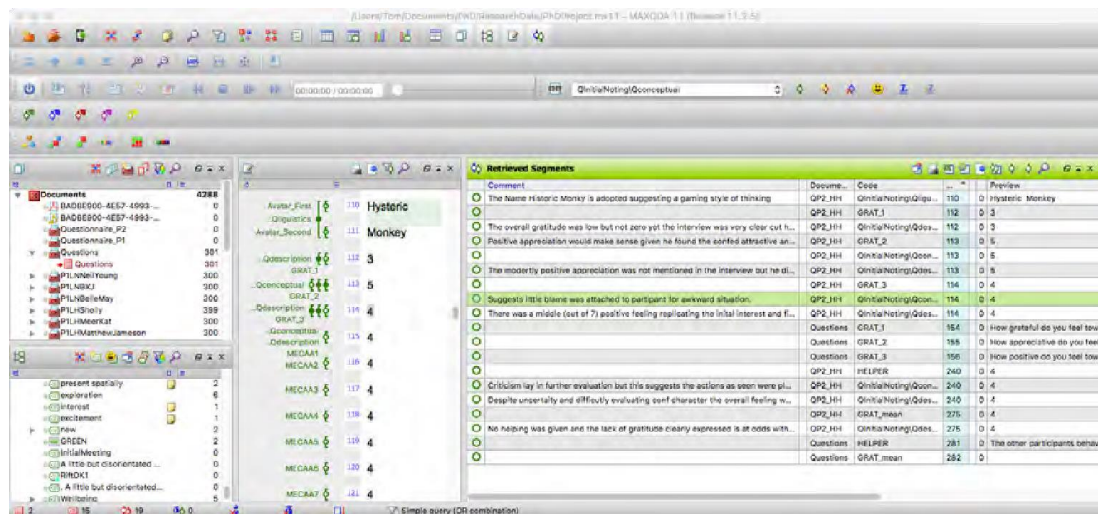
Qualitative Analysis of Questionnaire Data.

The panels are the same as in figure 4.6. All the participants questionnaires responses are in a single document with a code representing the question. Analysis is as per figure 4.6 although the initial noting is carried out after the interview analysis and interpreted in the context of the participant interview. Both interview and questionnaire analysis is brought together during Step 4.

APPENDIX I: SHELLY BROWN MAPS OF SUPER-ORDINATE THEMES

The graphical capabilities of MaxQDA were used to draw together the emergent themes to identify any super-ordinante themes.

Shelly Brown Themes

Excitement and Exploration of Place

Excitement

Enticed by the opportunity to enter room

Island image has a positive appeal that led to desire to explore

Interest

Novelty

Training sign suggests explore

Claim to justify act of exploration

Feeling of Being in a Real Place

present spatially

feeling of being there

Pleasurable Sense of journey and place

enjoyable and a lost sense of time

no marked conscious entry into feeling there

Requested and expected help in-world

Navigation splits focus

Split Focus of Attention due to navigation issues

learning so navigation not transparent.

Anxiety about messing up from uncertainty

anxiety (worry) about messing things up

mild concern of messing up

disengage from activity though fear of messing up

Feelings of Embodiment and Touching

embodied desire to reach out and touch with arm and hand

activities requiring touching triggered desire to reach out and

Intentionality: Conflicting Agenda between task and exploration

Claim to justify act of exploration

Recalls with amusement

Claim to authority justifying exploration

Disobedience

Did not follow audio instructions to wait in the park

Slightly coy as not followed interviewer's instructions

naughty laugh when going beyond authorised instructions

naughty

Immersion in Task

task focus lost awareness of hand (was being kept steady due to

attention led to deep immersion solely in virtual environment

sense of absorption in the task itself

task involved concentration

Gratitude from Helping

grateful upon being helped by her

Humanisation of the Avatar

Treated avatar as real person with real role (here helper)

Humanisation of avatar - assumed a she

Muted Feelings towards the confederate

Initial measured emotional response to confederate

On-going Social awareness

Distinction between task and place

Distinguishes between being there and computer tasks due soon
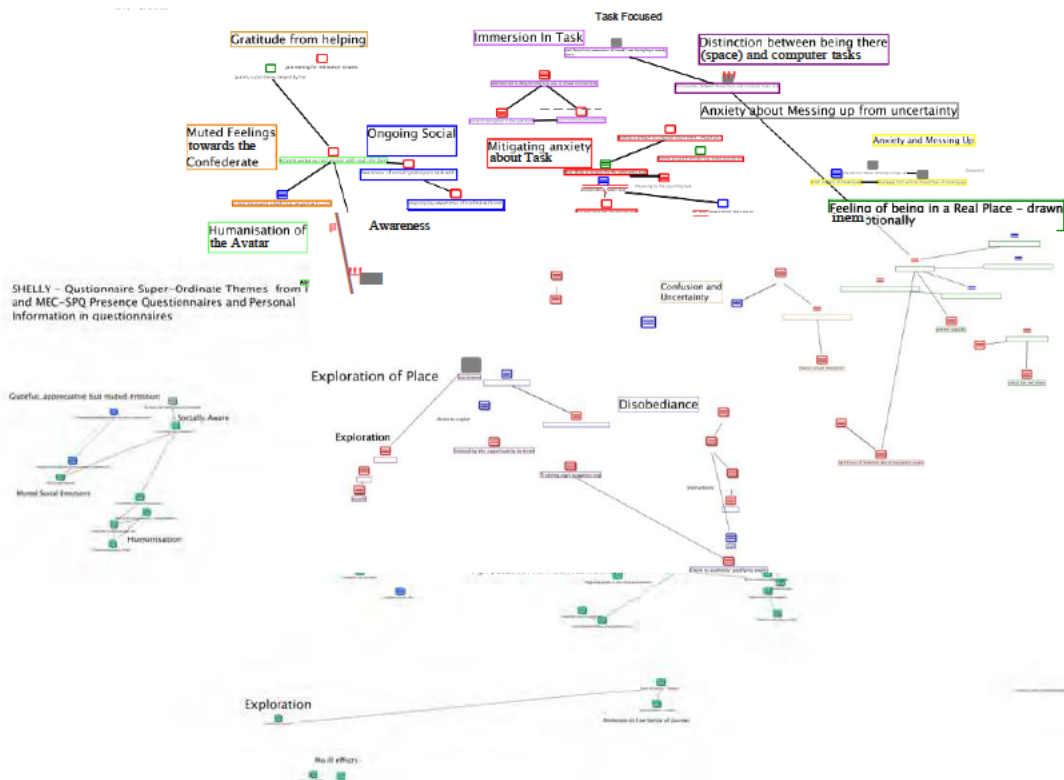
Figure 5.A.1 Shelly Brown: Map of Super-ordinate Themes from the interview
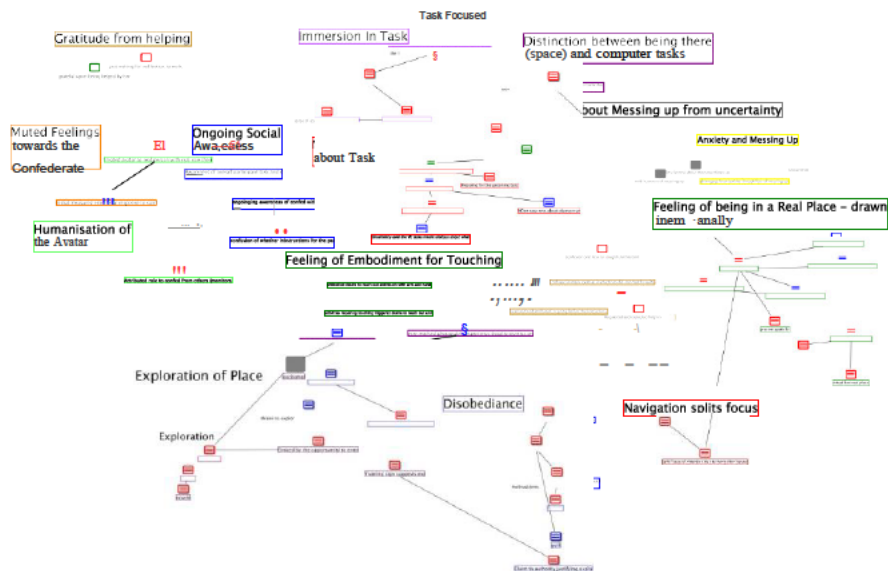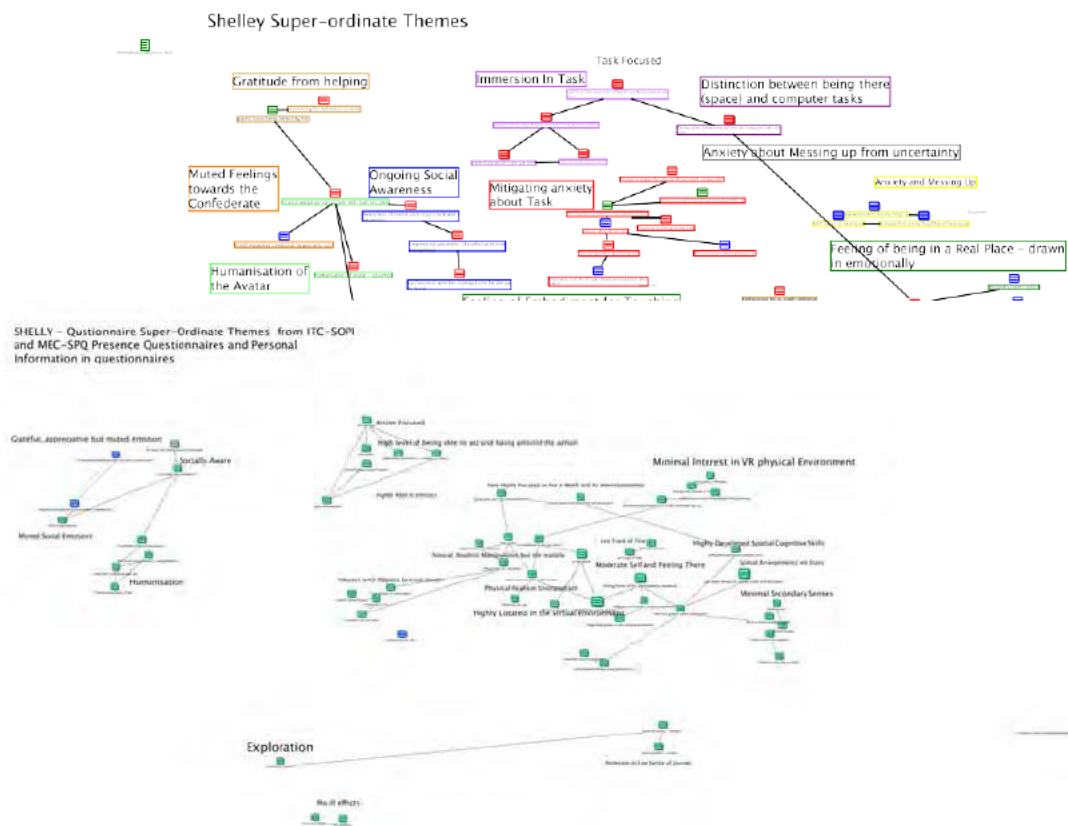
Figure 5.A.2 Shelly Brown: Map of Super-ordinate Themes from the Presence and Gratitude Questionnaires

Figure
5. A3:
Super-
Ordinate Themes from David Beckham Interview. The larger purple icons represent the super-ordinate themes. The smaller icons represent the emergent themes. The red icons indicate emergent themes relating to emotion. Blue gratitude. Green and Yellow other areas.

Appendix J: Participant Interview Selection

IPA requires data of sufficient quality and quantity needed for meaningful analysis. As an idiographic approach this requires that individual interviews have sufficient rich data to enable a meaningful analysis of that individual. The participant interviews were then evaluated to ensure they passed a quality threshold in terms of the length of the interview and the quality of the interview. There was a further check that the range of contexts wanted gained, if not then further interviews would have been carried out. Eight interviews were identified which could be analysed at the level of detail needed for IPA. The table summarising this is given below, with green indicating those passing the quality criteria.

| Data	Size	Depth	Suitable for IPA	Context	Chosen	Rationale for Selection or Exclusion
First Pilot	Notes + Recoding latter part	Good/ Rich	N/A	LN	Y	The notes are very thorough with a good quality recording and verbatim transcription of a discussion. The discussion content is very rich in detail. However, the design is only a prototype design and different in many ways to the other studies. Its focus is upon evaluating the prototype environment but there are wider lessons that can be learned.
Neil Young	Medium	Good	Yes	LN	Y	The length and richness of the interview is good.
BXJ	Notes	V poor	No	LN	N	Technical problems led to a loss of interview data leaving relatively poor quality notes.
Belle May	Short	Good	Borderline	LN	Y	The interview was short with moderate quality data. However, the contents of the data were very relevant to the research questions and a full picture could be obtained. This was considered as at the quality threshold and still provided worthwhile data to answer the research question.
Shelley	Medium	Good	Yes	LH	Y	This was a medium length interview with a good level of richness of data suitable for IPA.
MeerKat	Medium	Good	Yes	HH	N	This was a medium length interview with a good level of richness of data suitable for IPA. This was dominated by being unwell making answering the research question difficult.
MJ	Some Notes	VV Poor	No	LH	N	Technical problems led to a loss of rich verbatim interview data. The notes were insufficient to enable detailed IPA analysis.
Peter Parker	Short	Good	Yes	LH	Y	Whilst short the interview was of a good level of richness enabling detailed analysis using IPA. The richness offset the relatively limited quantity. This means detailed IPA of the other areas is possible.
Ken Adams	Short	Good in parts	No	HN	N	This is short and only good in small parts making it difficult to get a broad picture of this interview and is therefore unsuitable for IPA.

Bibble Bob Virtual ble	Short	Good	Yes	HH	N	Nausea overcame spatial presence thus this interview was dominated more about the problems of cybersickness rather than the research questions.
Cookie Monst er	Short- Med	Good	Yes	HH	Y	Whilst slightly shorter than wanted the richness of the data is good enabling detailed IPA to be carried out. There was no helping at the end due to nausea emerging at the final stages.
Hysteri c Monke y	Mediu m	V Good	Yes	HN*	Y	This was a medium length interview with a lot of high quality rich data suitable for details IPA. There was still some cybersickness in the later second DK2 variant of the Oculus Rift headset.
David Beckha m	Mediu m	V Good	Yes	HH*	Y	This was a medium length interview with a lot of high quality rich data suitable for details IPA. There was still some cybersickness in the later second DK2 variant of the Oculus Rift headset.
Bob Virtual	Long	V Good	Yes	LH	Y	This comprises two interviews due to interviewer seizures during first interview. The second interview was one week after the study. Despite this much could be recalled and tallied with that in the first interview.
LM	V Short	V Poor	No	LN	N	Language difficulties significantly limited the richness and reliability of the participant interpretation.

Implications

Applying the interview selection criteria ensured that the analysis returned sufficient data to identify the unfolding experience of the individual participant. Selecting after carrying out the interviews has the risk that one will select those participants that whose interpretations agree with your own preconceptions. However, using standard criteria minimises this and the researcher has aimed to separate out his own views in the same way that he sets aside his own views during IPA when focusing upon the individual's own interpretation. As an idiographic research, however, the problems of bias and insufficient data points across a population is far less significant than in statistical quantitative research. The greater danger is the lack of data points, or richness of data, within the individual interview needed to understand the individual's experience and this addressed is this selection. The data split over two interviews, the first interrupted, by seizures did not in the participant's own interpretation suffer from the one-week gap.

APPENDIX K: QUESTIONNAIRE QUESTIONS

ITC-SOPI Copyright restrictions prevent the publication of its questions.

Group	Question
GAC Questionnaire	
GRAT_1	How grateful do you feel toward the other participant?
GRAT_2	How appreciative do you feel towards the other participant
GRAT_3	How positive do you feel toward the other participant?
MEC-SPQ Questionnaire	
MECAA1	I devoted my whole attention to the computer generated environment.
MECAA2	I concentrated on the computer-generated environment
MECAA3	My attention was claimed by the computer generated environment
MECAA4	I directed my attention to the computer generated environment.
MECAA5	The computer generated environment captured my senses.
MECAA6	I dedicated myself completely to the computer generated environment.
MECAA7	My attention was caught by the computer generated environment.
MECAA8	My perception focused on the computer generated environment almost automatically.
MECSSM1	I was able to imagine the arrangement of the spaces presented in the computer generated environment very well.
MECSSM2	I had a precise idea of the spatial surroundings presented in the computer generated environment.
MECSSM3	In my mind's eye, I was able to clearly see the arrangement of the objects presented/described.
MECSSM4	I was able to make a good estimate of the size of the presented space.
MECSSM5	I was able to make a good estimate of how far apart things were from each other.
MECSSM6	Even now, I still have a concrete mental image of the spatial environment.
MECSSM7	Even now, I could still draw a plan of the spatial environment in the presentation.
MECSSM8	Even now, I could still find my way around the spatial environment in the presentation.
MECSPSL1	I had the feeling that I was in the middle of the action rather than merely observing.
MECSPSL2	I felt like I was a part of the environment in the presentation.
MECSPSL3	I felt like I was actually there in the environment of the presentation.
MECSPSL4	I felt like the objects in the presentation surrounded me.
MECSPSL5	It was as though my true location had shifted into the environment in the presentation.
MECSPSL6	It seemed as though my self was present in the environment of the presentation.

MECSPSL7	I felt as though I was physically present in the environment of the presentation.
MECSPSL8	It seemed as though I actually took part in the action of the presentation.
MECSPPA1	I felt like I could jump into the action.
MECSPPA2	I had the impression that I could act in the environment of the presentation.
MECSPPA3	I had the impression that I could be active in the environment of the presentation.
MECSPPA4	I felt like I could move around among the objects in the presentation.
MECSPPA5	The objects in the presentation gave me the feeling that I could do things with them.
MECSPPA6	I had the impression that I could reach for the objects in the presentation.
MECSPPA7	It seemed to me that I could have some effect on things in the presentation, as I do in real life.
MECSPPA8	It seemed to me that I could do whatever I wanted in the environment of the presentation.
MECCogInv1	I thought most about things having to do with the computer generated environment.
MECCogInv2	I imagined precisely what it must be like to further explore the world presented in the computer generated environment.
MECCogInv3	I kept wondering whether the presentation in the computer generated environment could have personal meaning for me.
MECCogInv4	I thought intensely about the meaning of the virtual environment presentation.
MECCogInv5	I thoroughly considered what the things in the presentation had to do with one another.
MECCogInv6	The virtual environment presentation activated my thinking.
MECCogInv7	I thought about whether the virtual environment presentation could be of use to me.
MECCogInv8	I thought about just how much I know about the things in the presentation.
MECSoD1	I concentrated on whether there were any inconsistencies in the virtual environment.
MECSoD2	I didn't really pay attention to the existence of errors or inconsistencies in the virtual environment.
MECSoD3	I directed my attention to possible errors or contradictions in the virtual environment.
MECSoD4	I thought about whether the action or the virtual environment presentation was plausible.
MECSoD5	I wondered whether the virtual environment presentation could really exist like this.
MECSoD6	I took a critical viewpoint of the virtual environment presentation.
MECSoD7	It was important for me to check whether inconsistencies were present in the virtual environment.

MECSoD8	It was not important for me whether the virtual environment contained errors or contradictions.
MECDSI1	I am generally interested in the topic of the virtual environment.
MECDSI2	The virtual environment corresponded very well with what I normally prefer.
MECDSI3	I have felt a strong affinity to the theme of the virtual environment for a long time.
MECDSI4	There was already a fondness in me for the topic of the virtual environment before I was exposed to it.
MECDSI5	Whenever I had a choice, I would decide to deal with the topic of the virtual environment.
MECDSI6	Things like the ones in the virtual environment have often attracted my attention in the past.
MECDSI7	I just love to think about the topic of the virtual environment.
MECDSI8	In the past, I have spent a lot of time dealing with the topic of the virtual environment.
MECVSI1	When someone shows me a blueprint, I am able to imagine the space easily.
MECVSI2	It's easy for me to negotiate a space in my mind without actually being there.
MECVSI3	When I read, I often have a precisely detailed image of the described surroundings in my mind's eye.
MECVSI4	When I read a text, I can usually easily imagine the arrangement of the objects described.
MECVSI5	When someone gives me directions to a place, I can picture the route as though I were watching a film.
MECVSI6	When someone describes a space to me, it's usually very easy for me to imagine it clearly.
MECVSI7	I can vividly imagine how small I would seem at the foot of a high mountain.
MECVSI8	When a picture shows only part of a space, I can clearly imagine the rest of the space.
	Additional Bespoke Questions
HYPOTH	Please state briefly what you believe the experiment was trying to show? If you do not know
HELPER	The other participant's behaviour was genuine

APPENDIX L: SAMPLE ANALYSIS: SHELLY BROWN

This is the result of an individual analysis under IPA (see Chapter 4). Each participant was analysed independently prior to consideration of drawing together the individual superordinate theme to enable the analysis presented in Chapter 5.

Shelly Brown is a white female of the English-Speaking cultural grouping. Shelly Brown uses a Laptop and is helped by the confederate.

The analysis of the interview identified twelve superordinate themes:

- Excitement and Exploration of Place
- Feeling of Being in a Real Place
- Navigation splits focus
- Anxiety about messing up from uncertainty
- Feeling of Embodiment and Touching
- Intentionality: Conflicting Agenda between task and exploration
- Immersion in Task
- Gratitude from Helping
- Humanisation of the Avatar
- Muted Feelings towards the confederate
- On-going Social awareness
- Distinction between task and place

Excitement and Exploration of Place

The striking aspects of Shelly Brown were the level of excitement and the sense that she is present in a natural place from the first moment in the training session. The training session was based upon an Island and was a novel experience, which excited her.

> **Shelly Brown**: *I was excited It was something new to me, so I was interested*
> **Interviewer:** *and erm did you feel, what place did you feel you were in?*
> **Shelly Brown:** *A new city like I was you know I was in another country exploring for the first time.*

This strong emotion was expressed in her voice in relating to places as real places such as a city or country. Her desire to explore the island she described as appealing.

> **Shelly Brown:** *And because it was an island it sounded appealing, so I just wanted to go around.*

This emotional desire to explore was also reflected later by her being enticed to enter the building by seeing a way in despite thinking she ought to wait for instructions:

> **Shelly Brown:** *Because yes and then I did not see a box, so I became confused. so that it when I oh I might have to wait for this instructions so, but I saw a way in to the building, so I thought I would go in.*

Alongside this desire to explore was her sense of journey and associated pleasure:

> **Shelly Brown:** *Erm … and yet at some point it just felt like I was there. The sign said the way in. (inaudible) felt like going somewhere nice.*
> **Interviewer:** *So, you enjoyed it?*
> **Shelly Brown:** *Yes, yes, o yes, I did.*

This pleasurable sense of journey is contradicted in her questionnaire response where her overall sense having been on a journey was only given relatively low ratings.

Feeling of Being in a Real Place: Drawn in Emotionally

Shelly Brown described strong emotional feelings associated with the real place, suggesting it is the emotions that lead to the virtual place feeling like a real place. This built upon her earlier references to exploring a city and country in terms of a real place. She expressed this experience of real place explicitly as:

> **Interviewer:** *And did this still - a real place or non-real place?"*
> **Shelly Brown**: *Yes, yes real place, I was drawing with all my emotions to the place like I was there, yes, I was [feeling there].*

She explicitly related the relationship between her emotions to the computer-generated place and implicitly in the excitement and passion of her interview answer. Shelly Brown described how she was not consciously aware of when she felt in the real place, lost awareness of how long she had been there and the pleasure she felt whilst there.

> **Shelly Brown:** *Erm … and yet at some point it just felt like I was there. The sign [to the building where the task was held] said the way in. (inaudible) felt like going somewhere nice.*

Navigation splits focus

The feeling of embodiment and being in a real place was not continuous, but could be disrupted by navigation matters, such as using the keyboard. This Shelly Brown attributed to a lack of

familiarity with navigating the avatar. Even so, she described this as affecting half of her attention not all of it.

> **Shelly Brown**: *Erm I had to concentrate on the navigation like the keys*
> **Interviewer:** *Yes*
> **Shelly Brown:** *I am not used to this, so I was focusing half of my attention onto this and just moving.*

Feelings of Embodiment and Touching

Shelly Brown's experience of being in a real place extended to her body with a strong sense of wanting to physically interact and touch objects with her real limbs, both during her initial training and during the main task whilst pushing boxes and pressing the finish button. This she expressed with great passion and emphasis on wanting to use her real arm and hand as:

> **Shelly Brown**: *That's it. (Laugh) erm and then I messed it up, so I decided I would just finish, especially with the finish button, I was like, you know, wanting to touch it with my real, my arm, my hand.*
> **Interviewer**: *You wanted actually wanted to reach out?*
> **Shelly Brown**: *Yes.*

The avatars and virtual world interface used in this study had a limited scripted ability to reach out when touching which is associated with mouse/controller buttons or keys rather than synchronisation with her biological hand and arm movements. Hence, her experience of physical embodiment was limited in its practical application.

Anxiety about messing up from uncertainty

In addition to the emotions such as excitement, other significant emotions involved anxiety about messing up the tasks and study:

> **Interviewer**: *During the actual training session itself you wanted to explore the whole island?*
> **Shelly Brown**: *That's it. (laugh) erm and then I messed it up, so I decided I would just finish.*

Shelly Brown discussed two aspects of anxiety, that associated with messing up and that associated with the task. Her anxiety about messing up led to her disengaging from activities such as exploring (see quote above) whilst her anxiety about the unknown upcoming tasks triggered her engagement with preparatory activities:

> *Shelly Brown: Yes (laughs), erm, I just know that I had to do something, like to do*
> *a task so I was kind of not being nervous but being anxious what I would be asked*
> *to do with this place. erm, that is what I was thinking, I was just preparing myself*
> *Interviewer: Anxious?*
> *Shelly Brown: Yes.*

This anxiety about messing up was also related to the benefit of emotion Gratitude from Helping Theme discussed below.

Immersion in Task

Shelly Brown was highly immersed during the task where she concentrated to the extent that she lost an awareness of other things including movement of her natural hand, which had Galvanic Skin Resistance (GSR) probes attached.

> *Shelly Brown: Another thing I noticed myself doing I was concentrating on the*
> *task so much that you know at beginning. I was resting my hand on the table and*
> *then my hand was like this because I don't know because danger may be all I was*
> *just so focusing upon the task that I did not realise I was moving my hand.*
> *Interviewer: How aware were you of other things around you?*
> *Shelly Brown: No, I was just in the task. I was just focusing on like just doing it.*

This high level of immersion in the doing of the task she described as a state of "just in the task".

Distinction between task and place

Whilst drawn in, immersed and losing awareness of both the task and the place, Shelly Brown felt able to distinguish between feeling of being in a place and in the task, which she described as "someone on a computer" or "in the task".

> *Shelly Brown: Yes, because I was drawing my, whole of my emotions to the place*
> *like I was there, yes, I was feeling there. And then I have to do something in a bit,*
> *no place, someone on the computer.*

Intentionality: Conflicting Agenda between task and exploration

Intentionality, as with emotion, was reported throughout her virtual experience. This occurred both at the micro level e.g. controlling the avatar movement, but also the strategic level with the desire to follow the study tasks and her personal desire to explore the virtual environment

presented in the theme 'Excitement and Exploration of Place'. Shelly Brown also recognised that there was an up and coming task and she was being given instructions.

This led her to either push the barriers e.g. exploring the barrier or ignore instructions e.g. waiting. The room at one level was to prepare for the task at another level to open door and sign she found inviting.

Disobedience

This conflict over the strategic agenda resulted, on occasion, in choices to disobey explicit instructions and to formulate her own aims.

> **Shelly Brown:** *When the music stopped there were instructions to go to the room*
> *I did not go because... So, it says I have eight minutes.*

She broke the instructions and continued on to explore, so leaving the park early to go into the main room where the tasks and meeting with the confederate was planned.

This sense of excitement and desire to be explore a real place originated early, however, the emotion was excitement about the virtual environment as a parallel place.

> **Shelly Brown:** *It said go and touch the large box for more instructions, but I could*
> *not see a large box.*
> **Interviewer:** *Okay*
> **Shelly Brown:** *Maybe because I was early. (Laugh)*
> **Interviewer**: *And em, you did quite a bit of exploring I think.*
> **Shelly Brown:** *Oh yes, and especially during the training I did exploring there..*
> *(laughs) erm there was sign saying that you can go on like, after the finish but that*
> *you can go on and explore.*
>
> **Shelly Brown:** *When the music stopped there were instructions to go to the room*
> *I did not go because. So, it says I have eight minutes.*
> **Interviewer:** *Yea*
> **Shelly Brown**: *And then that I will go to another place.*
> **Interviewer:** *Yep*
> **Shelly Brown:** *But I think I went to the place before the eight minutes*
> **Interviewer:** *yes (smile)*
> **Shelly Brown:** *Because yes and then I did not see a box, so I became confused. so*
> *that it when I oh I might have to wait for these instructions so, but I saw a way in*
> *to the building, so I thought I would go in.*

Social Aspects: Muted Feelings towards the confederate

In contrast to her excitement towards the physical and spatial environment or the anxiety and focus upon the tasks, Shelly Brown's feelings towards the confederate were relatively muted. Her feelings were more considered or deliberative and, rather than welcoming the presence of the confederate, she did not mind her presence.

> *Interviewer: Your feelings about the towards the other participants?*
> *Shelly Brown: Oh I was very deliberative. Like in general?*
> *Interviewer: In general (confirming)*
> *Shelly Brown: I didn't **mind** them being there…*

Social Aspects: Humanisation of the Avatar

Whilst her feelings towards the confederate were muted, she accepted fully that the confederate was human, evidenced by her use of "*someone*" (a person) or "*them*" rather than it. She attributed roles to her, firstly as an official helper and latterly as another participant. At no point was any doubt about the humanity of the confederate questioned or the confederate's avatar raised.

> *Shelly Brown: So, I thought this was someone come to help me out. I did not realise it was another participant until the monitor, when you said go to the right and the other participant goes to the left.*

Social Aspects: On-going Social awareness

There was an ongoing social awareness of the confederate but do no desire to directly engage or talk to the confederate. This awareness was especially during the box pushing exercise the participant and confederate came close together but the target of instructions from the boxes giving instructions was confusing for Shelly Brown.

> *Shelly Brown: … But what confused me was when I was moving the box and it said… erm… when you move it to the right, that's under testing [a test run of the exercise?], touch. But maybe they were touching it before me? So, in the chat place I was seeing where they have to move theirs so wasn't sure of this was mine or this was theirs.*

Social Aspects: Gratitude from helping

Gratitude was felt from the act of helping but was not expressed in particularly exuberant tone. This was despite the relatively muted feelings towards the confederate. No gratitude was expressed as a result of the participant as the official helper in response.

> **Shelley:** *That is why I was getting a bit confused. Erm... But then she helped me (laugh) so I was grateful. (emphases grateful tone).*
> **Interviewer:** *How did you feel about that? You felt grateful that was the word that came through.*
> **Shelly Brown:** *Y*es, close just sitting there standing there and ... erm ... Getting worried again that I'd messed it up and she came and helped to me*,* so I was... grateful."

This gratitude, she described, as flowing from the participants fixing of her fixing her problem so alleviating her worry about messing up with no mention of an ulterior motive or association with the studies aims.

Qualitative Analysis of the questionnaires.
The questionnaires are focused upon spatial presence and gratitude hence the themes with relatively little mention of emotions other than gratitude.

She had almost no prior interest or experience of virtual environments or gaming and no interest into any personal meaning and negligible interest in the physical reality of the environment. She was not bothered by any discrepancies here about these aspects.

The main impression was of a woman very highly focused upon the spatial aspects and how the different parts of the virtual environment relate to each other.

In terms of spatial presence, she had a high sense of being located in the environment with moderate feelings of being there or her 'self' being in the virtual environment. She was very action focused and felt very much in the action and able to manipulate and interact with objects which she felt were natural and the interactions plausible.

As in the interview she had a strong desire to explore but a lesser sense of journey.
She also noted that her emotions were relatively muted, and she felt these did not influence her. Despite any anxieties her overall experience was enjoyable.

She was highly grateful and appreciative over the confederate but, as emerged in the interview, her social emotions and feelings about the confederate were relatively muted, only feeling

moderately positive towards her. Despite this, she was socially aware had a very strong feeling that others, including the confederate, were aware of her. There was a sense of presuming a humanisation of the other avatars and prior assumption, possibly suggested by her adoption of a real-world pseudonym 'Shelly Brown'. This suggests a relatively high level of social presence even if she was not particularly interested in the other participants.

The principal themes are:
- Exploration
- Very highly focused
- Grateful, appreciative but muted emotion
- Socially Aware
- Muted Social Emotions
- Humanisation
- Action Focused
- High Level of being able to act amidst the action
- Highly able to interact
- Highly Located and moderately feeling and self within the virtual environment
- Minimal Interest is virtual reality physical environment
- Natural and Realistic Interaction but unreal objects
- Can interact with objects but not touch
- Spatial arrangements not sizes
- Moderate to low sense of journey
- Highly developed spatial cognitive skills
- Minimal awareness of non-visual sense.

APPENDIX M: PARTICIPANT OVERVIEW IN MAIN STUDY

This section provides an overview of the particular individual's experience in order to increase the transparency of their context, followed by a summary of the super-ordinate themes at the level of the individual. The themes that emerged varied due to the kind of experience and the emphasis on common experiences by the individual.

David Beckham: Version 2 (DK2 Oculus Rift) Headset, Helping and Button Pushing

David Beckham is a white male of the English-Speaking Cultural Grouping. David is a frequent computer gamer and has wide current experience and knowledge of virtual reality, including the headset and touch controllers, and Second Life similar to the platform used in this study.

David upon first entering the park expressed a personal desire and intent to explore both the objects within the environment and people, whilst aware of the wider trans-personal purpose of the research context. This exploration followed a cycle of curiosity, investigation and evaluation where he was happy and content, and he had an increased sense of spatial presence where he explored the building and post box within the park. He noted that there was a lack of variety early on and during this period he felt bored, with less of a sense of presence and less desire to explore. His interest and sense of presence increased when he caught sight of the researcher's avatar. On one occasion, he got frustrated when navigating where his attention switched to the controllers external to the virtual environment.

Whilst David readily evaluated his own avatar as that of himself, and that of the researcher as the researcher's, there was an on-going uncertainty about the identity that lay behind the confederate's avatar, and a suspicion that she may be a form of artificial intelligence. He did, however, feel more positive and there was a slight increase in both spatial presence and being with another. David's sense of both spatial and social presence increased during the communication, however; when he thought about the confederate as not real it diminished.

During the trial there was an on-going interaction between David and the confederate. He was confirming that what he was doing was correct and checking that she was all right whilst competing using his own assumed success measures. There was thus an element of empathy and concern expressed towards the other. This level of interaction suggests a higher level of social presence.

During the gratitude-helping episode David felt grateful for the act of helping as well as the direct benefit and pleasure that he had completed the task. Key for David was the bringing of a positive relationship, similar to that of the initial greeting, that increased social presence. His doubts

about the authenticity of the helping act persisted, which reduced the level of gratitude, whilst making him feel bad for doubting the integrity of the other participant.

This suggests that there is no simple relationship between presence and emotion. Both spatial presence and the pleasure of exploration coincided. Similarly, the frustration associated with navigation, prompted a focus on the external controller, breaking the level of immersion and spatial presence within the virtual environment. The positive social emotions did seem to be associated with increased social presence, however, doubt over the genuine nature of the avatar and her help and feeling guilty for doubting her authenticity may have reduced this. Similarly, concerns and anxiety over not completing may have laid the foundations for increased gratitude by increasing the benefit of the help and any consequent increase in social presence.

The analysis of the interview identified 9 superordinate themes drawn from 182 emergent themes.

The nine superordinate themes are:
- Purpose and Intentionality: Task, Personal, Intrapersonal and Transpersonal
- Curiosity, Exploration and Evaluation Episodes: happier and greater spatial presence
- Lack of variety considered less realistic, less spatial presence, less happiness and less desire to explore
- Anxiety and Frustration from poor interaction
- Evaluating Others: the reality behind the avatar
- Avatar invokes uncertainty but still engages socially and reacts emotionally as expected
- Friendly social interaction increases social presence
- Helping and Empathising with others
- Focus of gratitude: Other, Benefit and Help

Cookie Monster: Version 1 Headset(DK1 Oculus Rift), Helping and Box Pushing

Cookie Monster is a white male of the English-Speaking cultural grouping. Cookie's experience was dominated by frustration, bordering on anger, and later nausea with relatively little interest in the confederate other than a brief desire to attack her. He was, however, amiable and friendly after this experience in the following interview. Whilst feeling immersed, this was no more than his prior relatively passive use of CAVE (VR environments with images projected onto the walls). His immersion was readily broken by his awareness of the researcher's external typing. His mild levels of emotion early on may have been associated with having relatively little to explore, leading him to follow his own desire to explore beyond the park in contrast with the instructions.

He was tempted to test the boundaries of the environment but held back in case he damaged the experiment. He had relatively little emotion early on and considered that there was little to explore. Upon entering the main area, it was not set up in line with the main instructions and he

felt confused and frustrated. He pressed the help button in world but did not get the response he expected (text advice rather than the researcher in-world) but did not notice. He felt frustrated and, in an angry response, started attacking the 'mushroom buttons' (heavy but movable) used in the exercise around the room over a 4-minute period.

He felt little towards the confederate but felt it would be nice to talk. He could use speech but not text, due to wearing the VR headset, so felt unable to talk, given that the researcher had used text to talk. He chose not to initiate conversation with the confederate. He briefly, mischievously, considered attacking both the confederate and researcher, as this was normal within competitive gaming environments, but this was not his main feeling. He felt the navigation was unnatural, with a conflict between the use of the key board, with an avatar and VR headset. There was also growing nausea and conflict between his forward walking direction and the headset (the headset was no longer aligned precisely with this physical head) during the many turning movements. This started to dominate his thoughts until he finally chose to 'bail out' as all participants are advised before entering the virtual experience. He acknowledged that he got sick in other types of virtual environment and had given up gaming due to getting frustrated.

From Cookie Monster's interviews, the ten superordinate themes identified were:
- Gentle curiosity, exploration and emotion – some immersion
- There is a low level of curiosity associated with some exploration.
- Presence similar to a static CAVE
- Own purpose balanced with research purpose
- Minimal social presence and interest in the confederate
- Frustration
- Anger-violence
- Uncertainty over purpose
- Little variety so explore elsewhere
- Gratitude.

Hysteric Monkey: Version 2 Headset (DK2 Oculus Rift), No Helping and Button Pushing

Hysteric Monkey is a white male from the English Speaking (Inglehart & Baker, 2000) cultural groupings. He has a gaming background.

Hysteric Monkey felt relatively little spatial presence until the main exercise. A key aspect arising out of this study was the interaction between the confederate and participant. There was initially a social interaction drawn by curiosity, gender interest and, when the confederate greeted him, a social requirement to respond. He felt, however, unable to respond in kind via typing (his virtual head set prevented this) and hence felt awkward and anxious which led him to disengage and focus upon the task without further engagement.

Despite feeling anxious, there was no increase in spatial presence until the main exercise. Up until this point he felt more like an observer, indicative of lower levels of spatial presence. The initial interest that he brought to this was an interest in the visual fidelity and comparison to the latest computer games that reduced the level of realism for him from the beginning such that he did not feel particularly emotional, with relatively low levels of spatial presence. Navigation problems led to frustration and there was a conflict between being seated in the natural environment and walking in the virtual environment. This frustration led to a break in presence such that his awareness switched out of the virtual environment to the external 'natural chair'. In this case this frustration was not associated with an increase in spatial presence within the virtual environment but could, arguably, be associated with increased spatial presence within the natural environment.

The superordinate themes that emerged from Hysteric Monkey are:

- Psychological and Physical disengagement
- Increasing enactive social presence ultimately reducing social presence.
- Spatial presence not always increase with emotion
- Navigation Problems, Dynamic Coupling and non-transparency of the 'natural chair'
- Role of Intentionality.

Bob Virtual: Laptop Display, Helping and Button Pushing

Bob Virtual is a white female from the Protestant Cultural Grouping. For Bob Virtual there were two interviews due to the interviewer being unwell during the first interview.

A significant feature of Bob Virtual's experience was the unfolding and increasing depth of presence, both social and spatial. In the early stages, she was readily distracted by a pressing external need and intention to attend a meeting, such that she could 'snap' out of the virtual environment. Snapping into the virtual environment was not mentioned. Such snapping out was associated with anxiety over missing the meeting. At this stage, she had a bird's eye view of her avatar as if she was an external observer, especially during early stages which were the less interesting and enjoyable. From this external observer phase, she experienced more immersion as if in a book, and by the end of her experience she was feeling markedly embodied and spatially and socially present. This embodiment was to the extent that she felt as if she was turning to look over her shoulder, which she felt in hindsight, was weird.

The following seven superordinate themes were identified:
- Unfolding Levels of Presence: from observer to embodiment and readily snapped
- Purpose and Intentionality
- Curiosity, Exploration, Evaluation and positive emotion
- Lack of variety reducing Exploration and pleasure
- Evaluating Others: The role of the avatar and identity
- Gratitude: helped, benefit and non-influence on spatial and social presence
- Social Pleasure: Good company,

Peter Parker: Laptop Display, Helping and Box Pushing.

Peter is a white male of the Orthodox cultural grouping. Peter felt relatively calm during the early phase with some exploration involving much running around. During this stage, he was mildly spatially present, feeling more within the virtual environment than out of it, but this significantly increased during the activity involving pushing the boxes around where he was more involved. During this phase, he was partially aware of his surroundings, describing his presence as more in the virtual world than in his physical self, but on one occasion spoke to the researcher directly across the desk.

Upon meeting the confederate, he felt excited and was pleased as it broke his feeling of being alone as he was now with another, an indicator of social presence. However, there was no report of a step change of increase in spatial presence; this occurred during the main exercise. He was aware of the confederate throughout the task, observing her to confirm that his actions were the same as her's. During this time, he compared his level of perceived success at pushing the box around with her's, suggesting a degree of competition, and this helped him feel more positive as a

consolation for his perceived failure to achieve the goals (pushing the box to the correct square) in time. He noted that it was pleasurable that both he and the confederate were doing the same task together. This suggests a growing level of interaction and coincides with his social emotions associated with her presence and behaviour; all indicators of increasing levels of social presence.

He felt appreciative and positive towards the confederate for both her helping with pressing the button to finish the exercise at the end and for the conversation. He expressed a desire to respond and interact in return but was constrained by difficulty typing (one hand had a skin conductance probe attached). During this final stage, he had both increasing positive social emotions and increased social presence. He initially assumed the confederate was a real participant upon meeting. When he started to have doubts, these were set aside as her small talk regarding his name being that of Spiderman, persuaded him she was probably human. There did, however, remain some doubt about how real she was and therefore whether she really helped him. The questionnaire suggested that he was highly appreciative and positive (6) towards her but only moderately grateful (5) reflecting this.

The analysis the nine super-ordinate identified themes were:
- Calm emotionally with some curiosity and exploration and spatial presence
- Immersion, spatial presence and embodiment with activity
- Initial social presence at the start, no step change with spatial presence
- Social presence: ongoing awareness within virtual environment
- Pleasure associated with social interaction and doing the same
- Helping and greeting boost appreciative and positive feelings
- Socially present: desire to respond and interact limited by the interface
- Humanisation of the avatar
- Balance of Intentionality.

Shelly Brown: Laptop Display, Helping and Box Pushing

Shelly Brown is a white female of the English-Speaking cultural grouping. Shelly Brown uses a Laptop and is helped by the confederate. A key feature of Shelly Brown's experience was her level of excitement and desire to explore the spatial location and its objects starting in the initial training environment. This sense of excitement was closely coupled with her curiosity and sense of exploration in a real place and marked feeling of spatial presence. She had a strong sense of embodiment and at times wanted to reach out and physically touch the boxes and objects within the virtual environment. At one point, she felt drawn in emotionally to a place which markedly increased her spatial presence when she entered the main room. In discussing this experience, she clearly distinguished between being drawn into a place and tasks. Anxiety was a key emotion; at one point, anxiety about messing up during training led her to stop exploring, whilst

anxiety about uncertainty related to the task led her to explore further, in order to prepare for the unknown, and to enter the main room before it was permitted.

There was a conflict in terms of intentionality with Shelly Brown wanting to explore, to the extent that she would go against the instructions of the study.

Whilst Shelly Brown had a strong interest in the physical environment, she had limited interest in the social aspects. She fully accepted that the confederate's avatar was that of another real participant, but had little interest, although she did not mind the confederate being there. Thus, there was limited social interaction and social presence although there was an ongoing awareness of the confederate. She did thank the confederate for helping at the end and minimised her worry that she had messed up again. The gratitude questionnaire noted that she felt highly grateful to but not particularly positive towards the other participant.

The analysis of the interview identified twelve superordinate themes:
- Excitement and Exploration of Place
- Feeling of Being in a Real Place
- Navigation splits focus
- Anxiety about messing up from uncertainty
- Feeling of Embodiment and Touching
- Intentionality: Conflicting Agenda between task and exploration
- Immersion in Task
- Gratitude from Helping
- Humanisation of the Avatar
- Muted Feelings towards the confederate
- On-going Social awareness
- Distinction between task and place.

Belle May: Laptop Display, No Helping and Box Pushing

Belle May is a white female of the English-Speaking cutural grouping. This was a particularly long in-world period primarily due to a delay and problems with the confederate logging in. Thus, the period from entering the main room was spent waiting and doing very little. The researcher interrupted twice, first to advise her not to wander too far out of the park (she was looking at the sunset) and secondly, to advise her that there were problems with the logging in from the "other participant". On one occasion she did try to send the researcher a message to his avatar whilst he was helping the confederate to log in. During this phase Belle May was inactive for a number of minutes. This was not raised in the interview and was only noticed when reviewing the video to provide context for the analysis.

A principal feature of Belle May's experience is a near total lack of immersion, spatial or social presence. Associated with this was a minimal level of emotion. She did however, feel bored or frustrated and her overall experience was a negative one. Whilst she did fill boring gaps with some exploration and evaluation of the surroundings, she expected instructions giving guidance. She felt firmly 'in the room' with the researcher so wanted to talk directly in order to ask questions. When the researcher communicated via in-world chat, she described this as weird.

Her interaction with the virtual environment was as the operator of a computer with the focus on a task. She demonstrated no affinity with the avatar or its clothing but treated it as an object through which remote operations located around the avatar could be carried out. At no point did she question that the confederate was human (operating a similar avatar to herself). Despite not being interested in interacting with the confederate, when the confederate began small talk and a greeting she reciprocated in kind using typing yet did not seem to relate to her discussion of dress; she had just picked an avatar object. She regarded computer games as far-fetched and was unable to connect. In contrast to this experience, Belle had felt significant levels of spatial presence, to the extent that she wanted to reach out and touch within 3D films.

She was not without emotion as she felt bored, frustrated and had an overall negative feeling, but this was as someone external to the virtual environment carrying out a computer task which had no impact upon her feelings of presence. Her response was to interact with the researcher in the actual room, to seek his external purpose and directions. How she felt towards the researcher was not explored, but there was a friendly conversation following the study.

The Super-ordinate themes identified include:
- No presence and little emotion
- Focus upon external instructions
- Operating avatar as if computer
- Remote operation of distal avatar actions
- Avatar as an object - no identity
- No social presence or social emotions towards the confederate
- Confederate mask evaluated as a human
- Present in room: virtual chat weird
- Task-focused emotions did not affect presence in world
- Far-fetched nature of virtual games
- Can feel present in 3D films
- Lack of touch made unreal.

Neil Young: Laptop Display, No Helping and Box Pushing

Neil is a white male of the English-Speaking cultural grouping. Neil initially experienced slight emotion whilst exploring the park, driven by his personal purpose to satisfy his curiosity. During this time, he felt, however, that there was little of interest there. On one occasion, he did feel significant frustration focused upon the virtual environment when he got trapped within the park's gazebo and felt increased spatial presence.

He distinguished between his presence due to focus upon the task of freeing himself from the Gazebo, and that of feeling more immersed and both spatially and socially present upon meeting the other participant and the researcher's avatar. This coincided with positive feelings, empathy and pleasure at there being a shared purpose with his fellow participant. Despite, at one level, being aware of using the mouse and upon recounting his experience of typing rather than speaking, he experienced the typing as talking to the other participant.

There was a dynamic and widely unconstrained interaction between his natural self and his avatar (as an object) that he regarded as drawing him into the virtual environment. His desire to converse, assumption that the confederate's avatar was that of a real person and negative feelings of loneliness when separated from the confederate during the task suggests a strong sense of social presence.

There was a sense of separation and loneliness due to the physical barrier (a small fence) and his focus upon the individual task at hand (pushing a box). This made him feel less co-present with the other person, yet there was ongoing awareness and emotional connection in relation to the confederate.

The meeting with the confederate was initially evaluated on the basis of the plausibility of her actions. She acted in a manner which made her real nature plausible. One personal purpose of the task was to compete with the confederate, making him wary and cautious not to talk at first and using his "poker face".

From Neil Young the thirteen super-ordinate themes identified were:

- Slight emotion related to park exploration
- Slight emotion, with mild curiosity, exploration and presence
- Contradiction between natural and virtual
- Negative emotion focused upon VE problem increases presence
- Thwarted personal aim of external purpose gives negative emotion
- Social Interaction and shared purpose feels good
- Increased immersion upon meeting
- Social presence and empathy unfold over time
- Own purpose and need of external purpose

- Evaluation of avatars
- Lone tasks reduce social interaction
- Loneliness and desire to interact on forced separation
- Distinguish between just task and person focus.

There is both commonality and variation in the unfolding experiences revealed by the individual participants. These are examined, and evidence provided in more detail in Chapter 5.

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