Social Presence in Team-Based Digital Games

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Abstract

This thesis explores the concept of social presence in team-based digital games, aiming to enlighten the core elements of social presence in this specific multi-user experience. The thesis achieves this exploration in three main ways, by using a novel approach to establish the core elements of social presence in team-based digital games, by developing a new measure for social presence specifically tailored for team-based digital games, and by exploring the effects of contextual gameplay factors on social presence in a large scale user study. The thesis documents the work carried out over the course of an Engineering Doctorate (EngD) sponsored by BAE Systems, who gave an industry perspective, helped to set the direction of the research and guide it throughout the program. The industry relevance to studying social presence in team-based digital games was the analogous nature of team-based games to virtual training technologies such as simulators and serious games, and the lack of understanding of social elements within these technologies.

The research questions for this thesis were as follows: What is the nature of social presence in team-based digital games? How social presence is affected by sharing a team-based virtual environment with human or computer controlled entities? What other contextual elements encourage or reduce feelings of social presence?

The first set of studies detailed in this thesis were a preliminary exploration of social presence in team-based digital games, a group of short user studies termed experiential vignettes, investigating the effect of agency on user experience. The experiential vignettes suggest that social presence is affected by a player's perception of the other entities in the virtual environment, however the extent of the affect is highly dependent on task. These preliminary studies led to the development of a questionnaire designed to measure social presence in team-based digital games, the competitive and cooperative social presence questionnaire (CCPIG), developed and validated using user studies. The CCPIG was utilized and further validated in a large scale user study which aimed to explore the conceptual crossover between team trust and social presence, and how various contextual variables affected these concepts.

This thesis shows that competitive and cooperative social presence are two distinct concepts, and that there is significant conceptual crossover between social presence and established notions of team trust. This thesis also shows that social presence is highly context dependent, affected by agency, familiarity with other players, team performance, and the nature of the game in which the experience occurs.

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Author's Declaration

I declare that the work presented in this thesis, if not otherwise stated, is my own. This work has not previously been presented for an award at this, or any other, University. Some of the material presented within this thesis has previously been published in the following papers:

Hudson, M., Cairns, P. (2014) Interrogating social presence with experiential vignettes. *Entertainment Computing* 5(2).

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Chapter 1

Introduction

This thesis explores the concept of social presence in team-based digital games, aiming to enlighten the core elements of social presence in this specific multi-user experience. The thesis achieves this exploration in three main ways, by using a novel approach to establish the core elements of social presence in team-based digital games, by developing a new measure for social presence specifically tailored for team-based digital games, and by exploring the effects of contextual gameplay factors on social presence in a large scale user study. The thesis documents the work carried out over the course of an Engineering Doctorate (EngD) sponsored by BAE Systems, who gave an industry perspective and helped to set the direction of the research and guide it throughout the program. The industry relevance to studying social presence in team-based digital games was analogous to virtual training technologies, such as simulators and serious games, and the lack of understanding of social elements within this technology.

Engineering Doctorate

This thesis documents the research completed over the course of an Engineering Doctorate which was part of the Large Scale Complex I.T. Systems (LSCITS) initiative. The LSCITS EngD contained both research and taught components aimed at giving graduates the tools to innovate and solve current and forthcoming challenges in LSCITS. An EngD differs from a PhD in that it is industry focused and an EngD student has both academic and industry supervisors. Each EngD is sponsored by a company which helps direct the focus of the research, this EngD was sponsored by BAE Systems and was specifically advised by the Integrated Aircrew Training and Human Factors groups within the company. Regular meetings between the student, academic and industry supervisors directed the research of this thesis. Therefore, while the nature of the work throughout this thesis is academic, the motivations behind the work come from an industry perspective. From an industrial point of view, the overall aim of this EngD was to contribute in some way towards providing increased training effectiveness for team-based simulations, and the optimization of overall training pipelines which use simulations. This was to be achieved by gaining a greater understanding of how social presence is affected by the various elements of socially complex virtual environments and thus understand the requirements for establishing and maintaining social presence in synthetic training environments. Due to the industrial involvement in this thesis the results will be presented in two ways, in addition to the standard academic PhD format, the thesis will be accompanied by a set of deliverables and succinct guidelines based on the findings of the studies.

Virtual Training Environments

The types of virtual training environment presented by BAE Systems to motivated the work in this thesis were complex multi-user virtual tools used for training air crew. The simulations were not simple virtual representations of a task, for example flying a fast jet, but involved users learning more subtle social capabilities, such as coordinating with ground crew to identify targets. The distinction made was the difference between learning how to *fly*, and learning how to *fight*. The virtual environments which motivated this research can be classified as socially complex multi-user virtual environments, virtual environments which are not merely inhabited by one or two users, but which have the potential to contain numerous users, working in teams to complete various tasks. In these environments there are socially complex relationships between users, with hierarchy, and the potential for competitive and cooperative activity between both humans and computer controlled entities (*bots*). These virtual environments are socio-technical systems, in which the users contribute as much to the experience as the technology.

The concept of a socially complex multi-user virtual environment is probably best expressed in existing examples. In team-based digital games such as *Arma 2* teams can be made up of both humans and/or bots, which can lead to complex and ambiguous social connections between both team-mates and opponents. While the term Shared Virtual Environment (SVE) is sometimes used for multi-user virtual environments [Schroeder, 2002], this term is rather generic and does not reflect the complex social structures which exist in many of the team-based virtual environments discussed in this thesis.

One of the most extreme examples of a socially complex virtual environment is Live Virtual Constructive (LVC) simulation technology. "[LVC] training combines live people, virtual environments and simulated actors to create a better training environment"[Newendorp et al., 2011]. LVC simulations create a mixed reality environment containing live, virtual and constructed elements. These LVC environments can be accessed through various forms of mediation. For example, the first major demonstration of an LVC simulation carried out by BAE Systems consisted of a single live aircraft, two virtual/simulated aircraft and one computer constructed (bot) aircraft taking part in a 2 vs 2 air combat simulation. In this scenario there were two teams, one containing humans, the other containing both a human and a bot, competing against each other, and collaborating with their team-mates and air crews. It is easy to see then why this scenario could be considered as socially complex, with social relationships simultaneously crossing the boundaries of reality-virtuality, agency, and competition and collaboration. Thus the aim of this research was to gain a greater understanding of the social experience of analogous socially complex virtual environments.

Virtual Team Training

Simulations have long been used to help people develop skills across a wide range of domains. From surgical training [Haque and Srinivasan, 2006] to operating machinery in a cargo port [Bruzzone and Longo, 2013], simulations offer an environment in which a wide range of safety critical tasks can be practised without risking human life or expensive equipment. Virtual environments are also used in training teams such as aircrew [Jentsch and Bowers, 1998]. While in the past team members in these training scenarios would need to be collocated, perhaps sharing a physical mock-up of a bridge or building, increased networking capabilities means that team members can take part in virtual training exercises from opposite ends of the country, even the world. Serious games, sometimes refereed to as 'zero-fidelity'[Hussain et al., 2008] simulations in the literature, have also been shown to be useful training tools, able to stimulate behavioural change in reality, and help develop team working skills across a number of safety critical domains [Toups et al., 2011]. However, while team-based simulations and team-based digital games allow geographically dispersed teams to share a virtual place and act within it, the core elements of social presence within these socially complex virtual environments had remained unclear.

Social Presence

There are many elements of the user experience which are relevant to virtual environments, including immersion [Cairns et al., to appear], flow, presence [Weibel et al., 2007], and so on. However, as this project was to focus on team-based virtual environments, and the social dynamics of these environments were not yet understood, it was decided among the student, academic and industrial supervisors that the research should focus on the concept of social presence. For teams in virtual environments to work together, learn together and build trust, a social connection between the team members is important, this social connection is often referred to as **social presence**. Social presence, also referred to as co-presence, is a concept built around the evidence of other humans within a virtual environment [Schouten, 2011]. In this thesis social presence is defined as the feeling of social connection through a virtual environment to another entity. It is the sense of "being together with another"[Biocca et al., 2003]. Technology, no matter how advanced, inevitably reduces the bandwidth of human interaction, and the understanding of social presence in these team-based virtual environments is limited. As virtual training moves from simple virtual representations of a task to complex socio-technical systems, there is a greater need to understand the nature of social presence to ensure the effective and efficient use of the technology. From an industrial perspective the initial motivation behind the study of social presence was gaining a greater understanding of social issues in multi-user virtual training environments, to establish what the required levels of social presence were in different training scenarios, and how required levels of social presence could be achieved and maintained. As the current literature could not provide the answers, the aim of this research was to gain a greater understanding of the nature of social presence in analogous team-based virtual environments, team-based digital games. Thus the main research question for this thesis was, what is the nature of social presence in team-based digital games? As the research progressed it became clear that to answer this one question there were a number of sub-questions which need to be addressed, such as how social presence is affected by sharing a team-based virtual environment with human or computer controlled entities, and what other contextual elements encourage or reduce feelings of social presence?

Team-Based Digital Games

At the beginning of the EngD process it was decided to conduct studies using, predominantly online, team-based digital games rather than simulators. The use of games as research instruments is by no means a novel concept, with conferences and special journal issues on the topic [Calvillo Gámez et al., 2010, Calvillo-Gámez et al., 2011]. The decision to use games in this research was based on three main factors, availability, relevance, and the significance of the medium. In terms of availability, team-based digital games are far more accessible for conducting research than simulation technologies such as dome simulators. In terms of cost, LVC simulations are simply prohibitively expensive: live flight time of a fast jet is around one hundred thousand pounds per hour. While simulators are not unobtainable they offer a substantial limitation in the availability of expert users. As the research in this thesis was to focus on social presence, competency at using any equipment was felt to be of high importance to the validity of the studies. If a participant was struggling with learning to effectively negotiate a virtual environment then their social connections within the game would not represent that of a prototypical user of either team training simulations or team-based games. So that participants could think, feel, and act as naturally as possible in these socially complex virtual environments it was important that they be expert users of the medium of the research. While studies using fast jet simulation would require expert pilots to be valid, there are millions of expert users in gaming communities who are happy to play the game they enjoy to take part in a user study.

In addition to the availability of users many team-based digital games have ties to team-based training in defence settings. One of the most well known of these ties is the relationship between the *Arma* series of games and the *Virtual Battle Space* training simulator which, while developed largely separately, share a common engine, content and features. Other game engines like the CryENGINE have also been used to develop maritime simulations, and the flow of concepts and technology is not unidirectional, but flows from the domain of digital games to simulations and back again. In *Arma 3* for example, a mode of play called 'Zeus' allows one player to act as a games master creating and evolving an online scenario for a group of players to create a more dynamic and unpredictable virtual environment. The idea of a single human commanding the enemy forces and directing a virtual scenario was no doubt inspired by the very same type of involvement by the controllers of training simulations. Not only are modern warfare based team-based games increasingly having practical applications in training simulations but more abstract games, sometimes refereed to as 'zero-fidelity', have been shown to be viable tools for training team-based capabilities [Hussain et al., 2008, Toups et al., 2011, Craighead, 2009].

Many team-based digital games also share many common elements with team training simulations, such as cooperating and competing teams, direct and indirect interaction between users, groups and subgroups of users interacting, the potential presence of human and computer controlled entities, and the potential for a mixture of friends, acquaintances, and complete strangers interacting. However, in addition to the conceptual similarities between team-based games and some team-based training simulations, team-based digital games warrant investigation on their own merit. Team-based digital games are some of the most populous contemporary games played online, games such as *Dota 2* & and *Counter Strike* series attracting hundreds of thousands of players each day, making them highly significant cultural artifacts.

Contributions

The contributions of this thesis fall into two categories, academic contributions based around answering the research questions, and industrial deliverables. The industry deliverables were formed from the implications for design which arose from the academic studies, therefore there was no conflict between the industry and academic output. One of the core academic contributions was the development and validation of a new measure for social presence in team-based digital games, the CCPIG questionnaire. This questionnaire is not only novel in that it is the first social presence questionnaire specifically designed to measure the concept within team-based games, but it also contributed to answering the research questions of this thesis. The three research questions consist of:

- What is the nature of social presence in team-based digital games?
- How is social presence affected by sharing a team-based virtual environment with human or computer controlled entities?
- What other contextual elements encourage or reduce feelings of social presence?

The answers to first question revealed that social presence in team-based digital games can be split into two distinct concepts, competitive and cooperative social presence which share a number of core elements; the awareness of other consciousness, Theory of Mind, an awareness of the social significance of one's actions, task focus, and social joint commitments. The conceptual split between competitive and cooperative social presence is novel to this research. Chapter 3 focused on answering the second research question, using a novel approach in exploring the difference human or bots make to the experience of a digital game by introducing ambiguous agency to push at the preconceptions of users. The answers to the second research question suggested that sharing a virtual environment with a bot and with a human can create substantially different experiences. However the importance of the agency, and a knowledge of the agency, of an entity within a virtual environment is highly dependent on context. Chapter 5 focused on answering the third research question and exploring what contextual elements have an effect on social presence. The contextual elements which served as the main variables for the team trust and social presence study were performance, interpersonal familiarity, perceived challenge, monitoring behaviour, and the games played by respondents. The answers to this research question suggested that the contextual element with the most substantial effect on cooperative social presence was performance, with respondents on winning teams feeling far higher levels of cooperative social presence towards their team-mates. Familiarity also correlated to a moderate degree with cooperative social presence, with high familiarity appearing to contribute to cooperative social presence.

In terms of industry focused contributions, the deliverables from this thesis provide a set of implications for the design of virtual team-training scenarios. Insights into the effects of humans and bots within team-based games are used to provide guidance for the use of both, insights into the effects of chaotic situations on team awareness and used to highlight how such effects could be designed in or out of a scenario to achieve specific challenges, and insights into how social dynamics such as team size and social disparity between team-mates are used to highlight potential negative effects on the development of team trust. Essentially these deliverables are a guide to help trainers choose/design the right tool for the job.

1.1 Thesis Structure & Methodology

The work in this thesis used a variety of research methodologies to answer the research question and to solve the problems presented by studying the ill-defined concept of social presence. In Chapter 3, experiential vignettes are introduced, which take the form of experiments, quantitative or qualitative studies which can be quickly set-up, run, and evaluated. These are used as quick probes, rapidly providing multiple perspectives on a concept upon which further study can be based. Chapter 4 relies on more a established methodology set out by Kline [2000] in the development of a new questionnaire based measure for social presence, and Chapter 5 uses this new measure in a large scale user survey in which the data was statistically analysed.

As stated, while the work in this thesis is inspired by defence orientated training simulations, the studies here do not use military simulators nor do they involve military personnel as participants. All studies in this thesis use digital games as an experimental tool, as the virtual environments in which the studies were conducted. Games offer a similar experience to training simulations, providing a virtual environment in which people act, and indeed some training simulations share software with training simulators, the *Arma* series of games and the *Virtual Battle Space* simulators for example. Games allow the experimenter to control variables or at the very least have a comprehensive understanding of the virtual environment they are dealing with. Most critically for a thesis such as this, games offer a high degree of availability, both in terms of the actual software, but more importantly in access to expert users. In addition to the relevance to virtual training environments, team-based games such as the *Arma* series and *Battlefield: Bad Company 2* were chosen for study over more explicitly social games such as *Second Life*, *WoW*, or other *massive multiplayer online role playing games* (MMORPG) to highlight the phenomenon of social presence in less obvious multi-user virtual environments. In an MMORPG one of the core elements of game-play is the social interaction and the feeling of sharing the virtual world with other players, this is the essence of an online role playing game. The Daedalus project, a substantial study of MMORPG players, states that there are many different motivations to play these games, socializing, the accumulation of wealth and tangible power, exploring and being part of a fantasy world, and so on [Yee, 2007, 2009]. Yet all these motivations are essentially social, it would be therefore quite unremarkable to discover a high level social presence felt by the players of these games. While MMORPGs can certainly provide insights into social presence in virtual environments, MMORPGs share fewer elements with contemporary team training simulations than team-based digital games such as the *Arma* series, and thus are unlikely to provide valid insights into the motivating technology behind the work in this thesis.

Community Survey Data

One of the key features of this research is the ecological validity of much of the data, particularly in Chapters 4 & 5. In Chapter 3 participants and respondents in each study were experienced gamers but a number of the studies took place in what could be considered unnatural (lab) settings, however in Chapters 4 & 5 all the data came from "the wild", from real gamers playing games they wanted to play, in a way they usually play them. For the larger scale studies in this thesis, participants were recruited from game community forums, played games they already owned and were familiar with, and asked to fill out an online questionnaire after a typical game play session. The benefits of conducting online surveys are savings in terms of time and money, potentially high respondent numbers, and access to unique populations [Murthy, 2008, Van Selm and Jankowski, 2006, Wright, 2005]. In terms of digital games research access to unique populations is particularly true, with niche communities built around specific games or genres. Of course online surveys have inherent challenges, with potential sampling bias, self selection bias, ensuring validity of data, and the potential for hostile responses from communities if they are not engaged with proper care or respect [Andrews et al., 2003, Wright, 2005]. However, in this thesis the risks were offset by active and respectful engagement with communities and careful analysis of the data, and so the benefits to this thesis of large ecologically valid data sets gained from the community surveys far outweighed the risks of the methodology.

Research into digital games and games communities comes in a wide variety of forms with varying degrees of ecological validity. Online surveys are common in studies of gaming attitudes and community habits, particularly in the context of MMORPGs [Park and Chung, 2011, Griffiths et al., 2011]. One of the most notable, in terms of its scale and novelty at the time, games research projects was the Daedalus Project [Yee, 2009]. The core methodology for collecting data in the Daedalus Project was conducting user surveys, both in the form of multiple choice questionnaires, and using more open ended survey questions. The project's strengths lay in focusing on one particular type of game, surveying its players, and thus gained a comprehensive view of a community. A detailed account of the process of conducting the community surveys to gather data appears in the beginning of Chapter 4. Respondents in the community survey studies were recruited on a self-selection basis from community forums creating unavoidable bias. We can assume that all of the respondents were to some extent invested in the game which they played and, as members of the community forums, active within the game community. However, while there is inevitably some bias as self-selected owners of the games, the respondent's familiarity with the game meant that the questionnaire responses were unlikely to be encumbered by a lack of game proficiency. In a study which is focused on social engagement and not immersion, flow, or gameplay mechanics, a low level of proficiency in a game could lead to respondents being unable to consider social issues as they struggle to master the basics of the game play. In other words, the bias which comes with respondents which are familiar with the game is likely to be less detrimental to a study about social presence than the bias which would occur if inexperienced players were used. In addition, the community survey data is from real gamers, playing the games they want to play, within a familiar context and so the ecological validity of this data is likely to be high. Indeed the benefits of the level of ecological validity of the data far outweigh the risks of online recruitment and bias.

Chapter 2: Background

Chapter 2 provides a review of the literature relevant to the topics of this EngD. The literature reviewed in this Chapter is highly interdisciplinary as presence is pertinent to simulation, virtual reality, teleremote systems, digital games, and mixed/augmented reality. The review provides an overview of general presence theory, the various interpretations of social presence, and takes an in-depth look at the notion of fidelity, considered an important element of training simulation. Chapter 2 highlights the lack of any definitive definition of social presence across numerous research fields, the lack of any suitable measure for social presence in team-based virtual environments, and the importance of conceptual fidelity in training simulations. Chapter 2 then details the research questions which arose from the initial motivation for the EngD, informed by the results from the literature review.

Chapter 3: Social Presence in Team-Based Digital Games

The lack of a sound theory of social presence from the literature led to the need for an exploration of the concept. Chapter 3 is a collection of short qualitative and quantitative studies that have been termed 'experiential vignettes'. These studies were a preliminary exploration of social presence in socially complex virtual environments, focusing on understanding how agency and ambiguity affected user experience. The experiential vignettes were quick probes into a concept, experiments and quantitative or qualitative studies which were quickly set-up, run, and evaluated. They are small-scale studies that provide opportunities for participants to talk about their experiences in the context of having played particular games, allow for ethnographic style observations of user behaviour, and provided behavioural and/or discourse data which can be analysed. These multiple small scale studies provided a guide to further research, acted as test-beds for methodology, and were used to rapidly probe a single complex concept, social presence, from a variety of perspectives. In summary, Chapter 3 combines the results from a multi-methodological approach and sheds light on the concept of social presence in socially complex multi-user virtual environments.

Chapter 4: A New Measure for Social Presence

Following the experiential vignettes of Chapter 3 it was determined that there was a need for a new measure for social presence, tailored for the team-based digital games which were the key tools of this research. Other social presence questionnaires were unsuitable due to the media used in their development and the subsequent lack of reference to interactivity, while the only questionnaire designed to be used with games (the SPGQ [de Kort et al., 2007]) was unsuitable for cooperative game play. The development of the new questionnaire followed the process set out by Kline [2000], which consisted of creating an item pool and using item analysis of the data from user studies to reduce the pool to an effective and succinct set of items that form the final measure. Factor analysis was then used to validate the questionnaire which was called the Competitive and Cooperative Social Presence in Gaming (CCPIG) questionnaire.

Chapter 5: Team Trust & Social Presence

Chapter 5 documents a user study which sought to explore the conceptual crossover between social presence and team trust in team-based games, in addition to establishing how the context of play affects these concepts. The study served as the first major test of the CCPIG questionnaire, using it to gather data from gamers across a number of communities. The study used a predominantly statistical methodology to analyse the data. The study found a considerable conceptual cross-over between accepted views of team trust and cooperative social presence, and also found that performance and familiarity generally had a substantial effect on both concepts. The shift in focus from social presence to team trust was influenced by the industrial supervisors of the EngD. This Chapter forms the main body of the thesis and is the culmination of the exploration and preparation of Chapters 2, 3 and 4.

Chapter 6: Discussion & Conclusion

The discussion begins by answering main research question and sub questions of: what is the nature of social presence in team-based digital games, how social presence is affected by sharing a team-based virtual environment with human or computer controlled entities, and what other contextual elements encourage or reduce feelings of social presence? The discussion gives an overview of the results of Chapters 3-5 and the potential implication these results have for the design of virtual team training scenarios. The discussion also explored how the results of the thesis could be evaluated. The conclusions of the thesis cover the nature of the research, outline the core contributions made, and discusses potential topics for future work.

Appendix 2: Deliverables

In addition to the academic discussion a set of succinct deliverables have been produced to reflect the client focused nature of the research conducted throughout this thesis. These deliverables are in the form of insights which have implications for the design of virtual team training scenarios.

Chapter 2

Background

This section reviews previous work relevant to the topics of this thesis, using games to explore social connections through virtual environments, inspired by team-based training simulations. This review covers a wide range of topics which inform the interpretation of user experience in virtual environments in this thesis. The core concept of this thesis is social presence, however there are a wide range of topics which must considered when exploring the notion inhabiting virtual environments. First, presence in general and the various theories of this experience are explored to contextualize the concept of social presence. Immersion and flow, while not the focus of this study, are central to the experience of virtual environments and thus are reviewed here. The penultimate topic of this review is one of the central issues in training simulations, the concept of fidelity and how it might affect learning. The notion of fidelity is central to much of the research into virtual reality training, from the way users control their actions in a virtual space, to how real a virtual situation feels. Finally this review provides a foundation for the concept of 'competency', a term used in industry to refer to the abilities of trainees.

2.1 Presence

Throughout the literature the term presence refers to a broad range of concepts, from the quite general feeling of 'being there' within a virtual environment, to the subtle feeling of sharing a virtual place with another consciousness. Presence in all its forms is a central concept in the use of virtual environments and so it is important to clarify the current definitions, and understand the strengths and weaknesses of previous research in the area.

2.1.1 General Presence Research

In the field of presence research it seems that as much of the literature seeks to define the term as explore the concept. This is no great surprise as presence is an entirely subjective phenomenon. Presence (or telepresence) is certainly a philosopher's gold mine [Floridi, 2005], or perhaps bottomless pit, and though it offers a great amount of fodder for ivory tower musings on the nature of reality [Mantovani and Riva, 1999], research in virtual reality (VR), augmented reality (AR) and digital games also has the potential to offer insights into more practical fields such as virtual training, situation awareness, human perception, unmanned vehicle control, the treatment of psychological disorders, and so on. Although the notion of presence throughout the literature is fairly fuzzy, one thing which most researchers agree upon is that there are various types of presence, the main differentiation being between spatial and social presence [IJsselsteijn et al., 2000]. However, these two distinct types of presence are not mutually exclusive and there may be some interplay between the two which is as yet unexplored. For example Ravaja et al. [2006] found that sharing a virtual environment with another human, a social issue, increased spatial presence. A concept referred to as 'self presence' also appears in the literature but is a far more philosophical issue and so will be discussed later in this review in the context of learning in virtual environments.

It is generally accepted that presence is useful within simulation based training. Alexander et al. [2005] states that presence "increases engagement with training content. Heightened engagement should increase students time on training tasks. Time on task is, of course, among the strongest predictors of the acquisition and retention of knowledge and skill", and Lombard and Ditton [1997] argue that "presence is valuable in a training tool because it increases motivation and provides a more engaging experience". Quoting Lombard and Ditton [1997], Schuemie et al. [2001] suggests that presence is a result of the combination of social richness, realism, engagement, and social action within the VE. Kalawsky [2000] succinctly supports this multi-faceted approach to defining presence as a multi-dimensional parameter, an "umbrella term for many inter-related perceptual and psychological factors"[Kalawsky, 2000]. Ijsselsteijn and Harper [2001] define presence as a "complex, multidimensional perception, formed through an interplay of raw (multi)sensory data, perceptual-motor activity and various cognitive and emotional processes".

Usoh et al. [1996] define presence as simply a psychological sense of 'being there' in a virtual environment, a definition shared to some extent by much of the literature on the subject [Schubert et al., 2001, Slater et al., 1994, Slater and Wilbur, 1997]. Usoh et al. [1996] go on to hypothesize that presence is enhanced by 'grounding' a person within the virtual environment through a virtual body, and by "increasing the match between proprioceptive and sensory data". In other words by creating the illusion of physical presence and tangibility of the surroundings, a person will feel a greater sense of spatial presence. Schubert et al. [2001] echo this sentiment, describing presence as the representation of potential bodily actions within the virtual environment, a suspension of disbelief, and a judgements of realness. This action centred view of presence is similar to a concept referred to as *agency* [Herrera et al., 2006], "the satisfying power to take meaningful action and see the results of our decisions and choices"[Murray, 1997]. Floridi [2005] distinguishes this observable presence from technologies which only allow a *telepistemic access* to a remote location, technologies such as radar, sonar, CCTV, etc. For example, if we watch a CCTV video feed we are not present at the videoed location in any conceptual way. We may not interact with the location as if the technology had removed a wall between us and it. Instead it gives us an expanded view of the world, another source of information to perceive, bringing us knowledge of a remote location.

A study by Bouchard et al. [2009] suggested that there is a specific presence part of the brain (the parahippocampal cortex) which deals with the current perception of places, providing contextual meaning of sensory information, specifically defining scenes in terms of a '*there*', rather than as a '*why*' or '*when*'. The physiological effects of virtual worlds is evident in a number of research fields, such as the treatment of phobias [Rothbaum et al., 2000], anxiety [Pertaub et al., 2002] and in cognitive rehabilitation [Munih et al., 2009]. An experiment by Brogni et al. [2007] studied the ECG signals of participants in a virtual environment to investigate how stressful virtual environments were represented in the brain. The results of the study suggested that entering an immersive virtual environment creates a stressful situation, however stress levels decrease in more "natural-looking and engaging" environments. Brogni et al. [2007] hypothesized that this was due to participants becoming comfortable within the environment, but also predicted that as participants spend more time in the virtual environment they may become aware of "problems with the system, which itself may be a stress inducer". These physiological responses in virtual environments may be regarded as interesting yet of minimal consequence to current virtual reality training or control systems. However as the brain computer interface (BCI) becomes a more realistic concept, this issue may be of huge importance to control systems.

2.1.2 Presence: The Mediation Debate

The subject of mediation, the way in which something is presented to us, is a bone of contention throughout the presence literature, with the main divide being between those who believe presence occurs when we do not perceive the mediated nature of a virtual environment, and those that believe mediation is largely irrelevant. The International Society for Presence Research[1] state that social presence (and "*co-presence*") "occurs when part or all of a persons perception fails to accurately acknowledge the role of technology that makes it appear that s/he is communicating with one or more other people or entities" and "that the person or people with whom s/he is engaged in two-way communication is/are in the same physical location and environment when in fact they are in a different physical location"[for Presence Research, 2000]. Thus the International Society for Presence Research define their view of social presence by failure of the human mind to acknowledge the mediated nature of the experience, Lombard et al. [2000] support this, suggesting that presence is the "perceptual illusion of non-mediation"[Lombard et al., 2000]. However, there are arguments against this 'failure' of the mind with regards to social presence. Mantovani and Riva [1999] argue against this view of a failure to perceive mediation.

> "*Speaking of mediation means speaking of culture, i.e., a network of instruments making up the everyday reality in which we live. In this view, it is impossible to continue to think that unmediated, pre-technological and pre-cultural 'natural' objects exist. We cannot speak of action at a distance, teleoperation or presence in virtual environments without thinking of cultural mediation, of which technology is an important expression.* [...] *There is no 'natural' environment, passively received and registered by social actors. If we start from the principle that all reality is socially constructed, we have no difficulty in accepting the mediated character of experience which social actors have of environments*"[Mantovani and Riva, 1999]

In other words, all we perceive is mediated and whatever our view of reality, is external, internal, or a cycle of both, mediation does not matter for practical usage of virtual environments because technology is just another level of mediation, along with our social and cultural filters. This idea of ubiquitous mediation is echoed in a number of theories, most notably activity theory [Bødker and Andersen, 2005].

Cairns and McManus [2011] argue that presence occurs "when the hypothesis on the virtual environment wins out over that of the real world. [...] When we really are somewhere, there is no sense of presence as there is no conflicting perceptual hypothesis to be resolved". Supporting this view Sanchez-Vives and Slater [2004] argue that while presence is the phenomenon of acting and feeling as if one is in the environment created by computer displays, one is simultaneously conscious of the fact that there is no environment. Sanchez-Vives and Slater [2004] go on to suggest that if "immersive virtual environment systems were able to deliver the perfect illusion of being and acting in a virtual world then probably the issue of 'presence'

[1] http://ispr.info

would never have arisen" [Sanchez-Vives and Slater, 2004]. Floridi [2005] also suggests that presence is not a 'failure to perceive' the mediation, but can be defined by an observable presence, in other words, we are present in an environment if we have an observable effect on that environment.

It is clear that humans are ever aware of the virtual nature of their environment when they are in a virtual environment. This can be seen in physiological evidence [Dahlstrom and Nahlinder, 2009], anecdotal evidence, and by observing the environments in which social presence occurs. For example, it has long been known that flight simulators can help new pilots learn procedures and team work [Dennis and Harris, 1998, Ortiz, 1994, Jentsch and Bowers, 1998] however, the *realness* of the experience they offer is debatable. Pilots report that in reality 50% of their brain's capacity for thinking is taken up with flying their aircraft, and that this is not the case in a simulator, no matter how convincing it may be [BAE PC]. This is because their mind knows the difference, and even though a simulator might provide a realistic training experience, there is not the terminal nature of reality. In studies of responses during real and simulated flight it has been found that, though simulations stimulate similar physiological patterns to real flight, the extent of the physiological response (heart rate for example) is far greater during real flight, particularly during unexpected events [Dahlstrom and Nahlinder, 2009, Magnusson, 2002, Veltman, 2002]. In a comprehensive review of literature on the subject of simulation verses reality in flight, Harvey [2003] states that flight simulation cannot replace real aviation, only supplement it, and that flying a thousand hours on a simulator does not make you a pilot, just as playing an FPS game does not make you a soldier. In short, due to the fact that humans can tell their environment is virtual, simulations and reality are not freely interchangeable, physically or conceptually. As Cairns and McManus [2011] state "presence is the sensation of being somewhere else knowing that you are not".

In terms of team-based digital games it is unlikely that a player fails to accurately acknowledge the roll of mediator the game has in their connection to other humans. Our minds know that technology is a part of our mediation of a virtual environment, indeed the presence we discuss in terms of virtual environments is a technology based phenomenon. There is little point to discussing presence in reality other than in a philosophical way, because humans do not wander around in reality experiencing the presence we talk about in relation to virtual environments.

2.1.3 Spatial Presence

Most of the studies already mentioned in this literature review deal with spatial presence. Spatial presence is the sense of physically being somewhere that you are not. A person with a high degree of spatial presence within a virtual environment will act as if that environment is real. They may try to touch virtual objects, or may react strongly to virtual stimuli. Features which previous studies have shown which increase spatial presence include: being able to communicate and/or interact with virtual humans in the virtual environment [Slater et al., 2006], methods of controlling movement within the virtual environment which resemble real life navigation such as physically walking [Slater et al., 1995], being able to physically manipulate objects or use tangible tools [Schubert et al., 2001, Pelechano et al., 2007] (this will be discussed later in the fidelity controls section), and avoiding forced breaks in presence caused by bumping into a real world walls, tripping over cables, etc.[Slater et al., 1995, 2006].

Spatial presence can be a useful phenomena if invoked in a simulation which is designed to teach motor skills or spatial reasoning tasks. For example virtual environments which create a feeling of spatial presence could be used to teach people how to operate heavy machinery [Bruzzone and Longo, 2013] or perform surgical procedures [Haque and Srinivasan, 2006]. Wirth et al. [2007] propose a common definition of spatial presence which is formed in two steps. First the "users build a mental representation of the [virtual] space portrayed by the [technology]", users then create a "perceptual hypothesis" which states that the "spatial environment represented in the [technology] is the primary ego-reference frame". If this hypothesis is confirmed spatial presence emerges as the mediated environment is accepted as the users physically contextualize themselves within the virtual environment "realized action possibilities within that space"[Wirth et al., 2007].

2.2 Social Presence

2.2.1 Social Presence Part 1: Basic Formulations

Biocca et al. [2003] state that social presence is the sense of "being together with another". Social presence is the social connections one makes with entities within the virtual environment, and the level of social presence one feels in a virtual environment depends upon the strength of these connections.

> "*Social presence is the result of being in a social setting. The more opportunities for social interaction the setting has, the higher the degree of social presence will be. Studies have shown that social presence is influenced by the possibilities for exchanging social cues: Settings that are richer in social interaction possibilities, meaning they allow for easier and more frequent exchange of social cues, lead to higher social presence*"[Schouten, 2011].

Schouten [2011] argues that social presence is a concept built around the evidence of other humans within a virtual environment, with even simple cues such as the score of other players in a digital game being enough to increases social presence. [Schroeder, 2002] supports this evidence based perspective by arguing that mutual awareness, common focus of attention, and collaborative task performance, are all important elements of presence in shared virtual environments. Alexander et al. [2005] states that in an interactive multi-user environment "greater interaction and presence of others will lead to higher engagement of the individual with the game and the group". Jian and Amschlinger [2006] explored social presence in virtual teams, investigating processes which created and maintained social presence, citing the most important processes as *team identification* (psychological attachment to the team)[Fiol and OConnor, 2005], structural interdependence[Hertel et al., 2004], and robust leadership[Hertel et al., 2004, Kayworth and Leidner, 2002]. Jian and Amschlinger [2006] concluded that though better technology is useful in improving virtual team exercises, technology is simply the enabler in building social presence. Sallnäs [2004] argues that the more modalities for interaction used in a virtual environment the greater the social presence, perceived quality of interaction, and joint task performance. Sallnäs [2004] goes on to state that while haptic and text based interaction can be useful, voice communication makes the biggest difference to social presence.

The use of human controlled avatars in virtual environments has been known to improve spatial perception in virtual environments [Ries et al., 2009], however in a study by von der Putten et al. [2009] the question of whether computer (virtual agents) or human controlled avatars elicit social presence was explored. von der Putten et al. [2009] suggested that both human and computer controlled avatars equally elicit feelings of social presence in users, with behavioural realism determining the strength of the feeling. A study by

Dean et al. [2009] supported the argument that computer controlled avatars can create social presence. In the administration of surveys in virtual environments their results showed that computer controlled avatars encouraged people to give more thoughtful answers and would allow the system to keep more personal information, compared to a simple text based questionnaire.

One challenge in presence research is the inconsistent terminology throughout the literature, for example the use of 'co-presence' & 'social presence' to describe essentially the same concept. While some research [Bulu, 2012] makes a distinction between the concepts of co-presence & social presence, this thesis does not, and like Youngblut [2006], the terms are treated as being synonyms. The argued differences between co-presence & social presence presented in various studies are as varied as the definitions of the terms themselves, with some researchers arguing that the difference is that social presence represents the perceived quality of communication while co-presence represents psychological interaction [Bulu, 2012], or that social presence in an individual perspective on being virtually together with another [Blascovich, 2002, Schroeder, 2002], while co-presence is the mutual feeling of two people being virtually together [Bulu, 2012]. Nowak [2001] argues that co-presence is based on mutual awareness [Goffman, 2008], but also stated that it is the feeling of somebody else being there [Bull, 1983], while Youngblut [2006] states the distinction is often that "co-presence occurs when people can sense others and are aware that others are aware of them. Social presence, on the other hand, requires an additional awareness of another persons role in an interaction". Across the literature both terms refer to the same concept on a high level, a social connection through technology. It is clear then that the separation of these terms is often arbitrary, and sometimes contradictory.

2.2.2 Social Presence Part 2: Space & Place

The difference between spatial and social presence might be explained as the difference between an environment being perceived as a *space* to a *place*. Spagnolli and Gamberini [2005] states that the difference between these two concepts is that a *space* is simply the locations of objects and the relative space between them, where as a *place* holds some significance to a human. Perceiving a virtual environment as a *place* involves interpreting that environment as having significance to humans and Casey [1997] defines this interpretation as being rooted in the "*contingent situation, its history, its projections on the future*", in other words, the environment must seem *alive*.

One problem with the argument of Spagnolli and Gamberini [2005] is that only a general sense of 'presence' is discussed, neither specifically referring to spatial or social presence. This is another example of the vague way in which much discussion of 'presence' is conducted. However Spagnolli and Gamberini [2005] refers to 'presence-in-place' in terms most similar to the concept of social presence, presence in a socially significant place. Social interactions can occur in virtual environments in which there is no physical or virtual space, such as on forums, in chat rooms, or in abstract digital games. So can there be place with no space? Harrison and Dourish [1996] argues that there can be 'Space-less Places', for example virtual communities "exhibit different social norms. [They are] different places. This placeness builds upon the tension between connectedness and distinction [...] but, critically, it emerges without an underlying notion of space" [Harrison and Dourish, 1996]. Similarly there exist non-places or placeless spaces [Arefi, 1999] such as airports and motorways.

2.2.3 Measuring Social Presence

There have been many tools and methods developed for measuring social presence in virtual environments. However one of the main problems with presence questionnaires is that their content is always determined by the model of presence that the researchers hold, thus they often do not work well in environments with which they were not developed. In addition to this, the fact that the term 'presence' has no completely standardized meaning across multiple domains, and often encompasses various concepts and elements depending on the author of any given paper, makes it problematic to establish if a measure is suitable for a particular study. Cross-media presence measures have been developed [Lessiter et al., 2001], however like the majority of presence questionnaires, this cross-media example focuses on the general rather than social sense of presence.

Much of the previous research dedicated to finding a way to measure social presence has occured within the field of distributed learning and online education. In a review of various measures of social presence in an online learning context Kreijns et al. [2011] cites a number of potential tools, including a 'Group Atmosphere Scale'[Fiedler, 1962, 1967], a 'Work-Group Cohesiveness Index'[Price and Muller, 1986], 'Social Presence Scales and Indicators' [Gunawardena, 1995, Gunawardena and Zittle, 1997], and their own 'Sociability' and 'Social Space' scales[Kreijns et al., 2004, 2007]. In their review of presence measures Van Baren and IJsselsteijn [2004] set out the details of 28 current presence questionnaires, 6 of which containing social presence elements. These six questionnaires were the Lombard & Ditton Questionnaire [Lombard et al., 2000], the Nowak & Biocca Questionnaire [Nowak and Biocca, 2003], the Schroeder et al. Questionnaire [Schroeder et al., 2001], the Bailenson et al. Questionnaire [Bailenson et al., 2001], the Temple Presence Inventory (TPI) [Lombard et al., 2009], and the Networked Minds Measure [Biocca et al., 2001].

The Lombard & Ditton Questionnaire [Lombard et al., 2000] measured physical and social presence and was developed and tested based soley on previous literature. It attempted to measure 'social richness', 'realism', 'transportation', 'immersion', and social feelings towards actors within the medium, and the medium its self. However Cairns and McManus [2011] argue that immersion and presence are entirely separate concepts, which while occuring in the same context, such as video games, are different.

A study which sought to test the Lombard et al. [2000] theory of presence was based upon film media, and therefore cannot be considered entirely valid for testing digital gaming. The method used by the authors also appears somewhat flawed, 300 subjects experienced two different media items in two different contexts and were asked to fill out the questionnaire. For the "high presence condition subjects viewed a presentation of the IMAX 3-D film 'T-Rex: Back to the Cretaceous' at the Sony IMAX Theater in New York" while the "low presence condition, subjects are viewing an episode of the American situation comedy 'Three's Company' on a 12-inch black and white television set in a well lit office" on the Temple U campus. The number of variables changed and the level of change is such that no matter what experiential questionnaire was used there would bound to be a difference in the results.

The Temple Presence Inventory (TPI) [Lombard et al., 2009] was created by combining elements from previous questionnaires such as The Lombard & Ditton Questionnaire [Lombard et al., 2000] above, and elements created from studies by the authors. It was developed and tested by exposing participants to 'dramatic television programs' and film. The questions reflect this process and would be unsuitable for interactive virtual environments such as computer games. The questions refer to the perceptions of the viewer rather than any real sence of social presence, 'To what extent did you feel you could interact with the person or people you saw/heard?', 'How often did you smile in response to someone you saw/heard in the media environment? ', 'During the media experience how well were you able to observe the facial expressions of the people you saw/heard?', 'How much did it seem as if you and the people you saw/heard were together in the same place?', for example. The questions regarding social presence in the TPI appear to measure emotional response, ability to see and hear, perceived realism, immersion, and the magical transportation properties of film.

The Nowak & Biocca Questionnaire was designed to measure presence in an experiment which examined the influence of "anthropomorphism and perceived agency on presence, copresence, and social presence" [Nowak and Biocca, 2003] in virtual environments, specifically virtual meetings. In this questionnaire the term social presence was used to mean social realism and was measured using questions such as 'To what extent was this like a face-to-face meeting?', while the term co-presence was used to refer to social closeness or *friendliness*, measured using questions such as 'My interaction partner acted bored by our conversation' and 'I tried to create a sense of closeness between us'. In this questionnaire there was no attempt to measure the concept of social awareness or task, elements considered central to the concept of social presence discussed throughout this EngD.

The Schroeder et al. Questionnaire [Schroeder et al., 2001] was designed to measure collaboration, task contribution, presence and copresence within a collaborative virtual environment. However, while the questionnaire aimed to measure presence in a similar context to a number of studies in this EngD, the questions focused mainly on the feeling of being physically present with another, rather than an awareness of other conciousness. For example the question 'To what extent did you have a sense of being in the same room as your partner?' aims to measure copresence, but seems to actually be measuring physical presence. An awareness of other conciousness is the awareness that one is sharing a virtual environment with another sentient entity, this could occur in virtual environments any size or form, not simply knowing that one is in the same space as another person.

The Bailenson et al. Questionnaire [Bailenson et al., 2001] aimed to measure only social presence and asked the following five questions to participants who had interacted with an agent in a virtual room.

1. I perceive that I am in the presence of another person in the room with me.
2. I feel that the person is watching me and is aware of my presence.
3. The thought that the person is not a real person crosses my mind often.
4. The person appears to be sentient (conscious and alive) to me.
5. I perceive the person as being only a computerized image, not as a real person.

The first two questions measure the awareness of other consciousness within a virtual environment, a central concept to the social presence investigated in this EngD. The other questions probe the perception participants had of the other entity within the virtual environment. As will be established in Chapters3 of this thesis, the perception of the 'realness' of other entities within a virtual environment can be very important to how people experience those virtual environments. The Bailenson et al. [2001] questionnaire is short, simple, seems 'to the point', and would likely be effective in measuring social presence in a general virtual environment setting such as virtual meetings, etc. However it lacks the competitive/cooperative elements which are important to video games and team based training in virtual environments.

There are many other presence and social presence questionnaires mentioned in the report by Van Baren and IJsselsteijn [2004] however most were developed by combining several telepresence questionnaires from the 1970s and 80s, and all lacked any focus on complex multiuser environments.

Closer to the field of simulation, in the field of digital games de Kort et al. [2007] developed a measure for social presence. Its creators saw computer games as too different to other forms of technology for which previous measures had been designed, and so created the Social Presence in Gaming Questionnaire questionnaire (the SPGQ), which was designed to be used across the various genres of gaming. de Kort et al. [2007] developed a measure for social presence in games, based on the Networked Minds Measure of Social Presence[Biocca and Harms, 2002]. Biocca and Harms [2002] argue that social presence can be experienced to varying definable levels, from simply perceiving the co-presence of other entities, to a deeper sense of psychological involvement with the other entities, and finally a sense of behavioural engagement in which there is perceived mutual social presence [Biocca et al., 2001, Biocca and Harms, 2002]. While the Networked Minds Measure has a strong theoretical underpinning, the questionnaire was primarily designed for teleconferencing, and so is completely unsuitable for multi-user digital games and training simulations. While the SPGQ [de Kort et al., 2007] can be used to measure social presence in some circumstances [Cairns et al., 2013], the questionnaire is unsuitable for team-based games for a number of reasons.

The SPGQ appears to be designed for use with only competitive games, including items which refer to ‘revenge’ and ‘schadenfreude’, which are not expected components of social presence in cooperative games. In the SPGQ there is also no distinction between who the other players are in relation to the respondent. This is easily remedied if the respondent is playing one other person who is an opponent in the game, but it is difficult to make the SPGQ suitable for team-based games. In this situation, when there are both opponents and teammates sharing the virtual environment the SPGQ items would either have to be doubled up, asking about both opponents and team-mates, or generalized to refer to ‘others’. Neither of these solutions are favourable, doubling up would significantly increase the length of the questionnaire and thus increasing the likelihood that participants would become bored and fail to complete the questionnaire accurately [Cairns and Cox, 2008]. Generalizing the questions on the other hand would create answers which would not clearly refer to any other entity, providing results that would at best be hard to interpret, and at worst so generic as to be meaningless. This makes the SPGQ unfit for studies involving both collaborative and competitive team-based scenarios.

In addition to taking inspiration from the Biocca and Harms [2002] questionnaire, the SPGQ was developed using data gathered via a focus group study [Poels et al., 2007]. The focus group study consisted of 16 participants, half of which were undergraduate students described as infrequent gamers. The first concern with the methodology is the question of whether the participants were a representative (or adequate) sample of social gamers, and how the sampling has biased the development of the SPGQ. Second is the potential weakness of the focus group methodology, for example, if not managed carefully, focus groups can give disproportionate attention to members of the group, groups can be dominated by a single individual, and so on [Lazar et al., 2010].

In addition to questionnaires there are also examples of other methods of measuring social presence Van

Baren and IJsselsteijn [2004]. Autoconfirmation [Retaux, 2003] is a method in which users are shown a video of their actions within a virtual environment and are asked to give a commentary of their retrospective thoughts and feelings. Autoconfirmation has been used in immersion research by Gow et al. [2010]. Other methods include qualitative measures such as Content Analysis of transcripts of online text-based interaction [Rourke et al., 1999], Ethnographic Observation of users of teleremote technology [McGreevy, 1992], and Focus Group explorations [Freeman and Avons, 2000]. While self reported measures and qualitative analysis are the most widely used methods of measuring social presence, it has been suggested that physiological data could be used to show social presence [Chanel et al., 2012, Ekman et al., 2012, IJsselsteijn et al., 2000, Spapé et al., 2013]. In a study by Chanel et al. [2012], it was found that physiological compliance, the correlation between the physiological signals of two players, correlated with self-reported involvement in the social interaction (measured using the GEQ [IJsselsteijn et al., 2008]). This suggests that physiological compliance "could be used as an objective measure of social presence" [Chanel et al., 2012], especially in competitive gaming environments, in which physiological compliance was found to be higher.

2.2.4 Presence in Mixed Reality

Whether a training environment is in reality, virtual reality or somewhere in-between, Milgram et al. [1994] suggests that each environment exists somewhere upon the Reality-Virtuality continuum. At one end of the scale are real world environments, at the other are environments "which exceed the bounds of physical reality by creating a world in which the physical laws governing gravity, time and material properties no longer hold" [Milgram et al., 1994]. Somewhere in the middle is augmented reality, sometimes called *mixed reality*, generally defined as an environment in which real world and virtual world objects are presented together within a single display. Of course, as different training environments appear at different points throughout the Reality-Virtuality continuum, different practical problems affect the implementation of the technology. For example, one of the most critical issues for AR is how one makes the system's graphical imagery appear in its proper place as it corresponds to the real-world. As Milgram et al. [1994] point out "this is no simple matter, especially if we are dealing with unstructured, and completely unmodelled environments". But does 'presence' exist within these mixed reality environments? There have been a number of studies exploring the concept of presence in mixed reality [Goldiez and Dawson, 2004, MacIntyre et al., 2004, Kristoffersen and Jungberg, 1999] which lean towards the concept of 'place making' (making a space meaningful[Gustafson, 2001]). However the most comprehensive study in this area thus far, exploring both general presence and social presence, was conducted by Wagner et al. [2009]. Wagner et al. [2009] used a number of mixed reality technologies to evaluate user experience, and used a combination of an ethnographic style observation method, interviews, and a presence questionnaire to gather data. It was argued that this range of methods were needed to evaluate mixed reality as they are far more complex than standard VR applications. In the Wagner et al. [2009] study it was found that multi-user mixed reality applications allow users to establish who is sharing their augmented world and thus creates a sense of common ground which invites social presence. It is also argued that social presence is not perceived passively in mixed reality, but is actively constructed by the concious effort of all the participants. This is more evidence to suggest the feeling of presence discussed throughout this study is not apparent in reality, but requires some technology to exist. This is supported further by Wagner et al. [2009] who states that the participants of the study felt "outside" of a mixed reality game when travelling between augmented locations. Similar to the concept of 'co-created media'[Morris, 2003], Wagner et al. [2009] argue that mixed reality experience is co-constructed and co-experienced by multiple participants, and whatever the "intentions of the designers are, these mixed reality experiences are beyond their control and open to all kinds of unforeseeable events". The study concludes that presence and social presence in mixed reality is very different from these phenomena in virtual reality and that the standard view of presence used in virtual reality literature is too narrow to apply to be meaningful for mixed reality.

2.3 Immersion, Flow and Presence

Immersion is important to the experience of virtual environments and can range from simply attending to a medium, to engaging with it and on to total immersion [Brown and Cairns, 2004]. However throughout the virtual reality literature the term immersion is often used to describe technology rather than experience. As attention is especially critical in learning and training it is key to distinguish the definitions and the current thinking on the subject.

The term 'immersive technology' is often used to describe stereotypical virtual reality technology such as visors, helmets, sensor gloves, and 'caves'. This becomes a problem when immersive technology is discussed as creating an 'immersive environment', suggesting immersive technology guarantees an immersive experience. For example in a study by Banos et al. [2004], participants were asked to play a game in three 'immersive conditions', consisting of a 'fully immersive' virtual reality head set system, a 'semi-immersive' video wall, and a standard PC monitor. While these technologies were refereed to as providing different levels of immersive experience the immersion level of the participants remained the same throughout all conditions. This suggests that immersive technology is simply a label describing the amount of reality that the technology blocks out, and does not necessarily equate to a more immersive experience. In terms of immersive experience, Cairns and McManus [2011] state that immersion is the "sense of being psychologically absorbed in an activity". Throughout the virtual reality and digital gaming literature there is little consistent use of terms such as immersion and presence. For example Schubert et al. [2001] suggests that immersion is an objective description of the technology, rating the extent to which the computer generated media is capable of creating an illusion of reality to the senses of a human participant. However this description has little to do with action and seems to be explaining image quality or fidelity. Slater and Wilbur [1997] echoes this technical view of immersion by stating that it is an "objective description of aspects of the system such as field of view and display resolution".

Flow [Csikszentmihalyi, 2007] is the experience of completing a task in which the challenge is a match to ones abilities, not too easy to induce boredom, and not too hard to induce anxiety [Chen, 2007]. In a game flow is the feeling a person gets when the actions they are taking within an environment are progressing steadily and linking seamlessly from one to the next. This feeling creates a very channelled and focused positive emotion. Weibel et al. [2007] argue that flow mediates between presence and enjoyment, that presence (of either kind) is the immersion into an environment/situation, while flow is the experience of immersion into an activity. Thus in this interpretation we may suggest that presence is related to the virtual *place* while flow relates to the virtual *action*, and to experience both a person must be immersed.

Witmer and Singer [1998] argue that presence can be defined as involvement in the virtual environment, while immersion is "a psychological state characterized by perceiving oneself to be enveloped by, included in, and interacting with a VE". So is immersion just heightened engagement through interaction? This is disputed in the *book problem* [ONeill and Benyon, 2003, Jones, 2007], a problem which states that one may become deeply immersed in a book, or film, in which there is no direct interaction to be had, only internal involvement. Floridi [2005] argues that the presence experienced in more *passive*[2] media, is different to that experienced in interactive immersive environments. As stated Floridi [2005] argues that the presence we speak of when we discuss virtual reality and similar technologies relies on the person experiencing observable presence within the environment. As there is no observable presence of the reader within a book of the person reading the book, then there is no telepresence to speak of [Floridi, 2005], though *choose your own adventure* books may be a grey area.

Cairns and McManus [2011] argue that immersion and presence are entirely separate concepts (though they can occur together), giving the example of the game Tetris as an example. In Tertis "there is little sense of 'being there' in this game as there is simply no 'there' for a player to be and yet the game is hugely absorbing and provides a strong immersive experience"[Cairns and McManus, 2011]. Jennett et al. [2008] summarize immersion as an "experience in one moment in time", "it involves a lack of awareness of time", "a loss of awareness of the real world", "involvement and a sense of being in the task environment", and "is the result of a good gaming experience"[Jennett et al., 2008]. While presence and immersion occur in similar contexts, and some studies have found a correlation between social presence and both flow and immersion[Oksanen, 2013], the precise interplay between the concepts is still unclear [Cummings et al., 2012].

2.4 Group Flow

A related but as yet relatively unexplored concept to the research in this thesis is 'group flow'[Kaye and Bryce, 2012], "collective competency, interdependence, collaboration, coordination, complementary participation and a shared task focus". Group flow could be seen an synonymous to 'social flow'[Walker, 2010], the feeling of flow felt by a member of group of people absorbed together in a challenging activity [Ryu and Parsons, 2012]. Essentially group flow is the feeling of flow, but during a social rather than individual task, and is produced in a similar way, with challenge met by equal skill, high levels of attention, etc. Walker [2010] states that the conditions of social flow include collective competency of the group being sufficient to meet their challenge, equivalent level of competency throughout the group, challenges are important and meaningful to the entire group, a focus on group members as well as group task, and both social and task based feedback. Walker [2010] goes on to state that evidence of group flow includes shared absorption, attention, and engagement on the task and on group members, a loss of sense of time and self awareness, a collective sense of meaning, purpose, joy, elation and enthusiasm, emotional communication, and a desire to repeat the experience.

2.5 Group Size & Experience

Experiential concepts such as immersion and presence are often studied using groups of players, however one core variable in such games, the number of co-players, is not often studied in relation to in-game interaction and experience.

[2] Though the passiveness to exposure to any media is debatable.

Previous research has shown that humans act differently depending on group sizes, for example a study of child behaviour noted that male children act more competitively in triads than dyads [Benenson et al., 2001]. The bystander effect is a well known effect of group size, in which the presence of others causes people to be less likely to help an individual in need of assistance [Blair et al., 2005]. This effect also exists in computer mediated communication [Blair et al., 2005], and in virtual environments [Stenico and Greitemeyer, 2014]. Mueller [2012] explain the negative effects of larger group sizes by stating that members of larger teams experience relational loss, in which an individual perceives that support is less available to them or that teammates will be less likely to help them if they need assistance, akin to the bystander effect from the opposite perspective.

Group size not only has an effect on human behaviour but on individual perceptions of behvaiour. In a study of computer mediated brainstorming Valacich et al. [1992a] found that while large groups (N = 9) created more ideas which were of higher quality, smaller groups (N = 3) were less critical, felt more satisfied, and rated themselves as more effective than individuals in other teams. Similarly, in a study of group computer mediated communication, Lowry et al. [2006] found that while discussion quality was no better in small groups (N = 3), the small groups experienced better communication in terms of appropriateness, openness, and accuracy than the larger groups (N = 6). In this study Lowry et al. [2006] measured both social presence and group size, arguing that both concepts affected group communication, but failing to compare social presence in the two group sizes.

Roberts et al. [2006] state that social presence can lessen the negative impacts of large group size. Comparing group sizes of three and six, the author's found that social presence in group computer mediated communication is affected by both the technology and the group size, however social presence impacts the perceived value of an individuals input to communication in addition to the quality of group discussion and work in general. Again however, the authors do not directly compare social presence and group size.

In a study of mobile educational games Schwabe et al. [2005] compared the experiences of individuals, dyads, and groups of three and four students. The results of the study showed that team size significantly influenced fun, with teams of three and four experiencing lower fun than dyads and individuals. In addition to fun, team size also influenced immersion, with dyads being the most immersed, individuals and teams of three scoring similarly, and teams of four scoring significantly lower. In summary the Schwabe et al. [2005] study found that team size affected fun, immersion and some aspects of learning, with team sizes of four being the most suboptimal. In another study of mobile educational games Melero et al. [2015] compared groups of three, four and five students, finding that team size negatively correlated with enjoyment and engagement in the game.

While not the focus of the studies, the work of Cairns et al. [2013] suggests that in terms of immersion, both dyads and triads show the same effect from playing digital games with humans and computer controlled entities. In these studies Cairns et al. [2013] found that both dyads and triads felt greater levels of immersion when playing with humans. Comparing other such studies also shows that dyads [Weibel et al., 2008] and larger groups [Lima and Reeves, 2010] are similarly affected in terms of engagement and enjoyment by the agency of other in-game entities.

Therefore, while there is evidence to suggest that larger group sizes have negative effects on communication and collaborative behaviour, the effects on digital games are inconclusive. The studies of educational mobile games [Melero et al., 2015, Schwabe et al., 2005] would suggest that group size decreases enjoyment, engagement and immersion, however the studies of more traditional digital games [Cairns et al., 2013, Lima and Reeves, 2010, Weibel et al., 2008] show no effect on the same concepts.

2.6 Fidelity: What really matters?

Fidelity refers to the level of realism of various aspects of the virtual environment and technology used to access that environment. Throughout the literature on presence and immersion there are a number of key issues of virtual systems which continue to be investigated and are the subject of much debate, fidelity is one of these key issues. In the following subsections fidelity is explored in terms of controls, image and sound quality, and conceptual issues.

2.6.1 Fidelity: Control

One rather critical aspect of any VR training system is the control system. One might expect that high fidelity controls would improve the effectiveness of any training simulation. In the field of digital gaming research, an experimental study by Hoshi and Waterworth [2009] found that presence was significantly higher when their participants were using a tangible tool versus no tool to play a VR game. However, one report by Hahn [2010] suggested that realistic controls do not help in flight training and that a simple mouse and keyboard system was more effective. This may have been due to various factors, novice trainees may have been overwhelmed by complex control systems or as Hahn [2010] suggested, it may be because simulations simply give people a *cognitive template* of a situation, rather than teach them every technical or procedural detail of the situation. This theory is supported by a flight training experiment and review of previous studies conducted by Roessingh [2003]. The study found that PC-based flight simulation did not result in a measurable improvement of manual flying skills but did result in a procedural advantage, meaning that trainees who used PC-based simulators to supplement their flight training required less pre-flight briefing. It was suggested that PC-based simulation could serves as a kind of automatic briefing tool which could be used to save flight-instructor time[Roessingh, 2003], an observation which supports the *cognitive template* or conceptual scaffolding theory of simulators. This view of simulations is also supported by Kearns [2010], who concludes in a comprehensive review of fidelity literature that there is no difference in training transfer between low and high fidelity simulators.

However in VR research it seems for every report which suggests one control method is superior, there is another highlighting problems. In the case of PC-based simulations the problem is that using a mouse and keyboard system to navigate and manipulate the virtual world can result in a *lack of second hand*, creating an unrealistic situation in which two objects within the world cannot be manipulated simultaneously [Netto and de Oliviera, 2002]. There may also be a general concern in the industry that low fidelity controls might cause negative training in experienced pilots. It is likely that this potential problem will affect training to greater or lesser extent depending on what is being trained and the level of competency of the trainee. The training of a new hardware capability might rely on an experienced pilot learning an efficient way to use the hardware, however when training is more conceptual, exploring new tactics or strategies, then high fidelity controls may be unnecessary. This is an issue of establishing '*the right tool for the job*'.

The fidelity of a control system is not purely hardware based, how controls react to user input is important in terms of maintaining a sense of *puppetry*[Calvillo-Gamez and Cairns, 2008] between the user and their virtual agent within a virtual environment. In brief terms puppetry is the extent to which the player feels in control of their virtual inhabitance within the game, for example, if a player character within a digital game does not respond to the preordained commands from the player's control-pad, or there is a delayed response, the player may feel there is a low degree of puppetry. There are external factors such as familiarity with the game and aesthetics which affect puppetry, but generally puppetry "is produced when there is a high level of ownership, and ownership is achieved when the player has a high level of control over the game"[Calvillo-Gamez and Cairns, 2008], a more comprehensive definition can be found in Calvillo-Gamez and Cairns [2008]. However the full extent of the importance of puppetry is not yet known. Just as users can overcome breaks-in-presence (BIPs) humans are extremely robust at dealing with unpredictable situations and troublesome control systems. In an experiment exploring the control of a robot through a virtual reality style control system[Herbelin and Cíger, 2008], the participants were geographically separate from the robot and its environment and controlled it via a headset which displayed the robot's view on the world. In this situation, it was found that the participants would find unexpected tricks to help their navigation of the robot more effective by *appropriating*[Dix, 2007] new uses for the technology and objects in the robot's environment. An experimental study by Cheng and Cairns [2005] found that if participants are immersed in a digital game, they are unlikely to notice small changes to the way their virtual agent reacts to controls.

2.6.2 Fidelity: Image Quality and Sound

While imagery and sound are the primary ways of accessing virtual environments, the importance of image and sound *quality* are not fully understood in terms how they affect presence (of either kind), immersion and learning within virtual environments. Whether image and sound *fidelity*, "the relative quality with which the synthesising media is able to reproduce the actual or intended images of the objects being displayed"[Milgram et al., 1994], consistently affects immersion or presence is still up for debate. While some studies suggest that image quality in games does increase spatial presence[Bracken and Skalski, 2009, Sherry, 2004] there are others which suggest the opposite. A study by Skalski et al. [2009] investigated whether sound or image quality was more important in terms of presence, enjoyment and player performance in computer games. The study found that surround sound had "a much more pronounced effect on player presence and enjoyment than normal sound or image quality"[Skalski et al., 2009]. These findings seem to support the findings of Cairns and McManus [2011] and other studies [Nacke et al., 2010] which found that increased sound quality improved presence and immersion, while graphical quality did not.

2.6.3 Fidelity: Conceptual

Conceptual fidelity is how *real* or *true* the model of reality within the virtual environment is. Sometimes referred to as psychological or functional fidelity, conceptual fidelity is the extent to which the underlying concepts of the virtual environment and scenario map onto reality. For example it is widely regarded that the game of chess can bestow benefits on players, and humans have been playing wargames with miniatures for centuries, conceptual fidelity is the *truth* in these games, underlying concepts which transfer competency from the abstract world of simulation to reality. Kearns [2010] states that the physical fidelity of simulators is not important in the transfer of training, what matters is the conceptual fidelity. The accuracy of the *cognitive template* [Hahn, 2010] a simulation provides is far more critical than any physical or sensory fidelity.

There are conceptual and physiological differences between the way we experience reality and virtual reality, no matter how real the virtual may seem. This difference is not necessarily a bad thing, it is simply a fact of life, one which should not diminish the experiential significance of a simulation, if it is skilfully implemented. Serious games are an example of how abstract concepts can stimulate behavioural change in reality [Baranowski et al., 2008].
Juul [2005] states that games are 'half-real', to "play a video game is [...] to interact with real rules while imagining a fictional world and a video game is a set of rules as well a fictional world". This does not just apply to digital games but many games: the rules we use to define success and winning within a game are real, yet the game is not real, whether virtual or imagined. Sometimes refereed to as 'zero-fidelity'[Toups et al., 2011] simulations, multi-player digital games have been shown to improve team work skills in the training of infantry [Hussain et al., 2008], emergency response teams [Toups et al., 2011] and robot operators [Craighead, 2009]. It has also been suggested that games could aid in the training of military decision making [Caird-Daley et al., 2007]. In these games image, sound, and control fidelity are unimportant, what matters is the conceptual fidelity. Alexander et al. [2005] found that military trainees playing a multi-player game but using a communications system which resembled a 'plausible operational communications infrastructure' were 'better able to potentially benefit from their experiences, irrespective of the fanciful nature of the environment'. It may have been that the authentic communications organization and medium increased participant buy-in, immersion, or perhaps increased the conceptual fidelity of the game.

In some game environments conceptual fidelity is *emergent*, for example in the study based around military infantry [Hussain et al., 2008] the fantasy game used (Neverwinter Nights) contained a magic ability which allowed a character to summon a number of goblins who flew ahead of the group of players exposing the map. In this situation the trainees stated that this was conceptually similar to the use of a UAV in a combat situation, and provided a conceptual fidelity that the participants could relate to. An example of the importance of conceptual fidelity occurred in the same 'zero-fidelity' simulation. In this game each participant had various skills and abilities, some were slow and powerful, some fast and weak, others magical. The in-game character that the commander of the squad had been assigned to was not combat based and was slow moving, the commander believed that this created low conceptual fidelity as in reality he would have similar abilities to his squad. This lead to low conceptual fidelity as the commander believed that it was critical to be able to lead from the front and thus gain the "respect" of his squad[Hussain et al., 2008]. This seems to suggest some cross-over between social presence and conceptual fidelity in training scenarios.

Theory and practice are all well and good but to paraphrase that renowned wordsmith Mike Tyson, 'everybody has a plan until they get punched in the face', for a pilot to be competent they must be able to react to metaphorical punches in the face. If a person is to be expected to react well under pressure then they must be exposed to similar pressure during training[Alexander et al., 2005]. However there is no way to create a truly realistic sense of life and death in a flight simulator, but to be able to create pilots who are able to deal with high pressure situations (or find pilots who are unable to do so) is critical. Thus simulations must hold some *truth*, a conceptual fidelity that in some way mirrors the essence of reality which cannot be forged.

2.7 Learning in Virtual Environments

While learning was not the focus of the research conducted throughout this Engineering Doctorate, the team-based virtual environments which were the inspiration for the research are primarily designed for learning. Virtual Reality (VR) has been proven to be successful in the treatment of phobias[Rothbaum et al., 2000], anxiety[Pertaub et al., 2002], in cognitive rehabilitation [Munih et al., 2009] and in Stress Inoculation Training [Wiederhold and Wiederhold, 2008] (preparing individuals for stressful situations). It has been used to teach children safe street crossing [McComas et al., 2002], in mine safety training [Squelch, 2001], for automotive usability [Salzmann and Froehlich, 2008], and surgical training [Haque and Srinivasan, 2006]. Research has also demonstrated both the utility and effectiveness of virtual air-to-air mission training to complement aircraft training [Crane et al., 2000]. It has been "known since Socrates that people learn better by experiencing a problem by themselves and by finding a [the solutions on] their own"[Herbelin and Cíger, 2008]. It is clear that experiential learning is useful in training [Kolb and Boyatzis, 2000], and that virtual environments provide a safe place in which to gain experience. But experience is not everything, honest and open reflection on that experience is also necessary, especially in critical environments such as aviation and healthcare[Fejes, 2008]. However, using a virtual environment to stimulate experiential and reflective learning has a number of problematic issues. One of the main issues with virtual training is evaluation, establishing if the simulation is teaching what it is designed to teach [Sennersten, 2010].

While simulation based training has many benefits in terms of time, cost, risk, etc, there are few "consistent standards to measure the performance and the benefits of simulation-based training"[Jean, 2008], and citing Graesser and King [2008], Sennersten [2010] argues that as the designers of training simulations often do not have "sufficient training in cognitive science, pedagogy, behavioral sciences, and learning technologies [...] far too many learning environments are launched without the required empirical testing on usability, engagement, and learning gains". The lack of standards leads to purchasing decisions about this potentially dubious virtual training technology being based on marketing over empirical evidence [Jean, 2008]. Therefore research which aims to better understand the user experience of virtual environments to help create guidelines and standards is potentially of value to the virtual training industry.

2.7.1 Presence and Learning

A study by Denny and Atkin [2006] explored whether the feeling of 'being there' increases the potential for learning when exposed to media. It should be noted that this study did not involve VR or games, but investigated presence when watching video media. The study used black & white and colour video, assuming that colour would be more immersive, exposed a number of participants to the videos, and then asked the participants to recall information from the media. It was found, unsurprisingly, that colour video had no affect on presence however, the participants that experienced a higher degree of presence had an increased factual recall score [Denny and Atkin, 2006]. This experiment was unsuccessful in that it could not intentionally induce increased levels presence, but the results do suggest that increased presence may positively affect the learning potential of a media experience. One of the largest areas in which social presence is researched in relation to learning is the field of online education. Within this field of research social presence is defined in a similar way to the virtual reality definition, as a "feeling intimacy or togetherness in terms of sharing time and place"[Shin, 2002]. In a review of the distance learning literature

Rockinson-Szapkiw [2009] states that social presence is "central to the success of online education", is "essential to the establishment of a community of learners"[Garrison, 2007], and is highly correlated with perceived learning, deep learning, and learning outcomes"[Garrison and Kanuka, 2004, Picciano, 2002].

2.7.2 Self Presence: Learning as Another

Heeter [1992] states that 'personal' or 'self' presence is a measure of the extent to which the person feels like he or she is part of the virtual environment, while social presence refers to "the extent to which other beings (real of virtual) also exist in the VE". The concept of *the self* can be defined as a person's own image of their "social roles, reputation, [...] values and priorities, and a conception of ones potentiality"[Baumeister and Muraven, 1996], or perhaps more simply as "the prototypic, generalized representation of self that most people verbalize when asked to do so"[Westen, 1992]. In other words, *the self* is the answer to '*who are you?*' Or perhaps '*who am I?*'. *Self-presence*, is a projection of the sense of self identity, and is the "extent to which a participant feels a virtual representation of self to be accurate"[Lombard and Ditton, 1997, Ratan et al., 2007], in other words '*who am I in the context of this virtual environment*'.

An study by Jung [2009] explored the phenomena of people changing their behaviour to conform to a representation of themselves. In the study the results suggested that "social presence could magnify the degree to which people conform to stereotypical behaviours when asked to enact a role identity in" virtual environments[Jung, 2009]. These findings were in line with previous studies on the subject of *the self* [Yee and Bailenson, 2007, Goldstein and Cialdini, 2007] and the study ultimately concluded that people change their behaviour to conform to the internal representation of *the self*, and that the magnitude of the conformation could be altered by increasing social interactions and social presence within the virtual environment [Jung, 2009][3]. The concept of self presence is potentially another example of a philosophical bottomless pit in virtual reality, with one's interpretation of the concept changing depending on if one shares the views of *the self* of any number of philosophers, Heidegger, Descartes, etc. So is a conceptual closeness between one's *self* and one's presence (spatial or social) important in terms learning in gaming, simulations, training, and so forth? In games people have little trouble acting in the virtual environment despite having no conceptual similarities to their in-game avatar, for example, our avatar in a game might be a different age, sex, race or even species, but we may still become immersed or present within the virtual world. However implications of the notion of the *self* in training simulations and how it relates to issues such as power distances and mere-presence are unknown.

2.8 Summary

This literature review covered various topics relevant to the experience of virtual environments and has revealed a number of areas which require further investigation. Overall the review highlighted the complex nature of social presence which, despite many definitions, is yet to be fully understood. Each domain in which social presence is discussed has an idiosyncratic model of the concept, which can lead to a sense of vague meaning when reviewing interdisciplinary literature. One of the key weaknesses of the research from the perspective of this EngD is the lack of a clear definition of social presence, and a lack focus of social

[3]Acting as *the self* (or a version of the self) in virtual environments could be equated to the concept of *doing being normal*, a sociolinguistic concept, inspired by Harold Garfinkel but refined by Harvey Sacks, Gail Jefferson and Emanuel Schegloff, which studies the efforts people go to in an effort to be perceived as acting normally.

presence in socially complex virtual environments, such as team-based digital games, or multi-user training simulations. This lack of focus is reflected in the lack of a suitable tool for measuring the concept in these environments. Thus one of the key outcomes from the literature review is the need to better understand social presence and define the elements which contribute to developing and maintaining the concept within the specific context of team-based digital games.

2.9 Research Questions

The shortcomings of the literature lead to the need to develop a greater understanding of social presence within team-based virtual environments. Thus in line with the use of digital games as research tools in this thesis, the main research question was:

- What is the nature of social presence in team-based digital games?

This research question focuses on the nature of social presence within a specific context, the socially complex virtual environments in which teams of users are cooperative and competing to achieve some goal, and these virtual environments have the potential to contain both human and computer controlled entities. To answer this one question there were a number of sub-questions which need to be addressed, such as how social presence is affected by sharing a team-based virtual environment with human or computer controlled entities, and what other contextual elements encourage or reduce feelings of social presence?

Chapter 3

Initial Exploration of Social Presence in Team-Based Digital Games

3.1 Introduction

Aims

The overarching aim of this Chapter was to explore the concept of social presence, to gain a richer foundation for the concept in relevant virtual environments. To explore the notion of social presence in socially complex virtual environments the studies in this chapter use the notion of ambiguous agency. The studies use the ambiguity of whether other entities in a virtual environment are human or computer controlled as a way to probe the nature of social presence by challenging the notions players have about the role of other humans in games.

Experiential Vignettes

To achieve these aims the concept of *experiential vignettes* was developed. These are small scale studies with a rapid turn around from set-up to analysis. The primary reason for using this methodology was due to the existing literature on social presence being so heavily domain specific and unrepresentative of social presence in team-based digital games. The low resource cost of vignettes allowed multiple studies to be conducted over a short space of time, insights from each influencing the next to provide a variety of perspectives on this single concept and push the boundaries of social presence in a variety of contexts. The vignettes in this Chapter are all small-scale qualitative studies that provided an opportunity for ethnographic style observations of gaming, to gather data that was subject to thematic and content analysis, and would allow participants to talk in detail about their gameplay experiences.

The experiential vignettes of this Chapter were greatly inspired by the research style of Hodge and Tripp [1986] and Wagner et al. [2009]. Wagner et al. [2009] conducted three different mixed reality presence studies, the findings of which combined to form a single argument. The studies used a number of mixed reality technologies, and a combination of an ethnographic style observation method, interviews, and a presence questionnaire to gather data. Like the studies of Hodge and Tripp [1986], the emphasis in this Chapter was on "discovery rather than proof, exploration rather than demonstration, suggestiveness rather than certainty". Each individual vignette was not aiming to prove a hypothesis, and like Hodge and Tripp [1986] there were "too many experiments with too few subjects from too many different points of view to make a watertight case in any one". However as Widdicombe and Wooffitt [1990] argue, low sample size "is only relevant to those forms of analysis which aim to provide a picture of the frequency of the issues revealed through analysis and when numbers can tell us something". In the case of social presence in socially complex multi-user environments, there was no pre-existing theory to test, only domain specific concepts tested in more simplistic or unrelated contexts. The use of more ethnographic style research in the field of HCI has been advocated by Ikeya et al. [2002]. Similar to cultural probes [Gaver et al., 2004], experiential vignettes open up a range of stimuli and facilitated the gathering of rich user data. To probe the concept of social presence many of the vignettes featured explicit manipulation of the gameplay scenarios to explore the expectations and subjective experiences of players. Specifically the vignettes in this Chapter used the ambiguity of whether other entities within the virtual environments were human or computer controlled as a way to encourage players to think more deeply about their awareness of other humans in games, and how this related to social presence.

While the vignettes were small scale studies that is not to say they were treated as pilot studies. These studies did not aim to reveal generalizable outcomes but, like the small grounded theory study of Brown and Cairns [2004], the vignettes provided unexpected insights and generated ideas about how social presence was experienced. The experiential vignettes provided insights and ideas which went on to form the basis of a validated social presence questionnaire.

Humans & Bots

Throughout the gaming literature there have been a small number of studies of how the perception of the other entities within a virtual environment affect player experience. In one such study by Weibel et al. [2008] groups of participants collaborated together in an multiplayer role-playing game to compete against other groups of players, some groups were informed they were playing against bots, and other against humans. It was reported that in this study the group who thought they were playing the humans felt a "greater sense of immersion and greater enjoyment" in addition to a greater sense of engagement and flow [Weibel et al., 2008]. In another study investigating the effects of the perception of other entities within competitive/cooperative gaming environment, Lima and Reeves [2010] found that participants not only "exhibited greater physiological arousal to otherwise identical interactions" when they assumed the other entities were controlled by humans rather than a computer, but also that participants generally disliked having a *bot* as a competitor. While participants in the Lima and Reeves [2010] study experienced the same emotional attachment and feeling of presence with a human competitive or cooperative co-player, competing against a *bot* caused these measures to drop significantly. Another study also suggests that playing a game, even something as simple as *rock, paper, scissors* against a computer 'feels' different than playing with a human [Gallagher et al., 2002]. This is likely due to the lack of the Theory of Mind [Baron-Cohen, 1997, Ratcliffe, 2007] or Schelling mirror-world (the capacity to analyse other's actions through mental simulation, simulating other minds simulating our minds [Levinson, 2006]), which is not available to players when playing against a computer. When playing *rock, paper, scissors* against a black-box computer system, the player may as well be guessing the outcome of a dice roll. Theory of Mind is the idea that a person is able to theorise about what another person is thinking [Premack and Woodruff, 1978, Baron-Cohen, 1997, Ratcliffe, 2007], and is a theory largely absent from gaming research. In team-based digital games players utilize their Theory of Mind in an attempt to outwit their opponents.

In a study focusing on player opinion of the in-game actions of bots and players, it was found that "if an artificial team-mate engages in risk-taking in order to help a human player, it is more likely to go unnoticed than if the team-mate is human"[Merritt et al., 2011]. This echos many of the sentiments discussed in the first experiential vignette study in this Chapter. In a study by Merrit [2012] it was found that players of a cooperative game perceived human team-mates as more thoughtful, understanding, and cooperative than bots, and players assumed bots needed more help as they are inherently less adaptive. It was also suggested that players feel more obligated to honour social commitments to human players, engaged in 'tit-for-tat' patterns of protective behaviour with them, and appreciated the efforts made by human partners more than bots. Ravaja et al. [2006] found that players anticipate a higher threat prior to playing a competitive game against a human rather than a bot and also report a higher challenge level post-game.

While the previous studies in the literature did not all deal with the effects of bots and humans on the user experience of team-based digital games, there is a clear pattern to the results. One could argue there is a large difference between real gaming and gaming in experimental conditions, for example joining a regularly visited *Team Fortress 2* server versus being asked by a psychologist to play a human/*bot* at virtual rock, paper, scissors. In lab based studies the players did not play the game because they wanted to compete, cooperate, and communicate with humans, and yet the perception of human presence (or lack of) within the virtual place still changed the experience of the participants. As the players joining online servers by their own volition are specifically looking for human interaction, the negative impact on player experience is likely to be even more intense than in the experiments, a conjecture supported by the venom in the quotes found on the community forums within the Problem with Bots experiential vignette.

The phenomenon of gaming being more engaging while playing with humans rather than bots is not only an important issue to players, but to game developers. This issue has led to some researchers and developers attempting to create a sort of 'Turning test' for bots [Hingston, 2010] in an attempt to create more human-like behaviour. However this research is probably missing the point, humans do not play humans simply for the challenge of unpredictable behaviour, though this is one reason. It is for the intangible effect that the knowledge of other human presence creates. No matter how human-like the *bot*, if a player knows they are playing a *bot* the experience will be different, something which the vignettes in this chapter support.

Chapter Overview

The first study of this Chapter was designed to give an overview of social issues in team-based digital games, asking experienced players how and why they played cooperative and competitive games. The data from 80 respondents was thematically analysed and various fundamental concepts were raised such as Theory of Mind, space & place, the differences between sharing a virtual environments with humans and bots, and how awareness of human consciousness changes the perceptions of virtual environments. The study found that in team-based online games, which at first glance may appear to be primarily conflict based, stimulate high levels of social presence, and strong feelings of camaraderie inspiring altruistic actions. The concepts within in the first study, particularly how humans and bots changed the perceptions and experiences of virtual environments, were pertinent to both online gaming and training environments such as team training simulations, and were explored further in the subsequent vignettes. The concept of ambiguous agency, players being unaware if the other entities within the virtual environment were human or computer controlled, was used to push at the boundaries of the concept of social presence. As the literature above suggests the knowledge that one is sharing a virtual environment with human or a bot changes the way people experience the game, it was hoped that ambiguity would make people fall back on their preconceptions and reveal insights into social presence that might note have emerged from more obvious studies.

The second vignette was based on previous studies [Gajadhar et al., 2008a, Cairns et al., 2013], but relating to cooperative rather than competitive gameplay. The study used cooperative *Tetris* to explore how the perceptions of a player's team-mate, whether they were a collocated human, a human mediated over a network, or a bot, would affect their level of social presence. While the debriefing interview revealed some interesting insights into player perceptions and assumptions, the study highlighted that the current measures for social presence in gaming (SPGQ) were unsuitable for cooperative gameplay. The third vignette was based on a review of data from online communities based around team-based games. The data consisted of found forum data and data from an online survey of team-based gamers. The data revealed that players made certain assumptions about being able to identify bots in games, and how bots would affected their experience of games. These assumptions were tested in the fourth experiential vignette, which involved a group of gamers playing *Unreal Tournament* with team-mates and opponents of ambiguous agency. This vignette revealed that social presence in not simply a matter of humans versus bots but is highly dependant upon the nature of the game and the tasks involved. Finally the fifth vignette explored the experiences of gamers playing a game in which ambiguity of agency was a central gameplay mechanic, which created a heightened focus on being aware of another human consciousness.

In summary this Chapter confirms that sharing a virtual environment with humans and bots changes the way a person perceives and experiences the virtual environment, however the importance of ambiguity is task dependant. Experiential vignettes were a solution to two problems, exploring social presence without a suitable measure, and gaining a wide view of social presence across a wide range of relevant games.

3.2 Vignette 1: Social Gaming Survey

Introduction

This study was designed as a preliminary exploration of social presence in online team-based digital games, exploring why gamers play these games, the social aspect of online gameplay, and the effects of playing with other humans has on the gaming experience. It was hoped that exploring these issues would enlighten the concept of social presence in team-based games. The study uses thematic analysis to discover common themes within data gathered from 80 respondents. The results of the study suggest that games which at first glance may appear to be conflict based, can stimulate high levels of social presence, and strong feelings of camaraderie which inspire altruistic actions. This study fits into the experiential vignette style as it did not seek to gain strictly defined data, but allowed the respondents to answer in as much detail as they wished, gaining rich data for 'discovery rather than proof', and to provide interesting insights which could influence further study.

Method

The data for this study was obtained via an exploratory questionnaire (see Appendix 7.1.1), in which gamers from several online gaming communities listed below were asked about their opinions on various aspects of online gaming, specifically on team-based games. The questionnaire received 80 respondents. The gaming communities chosen for this study were based around team-based online games with a warfare theme. The questionnaire items were developed based on issues within the literature and personal experience with game communities. Items included 'Why do you play team/squad based online team games?', 'To what extent do you conform to your 'role' in the squad?', 'Does being part of a squad make the game for immersive?', and 'If you lose the game but your squad worked together well, how would you feel?'.

Materials & Analysis

The questionnaire consisted of 34 questions which asked the respondents why they played the games, what their motivation is and what is important to them while playing, how these multiplayer environments affect their gaming experience, and how these games make them feel. The data collected for this study totaled around 30,000 words and was broadly thematically analysed to discover any consensus of opinions throughout the gaming communities. Thematic analysis is "a method for identifying, analysing, and reporting patterns (themes) within data"[Boyatzis, 1998, Braun and Clarke, 2006]. The thematic analysis in this study separated statements into broad first order themes, with the differences within these themes discussed in detail, but not separated into second order themes due to the focused nature of the questions and subsequent responses.

Procedure

The gaming communities asked to contribute to this study were based around the following games; *Battlefield: Bad Company 2*, *Red Orchestra: Ostfront 41-45*, *Darkest Hour: Europe '44-'45* (a mod for *Red Orchestra*), and *IL-2 Sturmovik*. The first three game mentioned were chosen based upon personal experience and *IL-2* was chosen due to anecdotal reports of prevalent team play. These choices were made as having a knowledge of the nuances of these games, the terminology used within them, and the gaming styles involved, would allow for a more comprehensive decoding of the respondent's data. The online questionnaire developed and used for this study can be found in Appendix 7.1.1, the questionnaire contained primarily 'open' questions, allowing respondents to express their opinions freely, without word limits or restrictive multiple choice rating systems. Throughout this vignette the terms squad and team are used, team refers to the entire group of players which make up one of the opposing sides within the game environment. For example, in *Red Orchestra: Ostfront 41-45* one might be on the *Allied* or *Axis* team, in *IL-2* one might be on the *blue* team or the *red*, and so on. The term squad generally refers to a smaller number of players from one team which are working together in a more direct way. In *Battlefield: Bad Company 2* there is a system which identifies which players are in a squad using a list and colour coding, in games such as *Red Orchestra: Ostfront 41-45* this may apply to a group of soldier who have decided to move together and give each other cover or become a tank crew. In *IL-2* a squad applies to a group of players who are working closer together or flying in formation. Calls for participants were posted on the 'Off Topic' sections of the *Red Orchestra: Ostfront 41-45*, *Darkest Hour: Europe '44-'45* and *IL-2 Sturmovik* (*IL-2*) forums, and on the *Battlefield: Bad Company 2* Steam forums.

The Games & Communities

Battlefield: Bad Company 2, is a squad based First Person Shooter (FPS) game which was released in 2010. The game has a modern warfare theme and features a single player element, however the long term gameplay focuses on the multi-player element of the game. The game has many interesting features such as destructible buildings, numerous weapons, vehicles, and players gain experience points as they play online. The more points a player gains in a round of combat, the more experience they gain, when a player gains enough experience they 'level up' and may unlock new equipment for their player character. In *Battlefield: Bad Company 2* points are gained for killing opponents, helping other players (resupplying them, healing them, repairing their vehicle, etc), and achieving objectives. In this game, a player is in one of two teams and may join a four-person squad made up of members of their team. More points are awarded to players for helping their squad mates. In this way, the game aims to encourage squad play and teamwork within squads by rewarding players for helpful behaviour.

Figure 3.1: Battlefield Bad Company 2

Red Orchestra: Ostfront 41-45 and *Darkest Hour: Europe '44-'45*, are team-based online FPS games set in World War 2. These games were designed primarily as online multiplayer games with no emphasis on single player gameplay. *Red Orchestra* was released in 2006 and was designed to be a more realistic alternative to other historical FPS games of the time. To this end there is a minimal heads-up display (HUD), realistic bullet drop and physics, no on screen cross-hairs (meaning players must aim using the sights on their gun), and player characters are far more vulnerable than in most other FPS games (generally one rifle bullet to the torso will incapacitate the player character). These features mean that for a player to be effective on this game they must play differently from games such as *Battlefield: Bad Company 2*. The gaming environments in *Red Orchestra* are fairly uninteractive compared to some other FPS games, with the only interactive elements being doors which players may open and close, and crates with ammunition which players may use to resupply their ammunition. *Red Orchestra* and *Darkest Hour* focus on historical accuracy and realism with the developers aiming to faithfully reproduce period uniforms, weapons, vehicles and buildings in game.

Figure 3.2: Red Orchestra

IL-2 is a team-based online aerial combat simulation based in World War 2. Like *Red Orchestra* the game aims to be both realistic and historically accurate, however due to the mechanics of flight simulation it provides a very different gaming experience. In this game players can view the world through a first person pilot's perspective or use a 3rd person view of the plane that they are controlling. The environment is fairly uninteractive, consisting of the runway that the players take off from, the ground and the sky. In both *IL-2* and *Red Orchestra* players are awarded points for killing enemies and achieving objectives such as capturing positions and destroying special targets.

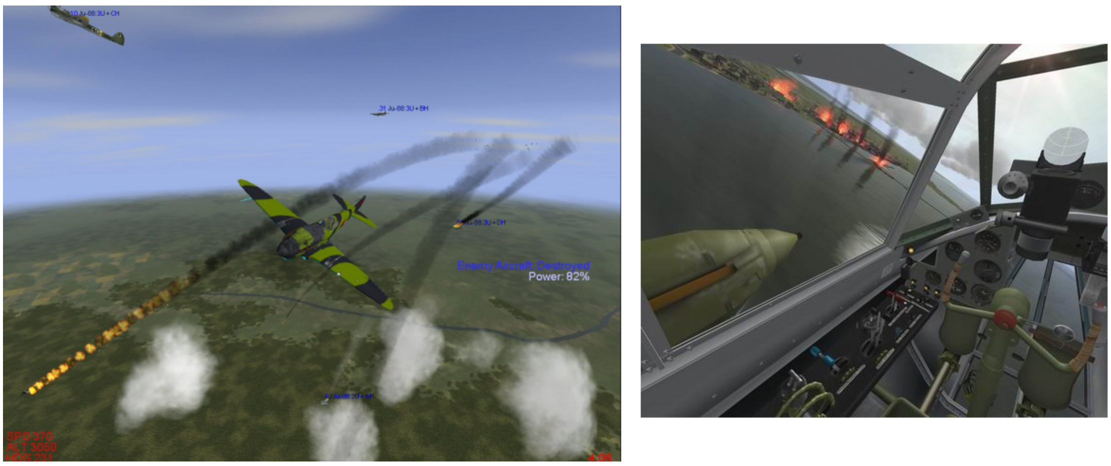

Figure 3.3: IL-2

The games in this study differ in gameplay styles and themes but all share the common element of being team-based games with both cooperative and competitive gameplay. In all of these games a player takes control of an in-game avatar, they use the weapons at their disposal to kill other players and achieve in-game objectives. In each game players can chose a 'class' of player character, from supporting medics or engineers in *Battlefield: Bad Company 2*, to various fighters and bombers in *IL-2*. Each game also involves teams of players attacking and defending, and team work is encouraged by the games. They offer an environment in which working collaboratively with a team can yield small successes and lead to ultimate victory, while offering a competitive environment in which players can beat opposing players by 'killing' them, and beat players on their own team by achieving a higher score than them.

Results & Discussion

Why Play?

One of the first questions put to the gamers who took part in this study was the question 'why do you play team/squad based online games'? As one might expect there were a variety of reasons given, but common reasons were the heightened perceived challenge factor of these games, and the comradeship/camaraderie felt while playing. Many of the respondents to the questionnaire mentioned that the games they play offer improved and more challenging gameplay due to the presence of other human players.

> "*Number one reason is that people act like, well, people. Mostly intelligently, but sometimes with utter stupidity. You can't get a robot (AI) to act in a decent manner, and it eventually gets very old once you learn AI routines. Real live people, on the other hand, make a game come alive*."

> "*Challenge. You're testing your mettle against opponents from across the world*."

Human players create a far more unpredictable gaming environment. In the games in this study players can expect to play the same map repeatedly, the presence of humans is important as it makes each experience within that map different, offering different challenges, scenarios and opportunities in an increasingly familiar environment. Human players turn a standard FPS game into a more dynamic and challenging environment, and respondents stated that one of the main reasons they play these games is the increased tactical element and the perceived realism that human opposition and team-mates bring to the games.

The human players within these games make them perceived as more challenging, however there are a number of games which include computer controlled enemies which are difficult to kill and extremely dangerous to player characters, in fact in most modern FPS games the player has the option to increase the difficulty settings of the game to extremely challenging levels. So if this is the case, why do many players still prefer human opponents? Perhaps in addition to the actual challenge presented by human opponents and team-mates it is the *idea* of human opponents which is most appealing. The very notion that we share a competitive environment with humans which are more or less as cunning and skilled as we ourselves may add an air of danger to the environment. It is the awareness of the presence of other humans which makes these environments more exciting and appealing. As difficult as a computer controlled enemy might be to destroy, the satisfaction of besting, or indeed cooperating with, another sentient being seems to be a very difference experience.

> "*When people are able to co-operatively make full use of everything available in the game environment, it makes the whole experience feel a lot more 'alive'*."

This concept of *aliveness* was a common theme in the data and demonstrates the conceptual difference between cooperating with human and computer constructed team-mates, due to the knowledge that the entities we are working with can feel and think as we do. For example, the reason why we might follow an order (or request) issued by a fellow player is totally different to why a *bot* would act on that order. The reasons why humans and *bots* inhabit and act in these virtual environments are fundamentally different.

While computer controlled opponents can be fun to kill in the context of a game, there is less satisfaction in 'beating' a computer, after all a computer game is designed to be beatable, otherwise games would simply be a convenient way to mentally torture oneself. The humans in the virtual environments of these games have not been designed to have weaknesses, predefined tactics or to be part of a narrative, and are there (broadly speaking) for the same reason as the other players.

Respondents noted how playing as part of a squad or team was also more challenging and more rewarding than playing as a *lone wolf*, a term which describes a style of gameplay in which the player acts alone, both physically in that they do not operate within a group of team-mates, and conceptually in that they act according to their own agenda. This challenge arises as players must focus on both their team and their enemy, while simultaneously balancing the goals of themselves, their immediate squad, and the overall team objectives. This suggests that many of the respondents enjoyed balancing the multiple goals which team and squad play provide. Thus it would appear that the increased cognitive load presented by these goals, each in constant flux over the ebb and flow of a battle, combined with the non-deterministic way in which each battle unfolds is one of the major attractions to these types of game. Another way to view this is that if games can be defined as 'voluntary problem solving'[Yoo, 2011], then these extra goals represent more complex problems to be solved. As the player is there to voluntarily problem solve, this increased complexity may provide a greater sense of enjoyment and satisfaction for the person indulging in the problem solving.

By far the most common reason stated for playing these games was not the challenge, or competing against other humans, or being the highest scorer. Primary to all these reasons was the concept of camaraderie, a concept which was the most mentioned reason for playing across all four game communities.

> "*The feeling of cooperation is a good one. You feel much more powerful and capable when you know that multiple people are coming together to do something that no one person could do by themselves. You feel like you are a part of something bigger than yourself.*"

> "*You feel as if your part in that team was somehow significant. You are proud to have helped that team to victory.*"

> "*It's less enjoyable to win when no one else can share in your victory and appreciate it.*"

> "*Nothing is better than saving your team-mates from certain destruction, and then having them say thanks!*"

The concepts of team play adding power and significance to a player's actions is akin to the tangible power mentioned in the Daedalus project [Yee, 2009] but is manifest in a different way. Unlike an MMORPG, in an FPS the power and significance of a player is not based upon the accumulation of wealth or magical powers or hit points, etc, but is based upon very much more immediate acts. Teams made up of humans allow players to conceptually 'save' another human, to see their relatively small actions leading to a greater accomplishment. For example, one could resupply a machine gunner leading to the defence of an objective, or one might kill a sniper who would have otherwise stopped the team achieving an objective. In each case the player may not seek explicit acknowledgement for these actions but will be aware of their significance and that these action inspired feeling in the other humans in their team. Thus it seems that the knowledge that our acts affect other humans is a central concept in social presence. Previous studies have suggested that as well as competitiveness and challenge, social reasons such as the possibility of cooperation and communication are strong motivators for people to play online FPS games [Jansz and Tanis, 2007, Frostling-Henningsson, 2009]. In this study the feeling of 'shared victory' and a shared sense of accomplishment was cited as a strong motivator, and is particularly interesting in the games in which many of the players are effectively strangers. Many of the respondents stated that these online team-based games gave them a feeling of being part of a larger force, connected to single mechanism.

> "*I take a lot of pride in being able to predict the behaviour of other team members and react to it in order to become more successful. I really enjoy being a driver and being able to operate the vehicle in the best manner to give my gunner the best chance of success. I guess you could say I live vicariously through my gunner. If he succeeds, then I succeed. My score is irrelevant, only the combined score means something*."

In this quote the respondent is describing being the driver of a tank. In the games the respondents of this questionnaire play, many of the vehicles can be operated by a number of players. For example, in *Red Orchestra* a tank can be operated by three people, a driver, a gunner, and an machine-gunner position. In this situation it is imperative for the players to work together with each player being highly aware of both their surroundings and the other crew member's intentions. The driver and the gunners of a tank operate as a single in-game entity which is far more powerful (in game terms) than the sum of its parts. It is easily observable within a game like *Red Orchestra* that a tank with a full crew who are communicating well and understand each other will be far more successful than a tank crewed by a single player or a number of uncommunicative players.

Many of the respondents to the questionnaire stated that the gaming experience is different depending on whether they are playing with their real world friends, strangers, or 'clan' mates. Respondents described how playing strangers rather than friends or people they know can often lead to them altering their play style and role within the team. This was mostly attributed to the comparative lack of communication between strangers and the fact that players could more easily predict the actions of their friends in game, and therefore could rely on them to fulfil particular roles within their team. A number of respondents described how they found playing with their friends more immersive due to the increased fun element, and because they did not have to be concerned about the behaviour of their squad/team and so could focus their attention on the action. However, a number of respondents did state that there is a unique satisfaction and sense of pride to be had when a group of strangers perform well as a squad. The fact that respondents stated that familiarity with other players changes the way they experience the game is consistent with the findings of Sweetser and Wyeth [2005].

This concept of predicable behaviour within the unpredictable environments of these games is an interesting one. The unpredictable nature of these games is the very thing which makes them so enjoyable for the players, and yet adding a predictable element seems to make the game more enjoyable. At first glance this may seem like a contradiction, however it could be argued that this is more about social presence than predictable in-game elements, it is a feeling of personal reliability, of someone '*having your back*'. The fact that a player feels they can rely on their friends is a sign of increased in-game empathy, a feeling of linked consciousness within these virtual environments which pulls the players deeper into the game. Another potential reason for the increased social presence when playing with friends is again the concept that our actions affect other humans. When playing with friends we know that these actions will not only affect them in game, but will be remembered in future social interactions (in or out of game), meaning that actions in game not only have immediate and short-term significance, but have a lasting social significance.

Around two thirds of the respondents to the questionnaire were members of a 'clan', a group of gamers who play together in a somewhat more organised fashion that normal gamers. Many members of clans form friendships and long term gaming relationships with fellow clan members, and that these players should feel camaraderie may be expected, even if one did not expect it to be their primary reason for playing these games. Respondents stated that playing in a team of clan members increases their commitment to the team and to the game, suggesting that the explicit identification and act of being a member of a community greatly increases camaraderie and perhaps social presence. However, camaraderie was also the primary reason for playing stated by the gamers who were not members of a clan. Therefore it seems that this sense camaraderie is a product of the game type, not only long term relationships created by a clan. Often this camaraderie is so strong that many respondents reported that the desire to play well as a squad often outweighs the desire to win the game as a whole. When asked how they would feel if they lost a game but their squad worked together well most respondents answered in a similar manner.

> "*I would be proud. Just because the numbers say we lost, doesnt mean we feel like we lost. If we worked hard and efficient, and we gave the enemy a tough time, then we accomplished what we went out to do. Winning is not everything, its just one goal.*"

> "*Then the game may say we are defeated, but I say we still won.*"

> "*Rather satisfied and comfortable in the knowledge that we didn't let the enemy grasp victory with ease.*"

When playing these team-based games almost all respondents stated that their aim was to work as part of a squad or team. There is an underlying assumed logic throughout the communities that if one works towards good team/squad play, fun and victory will follow. Playing these team-based games with humans is described by many of the respondents as both more challenging and far more intellectually stimulating than other types of game.

> "*Winning the game can be an important factor [...], but very often isn't main goal for the squad. Being effective as a squad thrills much more than just winning. In fact, it seems much more important to win or achieve something special when NOT in a squad. When in a squad everything not concerning the squad seems less important.*"

Though for some people fun is less on the agenda;

> "*First priority is to take or hold an objective. Second priority is to be the best player in the squad and the team. Third priority is to make sure everybody in the squad conforms and follows instructions.*"

Perceived Interaction

In the introduction to this study it was noted that *IL-2* and *Red Orchestra* had environments which offered a very low level of interactiveness. In *Red Orchestra* for example, a grenade will not destroy a wooden door and small trees are static objects able to stop a Panther tank. The gaming environment in this game provides cover, breaks in lines of sight, and establishes the historical setting, but does not provide much potential for interaction. However many of the players of these games suggest that the nature of online gaming changes the way in which they perceive the game environments.

Players describe how computer enemies become predictable causing the game to lose its edge. When playing against human opponents players describe how even uninteractive environments, such as those found in *Red Orchestra*, are perceived as more interactive as players view the environment in terms of how features within it might affect their interactions with other players. For example, if a player is fighting predictable computer controlled Bots, a wall in a level may be simply perceived as an obstacle to traverse or barely noticed, but because human players create a far more unpredictable gaming environment, a gamer might view the same wall in terms of cover from enemy fire, a place to launch an ambush from, a way of remaining unseen while flanking the enemy, and so on.

This shift in the way one perceives an environment is an example of *frame shifting*[Markussen and Krogh, 2008]. Frame shifting is the theory that humans interpret their environment, and artefacts within that environment, based upon a cultural frame in which the environment exists. For example, one would not react to a football in the same way if it was in a library as in a field, each environment exists in a different cultural frame to us, in one kicking the ball is acceptable, in the other is it not. Cultural frames are analogous to coloured lenses, they change how we perceive the world and when one views an artefact using different frames, one may see the artefact differently. In the gaming environment discussed above, the addition of human players to a game shifts the cultural frame through which the respondents view the level. This frame shift alters how players view features in the virtual environment and changes their expectations of the game. Simply put, players may act differently within the same environment depending on whether they think they are playing with humans or *bots*.

While the knowledge that one is fighting against human opponents somewhat changes the way players view a virtual environment and seems to increase social presence within the environment, the respondents stated that fighting human opponents in cooperation with other human players has an ever greater affect. Respondents how the "*tactical landscape*" of the gaming environment evolves more in team play situations, stating:

> "*You look at maps differently, you start to notice the tactical advantages and disadvantages an area imposes on your team over yourself.*"
>
> "[Being in a squad] *makes you look at your immediate surroundings in a different light, as you must now take into account the presence of your squad mates.*"
>
> "[Being in a squad] *gives it more intense feelings and emotions, because alone, it's just you but if you're in a squad, you know that there's someone covering you, or that you have someone's back. It gives a strong connection.*"

This awareness of other people's presence in the virtual environment, and consideration of how features in the gaming environment affect not only the player themselves, but their team-mates shows a high degree of social presence created by this shared conceptual place. Even in highly interactive environments such as the maps of *Battlefield: Bad Company 2*, team play, and the social presence it encourages, creates a perceived increase in interactiveness caused by players having "more to do than simply shoot enemies". The gamers also described how communication between players significantly increased the level of interaction and social attachment they feel towards the game, describing how communication improves their sense of their surroundings and gives a greater perspective of in-game events. In particular the ability to verbally communicate with team-mates is seen as critical to a successful squad.

Effort and Motivation

The gamers questioned for this study suggested that the shared place in which teams operate creates a sense of social responsibility and consequence. Players described how they would play '*more sensibly*' while acting as part of a squad and many respondents stated that they are far more motivated to play the game to a high standard in a team play situation so they did not disappoint other players or let their side down. Respondents stated:

> "*Shared victory and a sense of not wanting to disappoint are high motivators*."

> "*I do feel more motivated when I am part of a squad. I feel like they have my back, and I have* [theirs].*I feel like I need to prove myself, and I feel like they are going to try and prove themselves too. Overall, I play harder when I know I am being counted on, and when I am counting on others*."

> "*I will always try that little bit harder when playing with my squad so I don't disappoint anyone*."

> "[...] *if I am lone wolfing and I screw up it only affects me. If I screw up in a squad I let everyone down, I hate that*."

The responses from the gamers also suggests that when players are part of a squad there often form a strong bond to that small group of people, whether that squad is a group of friends of a transitory group of players who are effectively strangers. In these games it would appear that joining a team forms an implicit social *joint commitment*[Clark, 2006] with that team. In terms of the games discussed in this study, the implicit joint commitment between players is that they will help their team to win, winning as a team is the objective of these games. More explicit joint commitments are made when one enters into a squad based scenario. In games like *Battlefield: Bad Company 2* the explicit squad system publicly states this joint commitment, in games like *Red Orchestra* the joint commitment is made by committing to share a vehicle with another player, and so on. These joint commitments may seem rather adhoc and perhaps flippant given the circumstances, yet they are taken relatively seriously and can create changes in the way a person plays the game, and create emotional responses to players who do not adhere to this joint commitment. Players describe how they feel they must "*help my squad complete what we are doing*" over and above their own agenda, often changing their style of play to aid in their squad's goals. For example, a number of players described how they would change their 'class' of player character so that there could better help their squad.

> "*If I am by myself sniping and notice that my squad is really trying for objectives I will try to move and help them or switch classes and change my role to help them more*."

Another major reason many players stated that these games made them put more effort into their gameplay was the concept of reputation. The feeling that other people are watching their actions and will remember if they make a mistake and judge them in future is a strong sign that the level of social presence is high in these games.

> "*I try to avoid bad take-offs and landings when others are watching. Most people seem to try harder at the basics to avoid being embarrassed.*"

> "*I care more about what I am doing because my efforts not only effect me but my squad. My actions from the better to the worse are remembered.*"

> "*Tend to concentrate more so as not to cock up in front of others.*"

> "*If I die as a lone wolf my mind starts to wander till I respawn but if I die as part of a squad I think more about what went wrong and how I can fix it so I do not let my squadmates down again.*"

Around half the respondents to the questionnaire found the bond to their squad was strong enough to inspire the need to take revenge on someone who kills a member of their squad, often using a knife or bayonet for added spice, though few would actively hunt down the culprit if it required them to diverge too far from the squad's overall objective. The reason given by a number of respondents for this need to avenge their squad members was not, as one may expect, an impassioned need for revenge, but as a means of social bonding, to affirm the bond between squad members.

Many of the respondent's opinions on the topic of reputation and motivation return to the concept of the social significance of their actions. In these virtual environments populated by humans, respondents seemed to feel that their actions would be remembered and would affect their future interactions in the game. So while human team-mates allow players to feel their positive actions have a weight and significance, their negative actions also hold a greater significance and so players must work harder to avoid them and the perceived damage they inflict on their reputation.

Social Bonds

To explore the notion of social bonds within these multi-user virtual environments the gamers were asked if squad play increased the level of *emotional attachment* to the game they play. Around 70% of the respondents stated that playing a team-based combat game as part of a squad does indeed increase the level of emotional attachment to that game, and many players stated that even the mood of their squad members could affect them emotionally. One of the commonly expressed reasons for this was that playing in a squad creates more vivid memories for players, creating the phenomena in which memories of the game are memories of the emotions they felt as they played, rather than simply memories of actions and events.

> "*In a way it does. You have much better memories, a connection to certain maps or weapons.*"

It is likely that these memories stem from a heightened sense of empathy which team play, and to a potentially greater extent squad play, brings to online gaming.

> "*The character pawns become living things with personalities and therefore you* [empathise] *with them if they are struggling etc.*"

"*You get the option to care for other people and expressing that by giving them medkits and so forth. Also it feels nice if there is somebody who always looks that youve got enough rockets to take out that tank, or who continually revives you, when youre assaulting*."

As discussed the essence of these online team-based games is that the unique and stimulating gameplay is created by the unpredictable behaviour of human players. One respondent stated:

"*My squad mates ARE the game, and you can be sure I feel an emotional attachment to them*."

The players in these games create the game, and just as human opponents create a more unpredictable challenge, human squad members add a depth of gameplay which inspires a high level of social presence within the virtual environment. In team-based games players no longer think only of the enemy and themselves but the team as an entity, squad play adds yet another level to this social presence, inspiring heightened empathy throughout a small group of players.

"*I hate to give a command that gets my squad killed as I know them I know how they would feel and I know how I would feel if I was there instead of them*."

Just as altruistic behaviour and team work can bond a squad or a team of players, these environments can cause great annoyance to players who have differing goals to their squad members. The respondents gave many examples in which team/squad play could be annoying but the reasons generally fell into two main types, differing levels of team work and differing levels of commitment to the game. The issue of teamwork relates to the joint commitments mentioned earlier, players who are contributing towards the joint commitments of the team are annoyed by players who do not work towards them. It may be that joint commitments are related to the concept of group flow[Kaye and Bryce, 2012]. In terms of differing levels of game commitment it seemed that people who take the game seriously and people who do not, find each other very annoying. Like frame shifting, this issue touches upon the expectations that people have about gaming experience provided by a particular game.

Perceived Immersion

One question put to the gamers asked if, in their opinion, team play increases the level of immersion they experience while playing, if it made them lose track of time to a greater extent or forget about your everyday concerns, and so on. While five of the respondents stated that team play does not make the game more immersive, the vast majority of respondents stated that team play made games far more immersive. The players described that this was due to them being able to connect on a more emotional and intellectual level to the game and other players.

"*Once I'm focused on what's going on in-game, I could lose hours. And once I'm in there, there's little outside of it that distracts me*."

"*It makes the game much more interesting, and steps it up to a more cerebral level through the identification with larger-scale tactics. 'upping the game' so to speak does indeed make it more interesting*."

"*I once was late to work because I was really into a game and had a great group going and we were just destroying*."

"*It certainly ads to the atmosphere of a game. Youre feeling much more being part of something. Theres much more interaction too.*"

"*[The game] provides a place to retreat into, in which my everyday concerns are replaced by MG 42 fire.*"

These quotes are fairly representative of many of the opinions given by the respondents and suggests again, that it is not only the actual measurable effect that human players have on the action which changes the way players perceive the game, but it is the very idea of other humans sharing the environment which also alters this perception. We have established that in the opinion of the respondents human players make games measurably more challenging. However it is this intangible "atmosphere", the aliveness, that the awareness of other humans brings to a game that increases the social presence felt within it. Another kind of immersion discussed by the respondents to this questionnaire was the concept of community immersion.

"*In a community (clan) system, the immersion goes beyond the game, into the forums, community, even into real life.*"

"*Due to the social interactions that blur* [online] *with* [real life], *even while playing the game. However, I consider gaming a part of my life so it is scheduled along with my RL stuff.*"

In other words players become immersed within a gaming community, in the sense that the act of being in the community takes up their time, thoughts and effort. Respondents describe how they will willingly play for far longer, schedule time into their lives specifically for gaming, rather than gaming whenever the mood takes them. One players described the game and community that they play as a "*24/7 job*", while another stated that members of their community often meet in real life, such is their common interest in (in this case) Second World War aircraft.

"*I'll never forget the look on my wifes face when I first attended this event and had to confess to her that I was going to spend the weekend away with a group of guys I met on the internet.*"

The community side of things seems particularly strong in the historical based games, in which many of the gamers discuss the games as an opportunity to speak with like-minded people from across the world about obscure or niche interests.

"*I can have conversations with my squad that would be difficult/impossible to have with the majority of the public. My squaddies 'get it'.*"

Concluding thoughts

The data collected in this study suggests that the awareness of other human players change the gaming experience in team-based online games, making people focus more on their team as well as their enemy, creating different and greater challenges than those found in other games. All this seems to lead to more fun, but what has this study showed about social presence?

It was discussed in this study that the reasons humans inhabit these worlds and act in them is totally different to the reason why *bots* are there. This may seem obvious but this simple concept means that each human in the game knows that when a human player acts it is for human reasons. When players act upon requests or give orders it is based upon a complex set of motivations, instinct, personality traits, and so on, and the important thing is that all the players know this. The gamers know the other players are acting for human reasons, and though it is 'just a game' these acts do in some way affect other humans and so are of human significance.

One clear message from this study is that the awareness of other human conciousness within a virtual environment causes a frame shift, in which players change the way they perceive the environment. This frame shift is based upon the Theory of Mind [Baron-Cohen, 1997, Premack and Woodruff, 1978, Ratcliffe, 2007], or the 'Schelling mirror-world': the capacity to analyse other's actions through mental simulation, simulating other minds simulating our minds [Levinson, 2006]. The data shows that players are thinking about the thoughts of their opponents and team-mates, and that this thought process is changing their perceptions. This concept can make static virtual environments seem interactive, and changes a person's playing style. This is an example of how the knowledge of other humans in an environment changes a virtual environment from a *space* to a *place*. Spagnolli and Gamberini [2005] state that the difference between these two concepts is that a *space* is simply the locations of objects and the relative space between them, where as a *place* holds some significance to a human. Players experience a virtual environment with other conscious beings and feel and think within that virtual space, simulate the minds of their friends and enemies and take actions which affect other humans. Through this process the virtual *space* becomes a virtual *place*, and it seems logical that a virtual environment must be a *place* for a human to experience social presence within it.

This study also suggests that the way the players think of presence has little to do with the failure to perceive the technology which mediates their interaction with the virtual world, but is more to do with the feeling of connection through the virtual environment. The social presence discussed in this study is created by the knowledge that one is sharing and environment and playing with humans. The social presence also appears to be increased by the subtle acts of social bonding which occur in these shared environments (sharing ammo, healing others, sacrifice, etc), and social responsibility within these combat games. This study suggests that the social responsibility, the feeling that one *should* act as a squad/team member, is a strong motivator which leads people to change their playing style, work harder, and act in an altruistic with very little encouragement.

3.3 Vignette 2: Cooperative Tetris

Introduction

The previous vignette suggested that the perception of other entities within a virtual environment changes the experience of a game. Respondents spoke of how playing a digital game with other humans makes the virtual environment seem more alive and creates a greater sense of motivation and social engagement. This vignette aimed to test how manipulating the perceptions of a player's team-mate would change their experience of the game. This study aimed specifically to investigate how physical and conceptual distance affects social presence felt in a cooperative virtual environment. This study was inspired by both team-based gaming and team-training simulations, in which participants in the simulation can be displaced physically and may need to interact with human and computer controlled entities. This study was originally intended to be conducted as a formal experiment, similar to Gajadhar et al. [2008a] and Cairns et al. [2013]. However upon piloting the experiment is was found that the intended measure for social presence, the SPGQ [de Kort et al., 2007], was not a suitable measure for cooperative gaming. Despite this problem, the post-game interview data was providing useful player experience data. Rather than adapt the experiment to the measures, or force the respondents to fill out questionnaires they had problems with, it was decided to proceed using modified versions of the questionnaires but focusing on participant interview data. In this way the main study operated as an experiential vignette, concentrating on the insights and ideas which were present in the qualitative participant data.

Aim

The aim of this study was to investigate how physical and conceptual distance between players may affect the level of social presence felt in cooperative games. It was hoped that any differences in the level of social presence felt by participants in the various conditions would enlighten some issues regarding social presence in team-based games a more general sense. In essence this study was a first step in exploring the differences between and perceptions of live, virtual, and constructive entities, team-mates which were physically present, virtually present, or computer constructed. The game chosen for this study was a cooperative version of *Tetris*. A cooperative, rather than competitive, version of *Tetris* was chosen for this study to explore social presence from a team-based perspective. Participants were asked to play the cooperative *Tetris* in various situations, being in the same room as their co-participant, playing with a human partner over a great distance (using an online client) and playing with a partner which they perceive as a construct (non-human *bot*).

Study Design

This study was similar to those conducted by Gajadhar et al. [2008a] and Cairns et al. [2013], in which participants played a game in one of three social contexts; playing with a computer (non-human or bot), playing with a mediated (non co-located) human, and playing with a co-located human. However, unlike these experiments, the participants in this study were playing in collaboration with the other entity, not against them.

In this study a single sample of participants was taken and asked to play a two player cooperative version of *Tetris* before completing a questionnaire to evaluate the level of social presence they experienced. In this study participants were required to play a cooperative versions of the classic *Tetris* game under three conditions. This study measured social presence by analysing the results of a questionnaire given after the participant had finished playing the game. The points scored by the participants were noted to evaluate if there was any link between social presence and cooperative competence. In this study these three conditions discussed in the Materials & Setup section below, the dependent variable was the immersion and social presence scores collected by the questionnaire. This study was conducted between participants as the familiarity with the study design may have coloured results of the study.

Tetris was chosen for this study as the aim was to test **only** social presence within virtual cooperative environments and was not concerned with spatial/physical presence. As the interplay between social and spatial presence has yet to be explored it was considered prudent that this variable be removed. Unlike many games which employ graphics to induce a sense of place to the player, *Tetris* is a game which involves very little (if any) sense of spatial/physical presence, even compared to other very simple games (*Figure* 3.4) where there is a *there* for the player's mind to be. When one plays *Tetris* one cannot feel *there* because spatially there is no *there* to be. Therefore it was hoped that this study would only induce social presence.

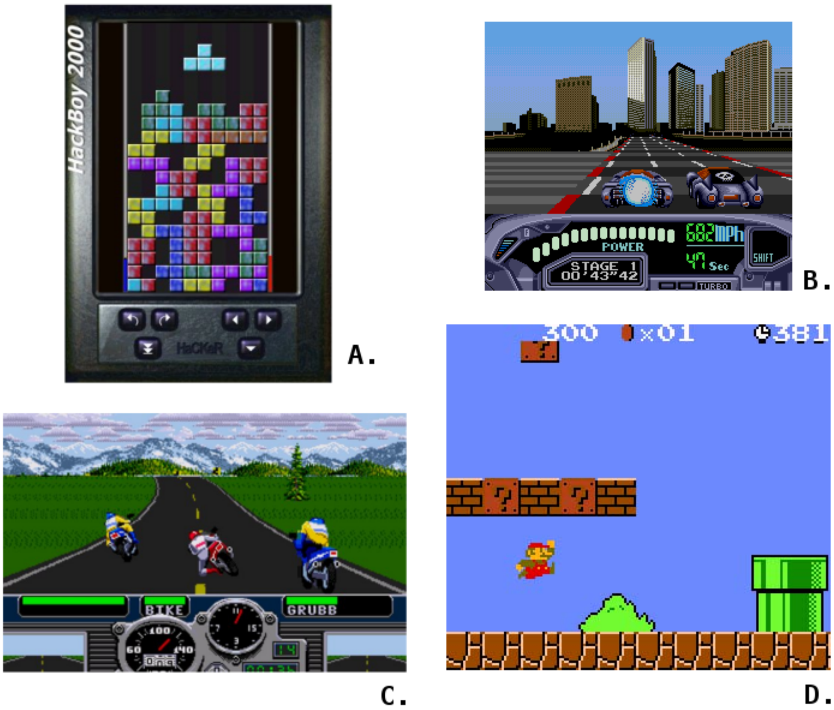

Figure 3.4: A. Hacker *Tetris*, B. Outrun 2019, C. Road Rash, D. Super Mario Bros.

Participants were told they were to work with their cooperative partner (a team-mate), to collect as many points as possible within an allotted time frame (5 minutes) and that there would be chocolate prizes for high scores. There were three conditions under which participants would play the game, the *Base* condition, the *Real-to-Real* condition and the *Bot* condition. In each condition the participants would play cooperative *Tetris* with the same team-mate (a *ringer*) who were instructed to play as consistently as possible. Consistency in this case refereed to consistency between participants, that the fake player should not act widely differently in terms of cooperative behaviour. In summary, while players of the Bot condition assumed they were playing a bot, they were actually cooperative with a human.

After a participant's time was complete they were asked to complete a questionnaire which was used to measure their level of immersion and social presence while playing, the questionnaire was based upon a gaming immersion questionnaire by Jennett et al. [2008] and a presence questionnaire (SPGQ) by de Kort et al. [2007]. The SPGQ was chosen for this study as it came from gaming literature and so it was felt that it would be the most relevant measure of social presence in a game based environment. However on piloting the study the SPGQ was found to contain some questions which were irrelevant to the game and or scenario, in addition the SPGQ failed reveal some key elements of social presence which were to be explored in this study. There was an attempts to modify the questionnaire to better suit the cooperative nature of the experiment, however the core data in this study remained the post-game interview data. The full version of the modified questionnaire can be found in Appendix 7.1.2.

Condition 1: Base

In the base condition the participant sat in the same room as their team-mate. This has been the only way to play cooperative *Tetris* until the HaCKeR version, from *Tengen Tetris* on the NES, to *Tetris Party* on the Wii, with two people in the same room playing together. The players sat beside each other but using separate PCs and viewing the game on separate screens. In other words the participant and their team-mate were playing the same game in the same rooms but on their own machines.

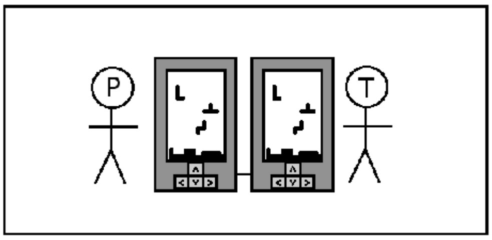

Figure 3.5: Collocated team-mates in the base condition, P = Participant, T = team-mate.

Condition 2: Real-to-Real

The real-to-real (R2R) condition physically separated the participant from their team-mate, the participant would sit in a room at one computer playing the cooperative Tertis and were told that their team-mate was somewhere else. Their team-mate was sat in another room at a computer playing the game.

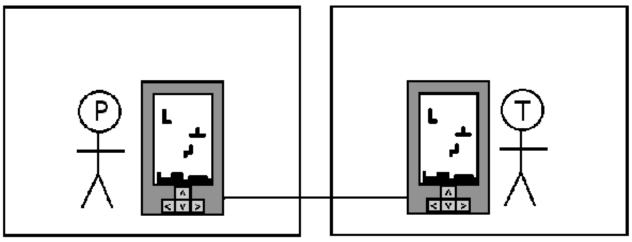

Figure 3.6: Physically separated team-mates in the real-to-real condition, P = Participant, T = team-mate.

Condition 3: Bot

The Bot condition was designed to create a conceptually different experience. The physical set-up was much the same as the real-to-real condition, with the participant of the study playing on their own with a cooperative partner located elsewhere. However, unlike the previous condition, the participant was told that the entity controlling the other blocks was a bot. The participant was playing a human as in the R2R condition, but assumed their team-mate was a bot.

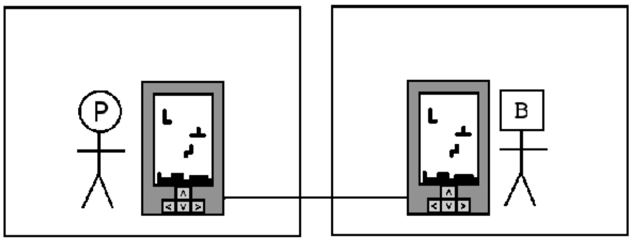

Figure 3.7: Participant and the perceived bot team-mate, P = Participant, B = Bot.

Expectations

In the similar studies [Gajadhar et al., 2008a, Cairns et al., 2013] it was found that there were significantly different levels of social presence between the three conditions, with the level lowest as the participants played against a bot, and highest when playing against a co-located human. In this study it was expected that the various conditions would also alter the level of social presence felt by the participants. It was expected that the participant playing with the bot would experience less social presence as they assume they are simply playing with an program. The difference in the level the social presence between the players in the same room and in physically separate from one another was harder to predict. As the previous vignette suggested, playing games in which we cooperate with other people to achieve a shared goal can inspire strong social connections and even spark emotional responses to in-game actions. However on most online games players have various methods of communication, including voice chat, text based messages, and using their online avatars to gesture. The cooperative *Tetris* has no voice or text based communication and so players in two conditions were only able to communicate in the most basic of ways, by moving their blocks in a way which may suggest intent to the other player. It was expected that the condition which creates a physical distance between cooperating players would cause a slight decrease in the level of social presence experienced, but not as significant a decrease as when the players believe they are playing with a bot. Verbal communication between non-collocated players could have been simply established using VOIP applications such as Team Speak, however in this study VOIP was not used in an attempt to keep the number of variables down.

Another variable which was measured in this study was the level of immersion experienced by the players. *Tetris* is a very simple and fairly timeless game from which one could expect a fairly high level of immersion reported from participants, however the addition of a cooperative element is likely to affect this. It was predicted that the conditions in which participants believed they were playing with humans would produce a higher level of immersion than the condition in which participants believed they were cooperating with a bot. This was based upon the results from the previous vignette, in which respondents suggested that cooperation with human players (though in a quite different virtual environment) may produce increased immersion.

Materials & Setup

The game used in this study was *HaCker*[1], and was used primarily because it was the first *Tetris* game to

[1] http://www.gameplayheaven.com/hacker.html

offer cooperative *Tetris* over Lan or the internet and, while some more modern versions of *Tetris* do offer a cooperative mode, *HaCKeR* was still (at the time of the study) one of the only *Tetris* games to support an online/Lan cooperative feature. *HaCKeR* has been developed for the Windows operating system and so the study required at least two PCs running a version of Windows (XP or later). To control this game participants would simply use a standard keyboard, manipulating the arrow keys to steer and rotate the *Tetris* blocks. *HaCKeR Tetris* has a number of game modes, the game mode used in this study was one in which two players play cooperative *Tetris* and *complete* levels by achieving a certain number of points.

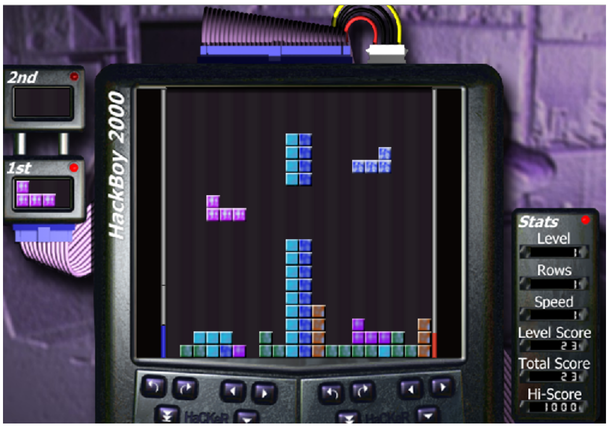

Figure 3.8: An example screenshot of HaCKeR coop mode

Participants

For this study 25 participants were sourced from friends and acquaintances. Most participants were regular players of some sort of digital game and were between the ages of 18 and 31. There were 15 male and 10 female participants, 8 participants played the Base condition, 8 played the R2R condition and 9 the Bot. 20 of the participants had not played a cooperative version of *Tetris* before and 18 had not played a competitive version of *Tetris*. Over half of participants had played some sort of online game before (with friends and or strangers) and 10 out of the 25 classed themselves as a 'Gamer'.

Results

Immersion

Immersion scores in this study were fairly middling, regular and consistent (Table 3.1). All the conditions produced similar scores with no statistical significance shown using a Kruskal-Wallis Test ($H = 0.2$, $P = 0.9048$). It was expected that a higher level of immersion would be attained in the conditions in which players perceived their team-mate as human, and though a small difference in the average scores can be seen in Table 3.1 below, this difference was not significant. This version of *Tetris* did achieve high attention and enjoyment ratings from participants, and also consistently caused the participants to become so immersed that they became unaware that they were using controls. These effects are perhaps unsurprising as *Tetris* is an incredibly simple puzzle game with enduring popularity.

Condition	Average Immersion	Average Social Presence
Base	95.1	68.1
R2R	94.9	69.9
Bot	94.1	56.3

Table 3.1: Average Immersion & Social Presence Scores

Social Presence

While the SPGQ was somewhat unsuitable for this experiment due to its focus on competitive play, the results still suggested that human team-mates produce a higher level of social presence than a bot. It was expected that the condition with the highest average social presence score would be the base condition, followed by the R2R condition, with the Bot condition scoring the lowest. As Table 3.1 shows, the base and R2R conditions are not significantly different from each other, however the Bot condition has a considerably lower average score. A Kruskal-Wallis Test on the social presence statistics gave a score of $H = 9.17$, and $P = 0.0102$. In this study the social presence score was not particularly high in any of the conditions, probably due to only a small interaction potential, and limited evidence of another entity within the *Tetris* game environment. There were no avatars representing the players, the only evidence that another entity was playing the game was the control of the 2nd *Tetris* block in the game environment. Despite this low social presence the difference between the conditions is clear, in the Bot condition the feeling of a social connection between the participant and their team-mate was far less strong.

The results from the social presence questionnaire showed that in the R2R condition players paid closer attention to their team-mate's actions than in other conditions and enjoyed the cooperative experience more. In the Bot condition players consistently reported finding their team-mate's actions 'annoying', and assumed their team-mate could not make tactical choices. The fact that players found their bot team-mate (which was of course really a human) annoying may be due to it being easier to assign blame to a computer and attribute failures in humans to simple 'bad luck'Merrit [2012]. Interestingly players did interpret their team-mate's actions as communicating intent in all conditions, for example one may have interpreted that their team-mate moving a block over a gap was communicating the intent to fill the gap, and thus the player would not attempt to fill it them selves. In all conditions participants assumed that they were paying more attention to their team-mate's actions than the team-mate was to their actions.

Immersion & Social Presence

The results of this study did not show any interplay between social presence and immersion, higher social presence did not consistently lead to high immersion and visa versa, and a square of the Pearson correlation coefficient gave a score of 0.085 showing no correlation.

Post-Game Interview

The difference in how the participant's team-mate was perceived is perhaps more telling than the scores from the questionnaires. In the post-game interview participants were asked if they felt they were communicating non-verbally while playing, and if they thought they would play differently if they were playing a bot (or a human if they were in the Bot condition).

Condition	Yes	Maybe	No
Base	6	1	1
R2R	5	2	1
Bot	2	2	5

Table 3.2: Did you feel you were communicating non-verbally while playing?

Condition	Yes	Maybe	No
Base	4	3	1
R2R	5	2	1
Bot	5	3	1

Table 3.3: Would you play differently if you were playing a bot/human?

When asked if they would have played differently if they were playing with a conceptually different team-mate (a bot or human), most players said they would play differently, stating "*Bots are stupid, I have never seen a useful bot*", "*Yes, Bots would have no personality*", "*I think so, would need more thinking, you cant rely on bots*", "*yes the game would change*", etc. The results of these questions suggest that the idea that a participant was playing a bot not only affected actual social presence but also their perception of the interactions taking place and their perceptions of their own playing style. This echoes the social gaming study in that the knowledge of the presence of another human change a virtual environment in some intangible way.

Discussion & Concluding Thoughts

It seems social presence is affected as much by the preconceptions or perception of a virtual situation than any cooperative interaction taking place. In other words if a person makes the decision that they will not have a social connection to an entity then they do not. This supports the argument that the knowledge that one is sharing a virtual environment with another human creates an underlying perceived connection, creating social presence. This perceived connection does not seem to automatically exist when one believes the virtual environment is only shared with constructed entities. Although it should be noted that it is perfectly possible for humans to willingly indulge in social connections with constructed entities and technology [Galbraith, 2011].

The aim of this study was to investigate how conceptual and physical distance affected social presence in shared virtual tasks, and to provide insights into the notion of social presence. The results of this study suggest that in this situation physical distance, working on a virtual task in the same room compared to separated, did little to affect social presence. The results also suggest that conceptual distance, that is players thinking their team-mate is not human, strongly affects social presence.

It was predicted that the conditions in which participants believed they were playing with humans would produce a higher level of immersion than the condition in which participants believe they were cooperating with a bot. As noted, this expectation was based upon the results from the previous vignette, in which respondents suggested that cooperation with human players make the game more immersive. However there was no statistical difference in the immersion scores between conditions. This may have been due to where the immersion comes from in games like *Tetris* compared to games like *Battlefield Bad Company 2*. *Battlefield* is a completely different game, it consists of large virtual environments in which many humans move freely, able to use multiple weapons and vehicles, in this environment human team-mates and enemies truly change the nature of the game and perhaps create a more immersive experience. In *Tetris* there is little scope for dynamic team work, it is still the same old *Tetris* but with one more block which is controlled by another player. Playing *Tetris* with another human does not change the game mechanics as it does in a game like *Battlefield*, it simply adds a cooperative element to a simple task, and therefore did not increase immersion.

In games such as *Battlefield*, players can also clearly see the digital representation of other players within the virtual environment. The players have a more tangible presence within the game in the form of their avatars, while in a cooperative game of *Tetris*, the presence of another human can only be observed via the movement of a block. In the previous vignette players stated that verbal communication was critical to teamwork and a feeling of social connection in online FPS games. In a study by Gajadhar [2010] it was found that audio cues which suggested the presence of another player increased social presence far more than visual cues. "Social presence in gaming is strongly influenced by the availability of audio cues in digital game settings; the added value of visual cues was modest. Observation data revealed that talking and especially laughing & cheering caused differences in experienced social presence" [Gajadhar, 2010].

This study had a number of limitations, the main limitation being the questionnaire used to gather the data. The social presence questionnaire (SPGQ) was modified to suit the game based on participant feedback in the pilot study, however the questionnaire was still not a perfect match for the game. This meant that the data gathered in this study, though useful in measuring a basic level social presence, was not as rich in detail as it could have been. It could be argued that the *Tetris* game used for this study does not accurately represent a real world cooperative virtual task, this may be a valid argument. However, this study set out to explore the very notion of social presence. Thus the study aimed contain very few variables and to provide a simple virtual task so that participants could experience a simple pure form of social presence, which could then be manipulated via the conceptual conditions, for this cooperative *Tetris* was a good fit. Finally this study also supports the notion that there can be a sense of place where there is no space, as a sense of social presence was shown to occur in the spaceless shared virtual environment of cooperative *Tetris*.

3.4 Vignette 3: The Problem with Bots

Introduction

The previous vignettes suggested that a person's perception of an entity acting within a virtual environment affects the strength of any social connection to that entity. If an entity is regarded as synthetic or constructed, it is likely that a lower level of social presence will be established with that entity. Simply put, awareness of others is key to social presence. So what would happen if ambiguity were introduced into a collaborative virtual context?

Across the net there are thousands of bots killing each other every day, such atrocities are due to online FPS servers which host games filled with bots masquerading as humans. Normally bots on an FPS server are easily identified, they have generic names and do not have a *ping* score. *Ping* denotes the quality of the player's connection to the server and is used to identify players which may be causing server slowdown or *lag*. As bots are located within the server, they have a *ping* score of Zero. However in some games, such as *Unreal Tournament* (*UT*) and *Team Fortress 2*, it is possible to modify bots so that they have the traits of a human client on the server such as human-like names and a *ping* score. Often called 'fake' bots, they are used as tools to make a server seem populated by humans searching for a game on a server browser. This tactic is used to encourage gamers to join the server as it is assumed players join online FPS servers to play against other humans. The motivation for this trickery is sometimes monetary but is often an attempt to keep a small gaming server/group alive.


A.


B.

Figure 3.9: A. Unreal Tournament, B. Team Fortress 2

Like the first vignette of this chapter, this vignette was designed to explore the opinions of gamers regarding team-based online games, however this study specifically focused on the concept of ambiguous agency. This study gathered farmed and found user data from gaming communities, gathering online data using a multi-method approach similar to Blythe and Cairns [2009], Cairns and Blythe [2009], Pace et al. [2010]. What makes this a study a vignette is that the data was not analysed to create generalizable facts, the biases and small data set are full acknowledged, but to enlighten different perspectives that real gamers have on the issue of ambiguity. The aim of this study was not to reveal what gamers actually think, but to give an idea of what some gamers think they think.

Method

The total data consisted of around 10,000 words of user generated content. This study used both found, pre-existing user generated content, and farmed, user responses to a question posed by the researcher, data. The found data collected from gaming forums totalled around 8000 words and was found by searching community forums for phrases such as 'bots vs humans', 'fake bots', 'fake clients', etc. This process produced a quantity of useful found data on the topic from the following forums: forums.ut-files.com, forums.steampowered.com, forums.gameservers.com, unrealadmin.org/forums. The farmed data was produced by posting a question on the *King Arthur's Gold* (*KAG*) community forum to elicit player opinion on ambiguity in team-based online games. The response data collected totalled around 2500 words and was used to establish the overall themes and opinions of the community. The *KAG* community was chosen for this study as at the time of the study it had a highly active community forum. *KAG* is a 2D online multiplayer game in which teams of players build castles and kill each other. The high level system is much the same as an online FPS such as UT, players control their avatars within a virtual environment based on a server, many players can connect at the same time and must compete and collaborate to beat the other team by killing their avatars.

Figure 3.10: King Arthur's Gold

The *KAG* community were asked:

> How would you feel if there was a KAG server, in which there were humans and bots but you did not know which were humans and which were not? To ensure ambiguity lets assume all the entities on the server had standardized names, did not communicate verbally/textually and all Bots would be given a ping score, etc. 1. In terms of social presence, would you feel feel more/less socially connected to the other players? 2. In terms of immersion, would the ambiguity make the game less immersive than normal?

As in the first vignette, once gathered, the data was thematically analysed to establish common themes[Boyatzis, 1998, Braun and Clarke, 2006].

Results

Fake Bot Forum Data

The thematic analysis of the found forum data revealed that in the various communities of online gamers the fake bots practise is seen as a problem, reducing both fun and trust, and repelling many players from the games altogether. In the forums dedicated to games such as *Unreal Tournament* (UT) and *Team Fortress 2*, players stated that they feel "cheated", "annoyed" or "tricked" when they enter a server and realise that the players are all 'fake' bots. The practise is frowned upon and described as "dishonest" and a "ridiculous, fake way of getting people". This is most likely due to the issues raised in the first vignette study, that the primary reason for playing online multiplayer games is for the presence of humans, and the social dimension and heightened perceived challenge, that this presence adds to play.

> "*Most people wont play against the bots, especially on an online game since there is no competition really. You're just beating the AI, you can do that off line. Kind of defeats the purpose of online game play*."

The sentiment of the quote above is echoed by Morris [2003] who argues that multiplayer FPS games are "co-creative media", the experience of the game not created solely by the developers, but requiring both the developed product and the players. This is similar to the concept of the co-constructed and co-experienced mixed reality applications discussed in the literature review [Wagner et al., 2009]. This co-creation means 'fake' bots could be considered as a weak or false part of this "co-creative media", reducing the level in which players are willing to invest their time and effort. The general consensus in the communities is that bots are acceptable when they are explicitly identifiable as bots.

> "*I don't mind the bots... I dislike the bots being disguised as clients.*"

KAG Community Question

Most players stated that the experience would certainly cause a lower level or immersion and a far lower level of social presence than they normally experience in a *KAG* server fully populated by humans, or in which the bots are clearly identified as such. However one player (ConmanMC) suggested that immersion is relative to a player's aims, that if one joins a server not to socialize but to simple play in a dynamic environment (for example if one wished to build and repair a building in *KAG* during a battle), whether the other entities are human controlled or bots is irrelevant. Some players stated that they would probably assume that all the players were bots and a number stated that they would try to identify the bots by testing them in various ways, such as blocking their path or acting strangely and observing their reactions. However most players were confident that they could identify a bot, not only in *KAG* but in any game, as they assumed bots are always either too bad, too good, or too consistent. Generally each member made it clear that the ambiguity would change the 'feeling' of the game, less of a connection to the other entities and a loss of immersion due to not knowing your actions are affecting other humans. To paraphrase one of the players the game would no longer create the feeling that you are being watched by a 'predator'.

> "*Bots lack empathy [...] whether it be positive empathy [the desire to help you] or negative empathy [schadenfreude], the ability for humans to comprehend + illicit emotions in other humans (even without speech/facial expressions/body language - simply through situational happenings and actions) is something that is so incredibly contextual, subtle, intangible that I doubt it could ever be satisfactorily accounted for with lines of code.*"

Discussion

This study consisted of a thematic analysis of a data set that represents a small slice of game community opinion. The data helps identify what users think they think about ambiguity in games. Overall the data suggests that players find it important to know if the other entities in a team-based online game or human or computer controlled. However, players also argue that they would always know if they were playing a human or a bot based on the way the entity would act. Players stated that if they were deceived they would be annoyed and cheated of a genuine game experience.

The themes identified in the data support the findings of the *Tetris* vignette in which players stated they would play differently depending on the agency of their team-mate, even though the participants in the *Tetris* study seemed to believe they were playing a bot when they were actually playing a human. Of course *Tetris* and team-based games with cooperative and competitive elements such as *KAG* offer disperate experiences with greatly different interactive opportunities. However, the analysis identified player assumptions that bots always produce a lesser gameplay experience than humans, and that players can always identify bots. Assumptions which can now be tested.

3.5 Vignette 4: Ambiguity in Unreal Tournament

Introduction

The previous vignette suggested that players think they can accurately identify human and computer controlled entities within a virtual environment. This study aims to test these assumptions by introducing ambiguity into a team-based FPS game to test if ambiguity affects social presence. This study constructs a gaming scenario in which teams of anonymous avatars compete in *Unreal Tournament*. In this study teams were made up of both bots and humans, and the human players knew that any of the other in-game entities could be either humans or bots. This study can be identified as an experiential vignette as it directly manipulated the experience of the participants, briefing them that there were about to play a team-based game with entities which could be both human or computer controlled. The study had a small number of participants but produced interesting insights into social dynamics in team-based digital games. It provided multiple stimuli to participants in the form of game mode comparison and ambiguous agency, all in the fast paced engaging game of *UT*.

Method & Procedure

The game chosen to provide the virtual place for this study was the original *Unreal Tournament* (*UT*). There were a number of potential team-based digital games which could have been used for this study, such as *King Arthur's Gold* or *Team Fortress 2* mentioned previously, and games such as those in the *Worms* series. However *UT* was chosen for this study due to its simplicity and purity of game style, and in the ease with which game could be set-up for the needs of this study. For example, in terms of gameplay *UT* is one of the original FPS Deathmatch games, it is extremely primitive and pure with very little to detract from the core gameplay elements. While in more modern games such as *Battlefield: Bad Company 2* players have additional functions such as throwing grenades, reviving team-mates, dropping ammunition boxes or health kits for other players, marking enemies on the map, etc., in *UT* the player simply has the ability to move and shoot. *UT* is also extremely easy to configure for the desired experimental conditions, bots are very simply modified to resemble player avatars by changing their names, appearance and playing style. In terms of playing style, bots can be altered to be careless, aggressive, cautious or avoidant, they can also be configured to jump, strafe or 'camp' and favour particular weapons. The bots are also very well 'mapped' to the various levels of *UT*, which means they would be able to navigate the virtual environment efficiently and not become stuck or partake in any other obviously non-human activity. In addition to making the identities of the bots ambiguous, *UT* servers are quick to set up across a local area network and extremely reliable, which ensures an efficient and effective study environment.

To help ensure ambiguity of the bot/human entities the servers were configured using the following details:

- All entities had standardized predefined names.
- All players were instructed not communicate via in-game text.

It was hoped that the results of this simple study would inform further investigation and experiments into teamwork in multi-user virtual environments, perhaps leading to the using more complex virtual environments. This study was designed to explore the concept of ambiguity, and much like the *Tetris* study, it was important that the game be simple, fun, and fit for purpose. *UT* provided a simple game environment in which the participants could experience the other entities in an uncomplicated way, at least compared to many more modern complex multiplayer FPS games.

To gather a range of experiential data participants were asked to play two different game modes one after the other, Team Death Match (TDM) and Capture the Flag (CTF). It was hoped that these different game modes would encourage participants to consider ambiguity from different perspectives and so produce more rich data. In TDM the players and bots were split into two teams, the aim of each team is to score a higher number of kills than the other team, each kill made by a member of a team counts towards both their team's score and their own individual score. The game consisted of one 'match' which lasted 10 minutes. In the CTF game mode the players and bots were again split into two teams, however the aim of this game mode is for one team to capture the enemy flag from their 'base' on the map, and return it to their own base. In this mode the number of flag captures count and the number of kills is irrelevant, although a tally is kept for ego purposes. The first team to make 5 flag captures wins, in the case of this study, this process took around 15 minutes.

In this study eight participants formed two mini focus groups of four, these two focus groups participated in the study separately. The group was asked to play on a TDM server, the participants were informed that there would be a number of other human players on the server and a number of bots. In this particular study the players were collocated within the same room, however they did not have visual access to the display of other players. The participants were instructed to play the game as normal until the match was over. After the match had finished the focus group was asked to discuss the experience in a group discussion with all participants. Throughout this discussion the players were asked specific questions relating immersion and social presence, in addition to the ambiguity aspect of this study. Following this discussion participants were asked to join a new server, this time a CTF match, and were again informed that there would be a number of other human players on the server and a number of bots. After the match had finished the group of participants were again asked to discuss the experience, this time comparing immersion, social presence and the issue of ambiguity in the TDM and CTF game modes. The data from this study was gathered by taking notes during the mini focus group discussions.

The *UT* server was run on a computer used by one of the participants, this server hosted the game in which the bot players were present. As stated the players were collocated within the same room and the other participants joined the server using laptops connected to the host PC via a network cables and a switch (LAN party style). Each mini focus group consisted of four people between the ages of 22-28. There were a total of six male and two female participant, five of the participants had played this version of *UT* before, all participants were experienced FPS players. Players and bots were randomly assigned to teams, each team contained two bots and two players though the players did not know this at the start of play.

Discussion

UT Deathmatch games take place in a relatively small virtual environment, designed to maximize player contact and provide a fun, challenging, and rapid action experience. In the TDM conducted in this study the participants stated that experience was extremely fun and highly immersive. The action was very quick, with most of the players and bots scoring a high kill count, in fact in the TDM a player was just as likely to be killed by a bot as by another human player. Throughout the TDM players did not communicate verbally.

The TDM provided such a chaotic experience that the participants had little time to consider who the players and bots were. Participants stated that in the TDM team-mates only represented "people to not shoot", and that they could only identify other human players if a clear mistake was made, i.e. a player shooting at their own team, something a bot is programmed not to do. In this high paced and often "confusing" environment participants expressed a great feeling of 'flow', stating that they were in an almost "mindless" state of enjoyment. In this situation the participants stated that ambiguity was not important to their perception of the game and they did not care who the bots were as all their enemies and team-mates were acting in a similar manner, jumping around and shooting.

The CTF section of this study took place in a larger virtual environment. Participants stated that in this game mode there was a far higher sense of social presence and the game made for a more tense experience. Throughout the game participants communicated far more regarding tactics. The participants discussed what roles they would take on (attacker/defender), requested help, encouraged their team-mates, discussed enemy location and movement, and so on. For example phrases such as "I'm going to get the flag" and "Someone's coming protect our flag". This verbal communication is interesting as the players reported that while they were talking to their team-mates, they were unsure which of the other human players were on their team, but assumed some must have been and so made open statements to the whole room. Players also reported making tactical decisions about what information to communicate to the room. In *UT* weapons can be picked up from spawn points, but once a weapon is collected by a player it does not re-spawn instantly, the more powerful or rare weapons often take longer to spawn, do not spawn until the player who hold it uses it/dies, or are located in difficult places to reach. One player stated that when another player complained that a certain prized and sought-after 'super-weapon' had not re-spawned, they did not reveal that they were in possession of it as it would have given a "clue to their position"and reveal tactical information to the enemy human players, "whoever they were".

While the bots present in the CTF game were still technically as 'dangerous' as the ones present in the TDM game (they were as accurate, skilled, etc, as before), the more tactical nature of the CTF environment reduced this threat in the human player's minds. In CTF the goal is more clear cut, yet winning the game requires more than simply taking less casualties than the opposing team. In this game the participants played far slower, and expressed that they were in a more "tactical state of mind" and felt more like snipers trying to outwit one another. After the CTF the participants stated that the ambiguity made them second guess their choices and act more cautiously than they might if they were playing CTF with only bots.

The tactical nature of CTF led to the ambiguous issue being of far more importance in the CTF than in the TDM, participants observed one another and often exclaimed "who was that?" when they were killed. The participants stated that in this game it was very important to know who the humans were as they were far more likely to be dangerous, both to the player character, and to the team's flag. In this situation the participants were often able to identify the bots due to their inability to adapt to this tactical environment. Other tell tale signs of bots were non-team focused actions (e.g. running towards the enemy flag alone, not giving 'covering fire'), and a lack of caution while acting in a sniping role.

The participants also reported that in the TDM the ambiguity did not affect immersion, whereas in the CTF the ambiguity detracted from the task at hand, at least in the beginning as the participants realised the human/bot distinction was to be more important in this game. Participants in the second group stated that in the CTF mode the ambiguity became increasingly distracting as their motivation changed from winning to identifying the humans. Participants stated that once they had adequately established to themselves which entities were bots and which were human, their feelings towards the entities changed. Their focus switched to the human players, largely ignoring the bots unless they managed to captured a flag. In one situation a bot captured an enemy flag and was bringing it back to a participant's base. The participant stated that they were mostly considering the enemy human players, and focusing on protecting the bot from them. It was also expressed that in the TDM mode it felt as though the teams were made up of individuals working alone, whereas in the CTF game the teams felt like "real teams".

Throughout both the TDM and CTF participants stated that they did genuinely feel that they were sharing a virtual place with other entities and that the biggest motivation for playing well was the team structure. Participants expressed that being in a team made the game more immersive, socially stimulating, and generally made them put more effort into winning.

Concluding Thoughts

This study aimed to test the assumptions made by gamers in the previous vignette and found that the effects of bots on team-based gameplay is not as black and white as might be expected. This study suggests that the importance of ambiguity is pragmatic and depends on the task at hand. In the previous vignette the *KAG* data suggested that players felt they could generally identify bots, however in this study the gameplay context determined whether participants even tried to identify the humans and bots. The ambiguity did not affect player experience in a situation where the human or synthetic nature of the other in-game entities did not matter to the participants. In the TDM the aim was to kill as many enemies as possible, in an environment so chaotic that survival depended on concentrating purely on the mechanism of the game. However in a situation in which a human was more dangerous/useful than a bot, participants invested time and effort to observe the other entities to deduce who the humans were. In CTF the situation was not chaotic, giving players time to consider tactics which hinged on the other humans present in the game, in other words, to exercise their Theory of Mind.

3.6 Vignette 5: Puji

Introduction

The previous ambiguity study highlighted that the effect of ambiguous agency on social presence was highly pragmatic. In a situation in which players were as much at risk from bots as from humans, ambiguity was of no concern. However in more tactical situations ambiguity was of great importance as players carefully observed the behaviour of in-game entities in an attempted to establish the bots and humans. This study aimed to explore this issue from a different perspective, it was decided to carry out a study in which ambiguity was not an additional factor to the core game, but was central to the game play. The game used for this study was *Puji*. To gain a direct experiential comparison between the *UT* study and *Puji*, the eight participants from the *UT* study were asked to participate again here. In this way the study can be identified as an experiential vignette, taking the insights from the previous study and wishing to explore them from a new perspective, using a new game to provide a stimuli to a group the participants in the hope that it would produce rich data and interesting comparative insights into ambiguity.

Aim

Following the *UT* based study, it was felt that the notion of ambiguity should be explored from another perspective. This study was a direct sequel to the previous ambiguity study, it aimed extend and explore the concepts and findings of the *UT* study using a game which uses the notion of ambiguity at its core. The game used for this study is an faithful example of the pragmatic nature of ambiguity in virtual environments. Where as in *UT* the ambiguity had little effect on the experience of Team Deathmatch gameplay, but a substantial effect on Capture the Flag, in the case of *Puji* the importance of ambiguity is absolute.

Method & Procedure

The game chosen for the basis of this study is the two player Flash game *Puji*, it is a 'party' style game in which players share a keyboard and a screen to control their avatars, and it is discussed in greater depth in the next section. In this study participants were briefed on the game and the structure of the study, asked to play the chosen game in pairs, and then asked to discuses their experiences. In the briefing participants were shown the game, informed of the aims and controls of the game, and how the study would be structured. The participants were then randomly arranged into pairs using a coin toss and asked to play *Puji* before discussing their first impressions of the game mechanics, their tactics, and their experience of the game. After this preliminary discussion another round of play was carried out in which the winning and losing players of the first round played against each other, followed by another discussion of the experience. In summary the structure of the study was as follows: participants were briefed and arranged into pairs, then the first round of play followed by the preliminary group discussion, this was followed by a second round of play and final group discussion. There were eight participants in this study, consisting of six male and two female between the ages of 22-28. All of the participants could be considered highly experienced with games across a number of gaming genres, all participants had played Flash-based games however none had played *Puji* previously. As stated the participants were the same eight participants as the previous vignette, this study was conducted less than two weeks after the *UT* study.

Participants were arranged into random pairs and would play each other in a league system so that everyone would play a total of 2 matches, decided on a '*best of three*' basis. This set-up was used so that players could play the game multiple times over the course of the study and become proficient at the game.

The aim of the multiple play opportunities within the study procedure was to allow the participants to become 'experts' at the game, or at the very least become highly familiar with the intricacies. Participants understood the concept and controls of the game extremely quickly and did not state any problem in playing the game.

In this study the participant's actions throughout play were observed and notes were taken, however the primary source of data was the reported accounts by the participants and the discussions which centred around them.

Materials & Setup

Puji[2] is a flash game played using a single keyboard and screen. In this game two (or three) players control a monk in an environment filled with identical monks. In this game the *bot* controlled monks behave in a set number of ways, standing still or moving along an L shape.

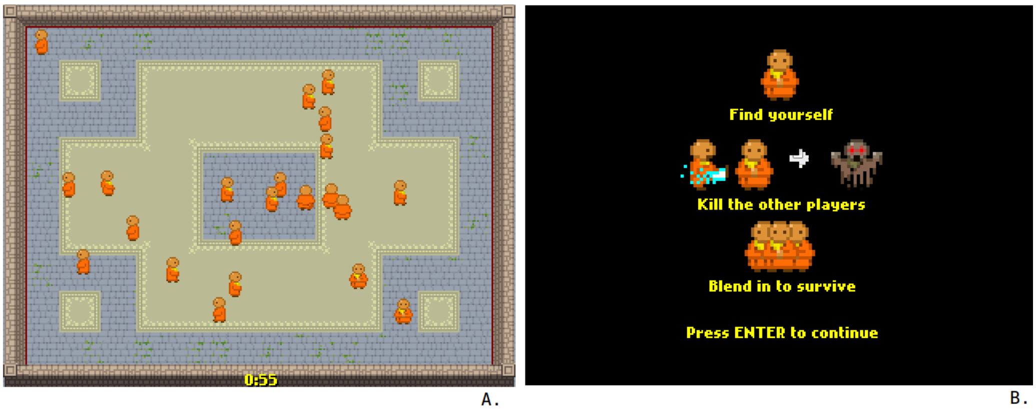

Figure 3.11: A. *Puji* in play, B. *Puji* instructions

The aim is simple, kill the other player's monk before they kill you. However complexity is introduced as the avatar of each player is not identified at the start of the game. Therefore players of the game must establish which of the identical monks is their avatar without giving away their identity to the other player, while also watching out for signs of the enemy monk. *Puji* was played on a laptop with participants sharing the single keyboard and screen. *Puji* is similar to games like *Spy Party*, an asymmetric multiplayer espionage game, and the *Assasin's Creed* multiplayer mod, and distils the core concepts of these games in a simplified mechanic, concepts such as ambiguity, theory of mind, and hiding in plain sight by emulating bot behaviour.

Discussion

Participants stated that *Puji* was highly immersive, engaged them to a high degree and made them notice their surrounding far less as they focused on finding their opponent. As well as being immersive, the participants regarded the game as extremely fun, facilitating high levels of competitiveness and suspense.

When describing *Puji* the participants stated that the game contained elements from many other gaming genres, combining them in one simple effective environment. *Puji* distills the core elements of more complex Player vs Player (PVP) games such as *Sniper Elite*, as players aim to remain hidden from their opponents and carefully chose their moment to strike. The way the game is played and the skills required to win made

[2] www.patkemp.com/wp-gallery/games/puji.html

some participants draw close connections to 'Hidden Object' games, in which players must spot certain objects hidden in a scene (much like *Where's Wally*). However, similar to multiplayer mode in *Assassin's Creed*, in *Puji* it was not an object but a hidden clue or 'tell' which the participants were looking for.

Participants also drew comparisons to more traditional games such as *Poker*, stating that the game was incredibly easy to learn, but difficult to master. Participants were surprised that such a simple game required such high levels of concentration to avoid slips and mistakes. However, participants acknowledged that it was not simply the mechanics of *Puji* that demanded their concentration, but their opponent which created the game. *Puji* then is a game with few simple rules, providing a simple environment to allow the opposing players to duel and create their own challenge.

In this study participants reported that there were several ways in which other players could be identified; watching for incorrect attacks on *bot* monks, watching for non-*bot*-like movement of monks or 'tells', and watching the key strokes of the other participant and trying to link their keystrokes to a monk. However the latter proved mostly unhelpful as participants often chose to move at same time and in same direction of *bot* monks to blend in and 'cover' key strokes. Participants stated that their main tactics for remaining hidden were; staying still, moving with groups of *bot* monks, and mimicking *bot* movements. To paraphrase one participant *Puji* is one of the few games in which doing nothing is doing something. Participants reported that moving in for the kill was difficult as bots "do not move with purpose", one participant stated that they had lost one match because even though they knew that their opponent was approaching them they did not want to "act human".

Overall the participants concluded that most important element of *Puji*, how the game was won of lost, was the successful management of 'tells' (detecting players and avoiding being detected). As one participant stated in *Puji* "bots dont twitch".

Concluding Thoughts

One of the strongest feelings expressed by the participants was the feeling of being 'hunted', being watched by a 'predator', a certain "got to find them before they find me" feeling. Participants stated that this intense feeling emerged entirely from the explicit presence of another human.

How did the participants compare the experience to the *UT* study? Participants stated that *Puji* felt like more of a pure battle of wits, a contest against someone's consciousness in a very mindful way. One participant stated that in *UT*, one has the ability to hide, take a moment to plan and gather one's thoughts and even relax, something which is not possible in the short *Puji* matches, as unlike the study, participants knew their opponent was always watching. Another participant argued that the biggest difference in how ambiguity affected the experience in *UT* and *Puji* was the matter of how terminal the consequences were. In *UT*, especially in a Deathmatch "if someone is or is not a bot is completely irrelevant to the matter at hand as both of your responses will be the same", you shoot them. "The only way in which it factors in is player skill", and while player's tactics will change depending on whether they think an opponent is a *bot* or a human, their overall aim remains the same, shoot them. "Whereas in Puji figuring out who isn't a bot is the objective", that and not giving one's self away are the only things that matter.

Puji created a sort of hyper social presence, not just the general, one could say *passive*, awareness of another human presence, but a constant awareness of being sought by another specific consciousness and in turn actively searching out evidence of that consciousness. Participants stated that sharing a machine (screen and keyboard) made the game far more tense that *UT*. It seems that this the explicit presence of one's opponent, knowing that they are watching the same screen while one is trying to be 'stealthy', increases the intensity of any tension. This hints towards the concept of 'mere-presence', in which the mere presence of another human within the vicinity will affect one's performance within a virtual environment. While the participants did not perceive the tension as social presence, it is perhaps evidence of social presence, as the tension only exists due to the explicit presence of the other player. This effect is similar to the results of a study conducted by Gajadhar et al. [2008b], who found that co-located play increases reported levels of fun, challenge, and perceived competence compared to mediated play. In addition to the explicit presence of their opponents, the high levels of tension felt by the participants may have been due to familiarity participants had which each other, as the participants were all friends or acquaintances it is likely that a sense of playful competition increased their desire to beat each other. One question which arises from this scenario is, what if the participants were playing the game remotely and/or, did not know their opponent as in the Tetris study.

In terms of social presence in general this study has confirmed the results suggested by the *UT* study, that the experience of social presence is highly dependent on the in-game task the player is engaged in. Tactical tasks such as those found in *Puji*, staying hidden and discovering the other player, are focused around the concept of theory of mind and so this is a key element to the experience. In terms of ambiguity this game is the concept taken to an extreme and highlights that in some circumstances, human presence in a virtual environment is essential for creating certain powerful feelings, in this case the feeling of being 'hunted'. While one might feel hunted while playing a well designed single-player digital game such as *Alien: Isolation*, the effect of human presence within a game creates an intangible depth to the experience. This study highlights the uncanny human ability, at least in the experienced gamers in this study, to read human-like behaviour in virtual environments.

3.7 Chapter Summary

This Chapter documented five experiential vignettes, a novel approach which aimed to quickly and efficiently gather multiple perspectives on the concept of social presence. The aim of these studies was to gain an overview of social presence in team-based digital games, and to push at the boundaries of the experience by exploring social ambiguity within these environments. Each vignette built on the last, further probing the findings and insights of the last, and the vignettes are documented in this Chapter in chronological order. The games in this Chapter were similar enough to provide a logical progression from one study to the next, but varied enough to provide a range of experiences and push the research into new and interesting areas.

The experiential vignettes were small scale qualitative studies, and it is important to acknowledge the bias and limitations of these studies. The studies have relatively small sample sizes and are focused on a small but varied number of games and game communities. However all but one of the games are focused on team-based games and are thus consistent in this core element. The vignettes aimed to gain some insight into the nature of social presence in team-based digital games as a foundation for further research. The vignettes in this Chapter were probes [Gaver et al., 2004] into social presence, using ambiguity to manipulate the experience of the user to explore the expectations and subjective experiences of players. The vignette methodology is similar on a high level to the sociolinguistic approach of Conversation Analysis, a discipline which tightly focuses on a unique piece of discourse, using 'narrow deep' analysis to reveal insights into more general patterns of discourse such as turn taking and self repair in speech [Hutchby and Wooffitt, 1998, ten Have, 1999]. These experiential vignettes took a range of specific user experiences and combined them to form an overview of social presence in team-based digital games.

The first vignette, the social gaming survey, revealed some of the motivations and social issues which are central to the experience of a number of team-based games. The social gaming survey revealed that players felt that sharing a virtual environment with humans changed the way that environment was perceived and experienced. The second vignette, the cooperative *Tetris* study, explored the difference between human and bot team-mates in a simple cooperative environment. This vignette revealed that a player's perception of their team-mate altered their experience and expectations of the game, despite the players being unable to discern if they were playing a human or a bot. The results of this study brought to mind the question of what would occur if the player was unsure if they were sharing a virtual environment with a human or computer controlled entity. To gain a preliminary view of the opinions of gamers on this issue a third vignette was conducted, taking the form of a survey of two forms of online user data on the topic of ambiguous agency in team-based online games. The user data confirmed that many gamers think that bots provide a different gameplay experience to humans, and suggested that gamers assume that they can always identify bots in games by their behaviour. In essence the third vignette gave a hint at what gamers think they think about the how they would react to ambiguity in team-based games.

The fourth vignette was designed to test these assumptions and to evaluate the interplay between ambiguity and context of play in team-based online games. To this end a focus group study was conducted in which teams of humans and bots played two different game modes of *UT*, one chaotic and one tactical. The results of this study showed that the importance of agency in team-based online games is far more pragmatic than gamers assume. In chaotic skill based environments whether a team-mate or an enemy is a human or a bot does not seem to affect the gameplay experience, while in tactical environments humans are seen as far more dangerous than bots, making identification of human controlled avatars of high importance to players. The final vignette aimed to compare the experience of *UT* with a game in which ambiguity is central to the gameplay. *Puji* confirmed that the way social presence is experienced is highly dependant on the task a play is attempting to complete.

The results of the experiential vignettes combined with insights gained from the literature suggested a number of interrelated core elements of social presence in team-based digital games, a number of which novel to this thesis.

- Awareness of other consciousness & Theory of Mind.
- Team identity & motivation.
- Socially significant actions.
- Task & social joint commitments.

Awareness of other Consciousness

The awareness of other consciousness within a virtual environment is the knowledge that the environment is inhabited by other conscious entities. The awareness of another consciousness within a virtual environment is an established concept in the social presence literature, the feeling of "being together with another" [Biocca et al., 2003] in a virtual environment is dependant on knowing that the virtual environment is being shared. The research in this Chapter has enlightened the effects of this awareness by suggesting that it creates a conceptual "frame shift" [Markussen and Krogh, 2008], a change in the way an environment is perceived. Evidence of this frame shifting based on Theory of Mind is apparent in the analysis of the social gaming survey data, and in the change in expectation of a team-mate in the cooperative *Tetris* study.

Theory of Mind is the idea that a person is able to theorise about what another person is thinking [Premack and Woodruff, 1978, Baron-Cohen, 1997, Ratcliffe, 2007], and is a theory largely absent from gaming research. In team-based digital games players utilize their Theory of Mind in an attempt to outwit their opponents. Theory of Mind was evident in the social gaming survey and the *Puji* study, however the *UT* study suggested that the use of one's Theory of Mind is dependant on the context of play and the task at hand, with more tactical environments encouraging the process. Theory of Mind ties into the concept of Space & Place [Spagnolli and Gamberini, 2005], as discussed in the literature review and the cooperative *Tetris* study. Frith [1996] describes the Theory of Mind as "differentiating between the world of objects (with physical states) and the world of persons (with mental states)". This statement encapsulates how the awareness of other consciousness and Theory of Mind creates a frame shift, changing the virtual environment from a virtual Space to a virtual Place.

Team identity & Motivation

Team identity and motivation to play well were elements in both the social gaming survey and *UT* study data. The feeling of being pat of a team, part of some larger entity, was a common theme throughout the social gaming survey, however the feedback from participants in the *UT* study suggested that again, this concept is dependant on context. In the chaotic Team Deathmatch scenario, players did not feel a strong tie to their teams, however in the tactical Capture the Flag mode, players felt more like they were in a team scenario. In both studies players identified that being part of teams including other humans motivated them to win, and made the experience seem more immersive and engaging. Thus while team identity seems to be dependant on the nature of any team-based scenario, social gaming seemed to consistently induce high motivation to play.

Socially Significant Actions

The idea that the actions we take in a virtual environment have some significance to another human is what makes gaming with other humans more satisfying that playing with bots. Besting a human opponent was stated as being one reason the respondents to the social gaming study played team-based online games, however far more prevalent was the idea that the greatest satisfaction in these games came from altruistic or social actions towards team-mates. Whether these acts were to help the team generally or to help one specific team-mate, the social significance of these actions were not lost on the gamers in the survey. This concept of course ties into the Theory of Mind, social acts are only so enjoyable as the actor knows there is a human receiving their help who can think and experience.

Task & Social Joint Commitments

One of the few gaming studies to note the importance of task in cooperative social gaming experience was a study by Scarpetta [2008], who found that players displayed and built social presence by acting and communicating with direct relevance to their joint task, and that the task players were undertaking affected their feelings of social presence. Throughout the experiential vignettes it has become clear that task has a major effect on the importance of other elements of social presence. The task a player is engaged with in game defines a large proportion of their context of play and affects the extent to which they consider other players. The social gaming study suggested that the idea of social 'joint commitments'[Clark, 2006] within games were important to how players perceived their team, with teams made up of players who were not acting towards the social joint commitment of the team casuing annoyance to those that were. The *UT* study suggested that the joint task commitments of teams can be used to identify bots, as humans can define their own emergent commitments, in the case of the *UT* study identifying the other humans, while bots will generally aim to achieve explicit goals.

Overview

The experiential vignettes enlightened underlying elements of social presence, but were not intended to produce generalizable findings about how social presence is experienced across all team-based. To perform more wide reaching research into social presence in team-based digital games would require a more efficient way of gathering large amounts of qualitative user data. Thus the next stage in this thesis was the development for a new measure for social presence specifically designed for use with team-based digital games. The core elements of social presence enlightened by the experiential vignettes form the basis for the questionnaire which, over the course of the following Chapters, evolved into a validated measure. Thus while the experiential vignettes may have been quick probes, the interesting insights and ideas they produced were useful and, perhaps more importantly, substantiated in a measure which could measure social presence across a wide range of games.

This Chapter highlighted the need for a new measure for social presence which could measure the concept in the socially complex virtual environments of team-based digital games. The use of the SPGQ in the *Tetris* vignette suggested that the measure was unsuitable for cooperative games, and a further attempt to use the SPGQ in the *UT* study resulted in the measure being abandoned due to consistent negative participant feedback.

Chapter 4

A New Measure for Social Presence

Introduction

The review of current measures for social presence in Section 2.2.3 highlighted the lack of tools designed for use with digital games. The SPGQ [Poels et al., 2007], the only social presence measure specifically designed for digital gaming, was unsuitable for cooperative digital games or team-based digital games. In addition, using SPGQ in the pilots of *Tetris* and *UT* studies confirmed the need for a new measure for social presence in team-based virtual environments. This Chapter documents the development of that new questionnaire. Based on the core elements of social presence as outlined in the previous Chapter, the development follows the methodology set out by Kline [2000], including item generation, item & module analysis, and finally principal component analysis. Data for this process was gathered using user experience surveys, with a total of 104 respondents for the process of initial item & module analysis, and 237 respondents for the principal component analysis.

A new measure for social presence which is specifically designed for team-based digital games is not only relevant to this study but will hopefully provide a valuable tool for future digital games research. Team-based digital games are among the most popular games played worldwide, with team-based FPS games such as *Counter Strike: Global Offensive* attracting tens of thousands of daily players, and team-based MOBA (multiplayer online battle arena) games such as *Dota 2* and *League of Legends* attracting millions. These games are not only highly popular and thus significant in their population, but team-based games and game technology are increasingly being used as the basis for team-training. The *Virtual Battle Space* simulation system shares technology with the *Arma* game series[1], game engines such as the *CryEngine* are used as the basis for a number of synthetic training environments[2], and there are examples in the literature of games being used as effective team training tools [Alexander et al., 2005, Hahn, 2010, Toups et al., 2011, Hussain et al., 2008, Craighead, 2009]. Therefore a measure for social presence within team-based digital games might not only be useful for measuring the user experience of gamers, but could also be used to measure social engagement in relevant training exercises. Social presence is a hard concept to measure as it is based on subjective experience, however a quantitative measure is essential to conducting studies with larger sample sizes to gain more generalizable results. In addition, if social presence is to be measured in an industry context, utilizing a valid questionnaire is far more efficient, more easily standardized, and less reliant on an academic style skill set than conducting experiential vignettes, ethnographic style observations

[1] Bohemia Interactive & Bohemia Interactive Simulation

[2] Realtime Immersive

or lengthy interview studies. A valid questionnaire which is designed to be succinct yet insightful can be applied to studies with little disruption or additional effort.

CCPIG

The questionnaire developed in this chapter was named the Competitive and Cooperative Presence in Gaming (CCPIG) questionnaire, as it was designed to measure social presence in the competitive and cooperative environments which are team-based games. The aim of the CCPIG development was not to produce a general measure for social presence, but a measure for social presence specifically as it is experienced in team-based digital games. Throughout the development of the questionnaire it became clear that the social presence felt towards opponents and team-mates were conceptually and statistically distinct and the CCPIG measures the competitive and cooperative social presence independently.

Aims

The aim of this Chapter was to develop a questionnaire that could be used to measure social presence more socially complex games than previous social presence measures. More specifically the aim was to make a questionnaire that could be used to measure social presence in multiplayer games that contain both competitive and cooperative elements (team based games). One objective of the process was to produce a questionnaire that was short enough to be unburdensome to participants of studies, have clear language, and to encompass concepts which the previous work on this thesis had highlighted as key elements of social presence.

Overview of Procedure

The method used to create and develop the questionnaire follows the process set out by Kline [2000]. This process consists of creating an item pool and using item analysis to reduce the pool to an effective set of items that will constitute the instrument. Factor analysis is then used to validate the questionnaire. An initial pool of 116 items was created around a group of concepts which arose from the literature review and previous research conducted as part of the thesis. The concepts that the initial pool of items were based upon were those outlined in the conclusion of the previous Chapter, expanded in more detail here:

- Awareness of other consciousness within a virtual environment.
- Theory of Mind [Baron-Cohen, 1997, Ratcliffe, 2007], that is, the player is able to theorise about what other players are thinking.
- Team identity, feeling part of a team.
- Motivation to play gained from the presence of others.
- Social action and the awareness of the social significance of action within a shared environment.
- Task [Scarpetta, 2008, Hertel et al., 2004] and social *joint commitments* [Clark, 2006] within the virtual environment.

Developing the CCPIG questionnaire was a substantial process, consisting of five main stages, followed by a further validation in Chapter 5 with over eight hundred participants. Throughout the Chapter each stage begins with a summary before the results are presented in detail.

Stage 1: From the list of concept above an initial pool of 116 items were created in a rating scale response format (Likert scale), and the items were structured into groups with common themes to help with data analysis, when used to gather data however the questions were mixed together to reduce the risk of participants flatlining their responses [Cairns and Cox, 2008], or producing the "right" answers due to social desirability bias [Nederhof, 1985].
Stage 2: From groups of items a pilot questionnaire, CCPIGv0.1, was developed and was used in an initial pilot study with a small number of experienced team-based gamers to gain feedback on the wording, item numbers, etc. Based on the feedback the questionnaire was shortened from 116 items to 80 items and edited to create the CCPIGv0.5.
Stage 3: The CCPIG was then trialled to gain statistical insight into the workings of the items in relation to the overall questionnaire aims. The trial in Stage 3 consisted of 48 participants and suggested further items that could be removed because they were either redundant or not relating well to the rest of the questionnaire.
Stage 4: The much reduced 42 item CCPIGv0.6 was trialled again in a study consisting of 56 respondents which helped restructure the CCPIG.
Stage 5: The leaner, more conceptually sound CCPIGv1 consisted of 40 items and was then analysed in a full principal component analysis (PCA) with data from 237 participants to check that it produced the expected factor structure. The final version, the CCPIGv1.1 contained 39 items.

Data Gathering

The data for the item analysis and PCA was gathered using online user surveys, for which respondents were recruited using a call for participants on game community forums. Game communities were chosen based on a number of factors. First the games around which the communities were based were all team based online games, which while differing in genre, setting, play style and graphical style, shared the core element of two collaborating teams competing with each other. Another important factor in the specific game communities chosen for these online surveys was the presence of an active forum on which community members could be recruited as participants. Once a game community had been selected as a suitable place to recruit participants the moderators of the community forums were contacted to request permission to post a call for participants on the forums. This step helped to show the game communities and their members were being respected, and avoided the call being deleted or criticised as spam/solicitation. Once permission was acquired a call for participants was posted as a new thread on the community forums, asking users to participate in a user experience study centred around their particular game, giving instructions on how to participate in the study, and supplying a link to the online questionnaire. Once the call had been posted the forum thread was monitored so that any questions from users could be addressed.

Statistical Criteria

The statistic methods used through this chapter include a establishing the Cronbach's α to ascertain the internal reliability of each subscale, finding the correlations between items, establishing the measures of sampling adequacy (MSA) and Kaiser-Meyer-Olkin (KMO) scores. The pairwise correlations between items in modules were tested to reveal items which did not fit with their module and if so, if they correlated with any other modules. Examples of very high levels of correlation were also used to identify items which were perhaps too similar, especially if the two items were similarly worded. Threshold criteria for establishing if modules were working well, or if they contained items which were unsuitable, were that if the

Cronbach's α score was substantially less than 0.7 (Table 5.3.2), this indicated that there were potential issues with the internal consistency of the module [Kline, 1999], and in accordance with Everitt [1993] and Nakazawa [2007] desirable KMO scores would be greater than 0.5, and MSA scores lower than 0.7 generally highlighted problem items which were either removed of moved to a more suitable module. Analysis was conducted in R, the R code used for the statistical methods can be found in Appendix 7.2.1.

Cronbach's α	Internal Consistency
$\leq$ 0.9	Excellent
0.9 - 0.8	Good
0.8 - 0.7	Acceptable
0.7 - 0.6	Questionable
0.6 - 0.5	Poor
0.5 $>$	Unacceptable

4.1 Stage 1: Item Generation

A large number of items were produced for the CCPIGv0.1, far more than were ever intended to make up the final iteration of the questionnaire. The large number of items were designed to cover the concepts which arose from the social presence studies in the previous Chapter, from a variety of perspectives and in various forms. The items were structured into groups with common themes to help with data analysis. The CCPIGv0.1 was intended as a starting point, to be tested and examined and subsequently cropped until it reached its most efficient form. Afterall, to paraphrase Antoine de Saint-Exupéry, perfection is reached not when there is nothing left to add, but when there is nothing left to take away.

Concept	Example Items
Awareness of other Consciousness	I was aware of my opponents
	I acted with my opponent in mind
	I felt my team-mates were looking out for me
Theory of Mind	I tried to imagine what my opponents were thinking
	I tried to second guess my opponent
	I was aware that my opponent might work out my goals
Team Identity	I felt camaraderie with my team
	I felt a social connection to my team-mates
	I wanted to appear capable to my team-mates
Motivation	I wanted to appear capable to my opponents
	Being part of a team motivated me
	The desire to help my team beat the opposition motivated me
Social Action	I felt I contributed to the team
	I felt the team helped me
	My actions were determined by the objectives of the team
Task	My team-mates were focused on the same task as me
	My team were focused on one goal
	My team-mates were focused on the same overall objective as me

Table 4.1: CCPIGv0.1 Concepts and Items

A full list of the items in the CCPIGv0.1 can be seen in Appendix 7.2.2.

4.2 Stage 2: Pilot Study

Once the CCPIGv0.1 items been created it was clear that much work had to be done to refine it and turn it from a loose collection of items to a validated research tool. This process began by gaining feedback from the very people who's experience this questionnaire would be used to measure, gamers. More specifically the participants for this study consisted of 12 acquaintances who were known to be highly experienced team-based online gamers. The participants were all between the ages of 17 and 28, and there were 11 male and 1 female. These participants were asked to play a team-based game together online and then fill out an online questionnaire. The game the participants played was *Darkest Hour: Europe '44-'45*, a World War 2 themed online team-based FPS game. All participants were highly experienced with the game. The pilot questionnaire was made into an online questionnaire, and a link to the questionnaire was provided to the participants once the game was complete. The participants were also asked to provide verbal and/or written feedback of their opinions on the questionnaire. The feedback from the participants produced two clear issues with the questionnaire, first that it was far too long (too many items), and second that there were too many duplicate/similar questions. These issues made the questionnaire both fatiguing and annoying to participants. Positive notes included that no participant complained about the language of the items, or stated any items were irrelevant to their experience.

Following the feedback the CCPIGv0.1 was examined to remove as many redundant items as possible, especially those identified by pilot participants, these included conceptually and structurally similar items. For example "My opponents played a significant role in the challenge of the game" was considered too similar to "My opponents played a significant role in my experience of the game", especially as there were other items referring to challenge. Such similar items were either merged, or one was deleted based on user feedback. For example of the similar items 'I tried to second guess/outwit my opponent' and 'I tried to imagine what my opponent was thinking'the former was chosen to be deleted due to the nature of competitive gaming, where by the act of outwitting seems a more relevant concept than imagining the internal state of the enemy. Following the pilot study of the CCPIGv0.1 the modules were split into smaller modules with narrower conceptual focus, and over the course of the pilot study the number of items was reduced from 116 to 80 to create the CCPIGv0.5, a full list of the items can be found in Appendix 7.2.3.

4.3 Stage 3

Introduction

This stage aimed to use item analysis to reduce the number of items in the CCPIGv0.5 (Appendix 7.2.3) to produce a more succinct and focused measure. Using user data gathered via an online community survey the analysis achieved a significant item reduction from 80 to 42 items. The following report of the process gives both a general overview of the reduction process in addition to a detailed account of how the CCPIG transitioned from version 0.5 to 0.6.

Procedure & Participants

The first step after generating the items for a questionnaire is item analysis. Data for this item analysis was gathered using the community survey methodology, with an online user survey being conducted with players of an online team-based FPS game *Chivalry: Medieval Warfare*. The aim of this study was to gather natural user data with which item analysis could be conducted to refine the CCPIGv0.5. The CCPIGv0.5 was created as an online questionnaire and a request for respondents was posted on the *Chivalry* community forums. The questionnaire was available to self selecting respondents for 3 days. The study gained a total of 48 respondents.

The Game

Chivalry: Medieval Warfare (from now on referred to as *Chivalry*) is an online first person melee game, much like an online FPS, but with a focus on melee combat with a medieval theme. Like other team-based games such as *Unreal Tournament*, this game has a number of game modes, a 'free-for-all' death-match, team death-matches, and task based 'Team Objective' mode (TO), in which players must work together to capture/defend points in the virtual environment. In the call for participants volunteers were asked to play a team-based mode before completing the questionnaire. The game was chosen for study as it contains similarities to previous team-based FPS games used in this thesis such as *Unreal Tournament* and *Red Orchestra*, but offers a significantly different gameplay experience. In using a variety of games in the development of the CCPIG it was hoped that it would ensure the CCPIG would be a tool which would be applicable to a wide range of team-based games.

Figure 4.1: Chivalry: Medieval Warfare gameplay

As this survey study was completed using a single computer game, (*Chivalry*), the nature of this game no doubt coloured the data gathered. Thus analysis of the data was completed with an awareness and consideration of game specific issues to ensure the results were interpreted in a meaningful way. For example, while the gameplay in *Chivalry* is team-based online game, the game has some specific nuances which were likely to affect the data. For example, while the *Chivalry* includes game modes which encourage team work, fighting and killing other players remains the primary focus of the game and thus the data was expected to have a competitive focus.

4.3.1 Results Summary

Social presence is a latent factor, and therefore it cannot be measured directly. However ensuring that a questionnaire item is measuring the latent factor and not some other concept is important. The aim of this study was to use the data gathered in the *Chivalry* community survey to analyse and improve the questionnaire, to reduce number of items and remove redundancy and irrelevance. The aim of the item analysis at this stage was to guide in the reduction of the number of items, and the initial development from pilot questionnaire to usable research tool, and by the end of Stage 3 the newly edited CCPIGv0.6 had been reduced to 42 items. Though this is a substantial reduction, the removal actually followed a careful consideration of the goals of the questionnaire alongside the statistical analysis that highlighted problematic items. To begin with the largest single cuts were the removal of two whole modules, removing 9 items in total, the 'General Social Engagement'module and the 'Cooperative Confirmation'modules, a module designed to measure whether respondents felt that the game they played contained tasks which were more effectively achieved via teamwork. These modules were deemed unsatisfactory from a statistical point of view as well as conceptually unnecessary as they did not directly address the specific experiences of social presence and were therefore prey to being subjective opinions rather than subjective measures of the gaming experience.

The other 29 items were either removed or merged with other similar items, and most modules had one of two items which could be removed, either based on the statistical results, user feedback, or while re-evaluating each item in terms of the core elements that the CCPIG aimed to measure. For example the 'Communication'module, performed moderately well, with a KMO score of 0.67, α was 0.71, and generally high correlations between items. However the module contained one item which, while not statistically unsuitable, was deemed vague and unnecessary. The item 'I felt I could communicate effectively with my team in the game', which is quite ambiguously worded. This item could be considered to be asking participants about the user-friendliness or capability of the technology involved in communicating with team-mates, or asking about the perceived attitudes of the other players and was thus removed. An example of the the process of removing redundancy was the competitive 'Behavioural & Cognitive Involvement' module. In this module the items 'I was aware of my opponents', 'I acted with my opponents in mind' and 'I reacted to my opponents actions'were far too conceptually similar, and two of the items achieved identical average user scores in the *Chivalry* survey study. The items were therefore deemed to be measuring the same concept and so were merged.

This process of statistical testing and conceptual scrutinization both reduced the items of the questionnaire and led to its restructuring. However, this allowed greater conceptual focus. The CCPIGv0.6 retained the core elements which inspired the original item development, while losing what might be considered excess baggage. A full list of items for the CCPIGv0.6 can be found in Appendix 7.2.5. For full item correlation data from this study see Appendix 7.2.4. It was felt to be advantageous to have had an initial questionnaire that

was too long in order to have a variety of items and to let the stronger items emerge from who respondents were able to answer them. In addition to the statistical analysis, the data from this stage was compared to content analysis of user feedback and found community data. This was done to explore whether the results of the user experience as measured by the CCPIG at this early stage were reflecting similar concepts within the community. The results of the content analysis correlated somewhat with the results of the stage data suggested that the CCPIG development was on the right track and that it was sensitive to issues inherent to team-based games, the study can be found in Appendix 7.2.12.
By the end of Stage 3 the newly edited CCPIGv0.6 had the following modules:

Section 1: Competitive Social Presence
- Module 1.1: Competitive Behavioural Involvement (3 Items)
- Module 1.2: Theory of Mind(5 Items)
- Module 1.3: Competitive Engagement (3 Items)
- Module 1.4: Competitive Sensation (4 Items)

Section 2: Cooperative Social Presence
- Module 2.1: Team Awareness (5 Items)
- Module 2.2: Team Security (4 Items)
- Module 2.3: Cooperative Motivation (6 Items)
- Module 2.4: Social Action & Communication (5 Items)
- Module 2.5: Social Commitments & Team-mate Value (7 Items)

4.3.2 Detailed Results

General SP

The aim of the General Social Presence module was, unsurprisingly, to measure the level of general social presence felt by the players of a game. This meant that the items focused around the general level of social connection felt towards other players, whether they be team-mates or enemies. As shown in Table 7.2 (see Appendix 7.2.4), most of the items in this module did not strongly correlate, for example the items 'The game was challenging' and 'The awareness of other players affected the way I played' did not achieve a correlation of over 0.2 with any other item. One of the only strong correlations between items occurred between the items 'The game was engaging' and 'I felt my actions in game were significant to others', which achieved a correlation of 0.64. It is likely that the correlation between these items occurred due to the feeling of interactivity, gained from the perceived significance of ones own actions had on other players, increasing the player's level of engagement. However these items, while measuring the interactivity of the game, appear to be more suited to the concept of immersion than social presence. The items were originally designed to assess how involved the player was in the game, assuming that high social presence would lead to high engagement, however as this relationship cannot be proven, and the correlations between them were so low, the theory behind these items was flawed.

The item 'I felt my actions in game were significant to others' also weakly correlated to two other items, 'The actions of others were significant to me'(0.42), and 'I was aware of the presence of other players' (0.37). These items all address the awareness of other players in the game environment and so could be expected to have some level of correlation.

The Cronbach's α for the General Social Presence data-set was a score of 0.51, which could be considered 'poor' to 'questionable'[Kline, 1999]. The MSA score for this module were also fairly middling, with a single clearly irrelevant item scoring 0.2 (Table 4.2). Removing the first items from the module caused the MSA values to rise to a slightly more convincing level (Table 4.2), and the KMO increased from 0.46 to 0.52. However overall the General Social Presence Module proved to be fairly ineffective, revealing no unique insights, and so was dropped from the next incarnation of the questionnaire.

Item	MSA Score	MSA Score
The.game.was.challenging	0.248	
The.game.was.engaging	0.465	0.501
I.felt.my.actions.in.game.were.significant.to.others	0.474	0.511
The.actions.of.others.were.significant.to.me	0.600	0.640
I.was.aware.of.the.presence.of.other.players	0.436	0.486
The.awareness.of.other.players.affected.the.way.I.played	0.558	0.531

Table 4.2: General Social Presence MSA

Cooperative Confirmation

The Cooperative (Team Task) Confirmation module was designed to measure whether respondents felt that the game they played contained tasks which were more effectively achieved via teamwork, in other words to evaluate if the game-play was enhanced by teamwork. All three items had the same level of correlation, around 0.2 (Table 7.51). While these correlation scores were low, and the Cronbach's α was an unacceptably low 0.44, yet the MSA values were a more promising score of 0.6 (Table 4.3). The results from this module may have been due to the small number of items (though the KMO score is 0.6), combined with the game specific issues discussed above.

This module was designed to be a separate module from the cooperative and competitive modules of the items, to be used to determine how relevant the cooperative section of the questionnaire would be in the total experience of the game. While the average scores for this module were high in the user study the results of the item of this module did not correlative with any other cooperative based items from questionnaire save for one example, a moderate correlation between the items 'The game was more fun when using team work' and 'I made an effort to work with my team mates' (0.55). This may show that the items in the Cooperative Confirmation module were measuring aspects of the game, rather than social interaction within it. The results the iem 'The objectives in the game were more easily achieved using teamwork' item show that the vast majority of the 48 respondents thought that the objectives in the game were more easily achieved using teamwork. On reflection this is likely to be because almost every objective in any team-based game is easier to achieve with teamwork. While this item, and the module as a whole, may be useful if one were analysing the design of a game, investigating if the game encourages team work, when attempting to measure social presence in a variety of virtual environments, these items are unnecessary.

Item	MSA Score
The.objectives.in.the.game.required.teamwork	0.597
The.objectives.in.the.game.were.more.easily.achieved.using.teamwork	0.613
The.game.was.more.fun.when.using.team.work	0.596

Table 4.3: Team Task MSA

Team Based Confirmation

This module was designed to measure how the competition within the two teams within the game affected the respondents. The items were designed to assess how the social attachment to one's team manifest in the behaviour and feelings of the players. These items were based upon the results of the social gaming survey vignette in the previous chapter, in which respondents stated that they were happy to make sacrifices for their team. The MSA scores for this module were encouraging (Table 4.4), the Cronbach's α was an acceptable 0.68, and the KMO of the data was 0.57. There was a moderate level of correlation among most of the questions, with only the question 'I felt I was playing my part in fighting the enemy' achieving consistently low correlation scores (Table 7.53).

However some of the highest correlating items were worded similarly and thus may have been measuring the same thing. For example the items 'The desire to help my team beat the opposition motivated me' and 'The presence of the other team motivated me' (0.55 correlation) address very similar concepts. 'I didn't mind dying if it meant my team would win' and 'I was happy to take a boring role if it meant the team would win' (correlation 0.45) also address a similar concept, sacrificing personal achievement/excitement for the sake of the team. The two strong correlations between the four items suggests that this module may have been measuring two factors, motivation and sacrifice. These two sets of items which may have been measuring the same thing were merged, but as this reduced the number of items in the module this meant restructuring the questionnaire. Ideally the new items would be merged with another module, however the cooperative and competitive modules were designed to be conceptually independent, able to be used separately if a game only contained competitive elements for example. This module which measured the social presence within a team versus team scenario, required both competitive and cooperative elements to make sense.

In terms of motivation, the items in this module appeared redundant. The item 'The presence of the other team motivated me' also gained the same average user scores in the community survey as an item from a different module, 'The desire to beat the enemy motivated me', and thus could be considered redundant.

Item	MSA Score
The.desire.to.help.my.team.beat.the.opposition.motivated.me	0.570
I.didnt.mind.dying.if.it.meant.my.team.would.win	0.527
I.was.happy.to.take.a.boring.role.if.it.meant.the.team.would.win	0.706
I.felt.I.was.playing.my.part.in.fighting.the.enemy	0.677
The.presence.of.the.other.team.motivated.me	0.471

Table 4.4: Team Based Confirmation MSA

Competitive Social Presence: Behavioural & Cognitive Involvement

While this module was fairly successful, having a moderate level of correlation throughout (Table 7.6) (see Appendix 7.2.4), a Cronbach α of 0.8, and a KMO of 0.6, the correlations were split between two sets of items and the module appeared to be measuring two distinct concepts. Originally the module was designed to measure the behavioural and cognitive expressions of social presence, to what extent other entities within the virtual environment changed the thoughts and behaviour of the respondent. Initially it was assumed that these concepts would be conceptually close enough to exist within the same module, however behavioural involvement and theory of mind seem to be different facets of the latent concept of social presence, at least in this data set. The module was split into two separate modules for the next version of the CCPIG, one measuring the behavioural social presence experienced by participants, and one which measures the Theory of Mind. The two modules were preliminarily organised into the following groups:

Behavioural Involvement (Cronbach's α: 0.85)
I acted with.my opponents in mind
I reacted to my opponents actions
My opponents played a significant role in my experience of the game

Mind Theory (Cronbach's α: 0.76)
It seemed as though my opponents were acting with awareness of my actions
I knew what my opponents was trying to achieve
I was aware that my opponents might work out my goals
I felt I affected my opponents actions
The actions of my opponents affected the way I played

Question	MSA Score	MSA Score	MSA Score
I.was.aware.of.my.opponents	0.498		
I.acted.with.my.opponents.in.mind	0.663	0.504	
I.reacted.to.my.opponents.actions	0.509	0.505	
It.seemed.as.though.my.opponents.were.acting with.awareness.of.my.actions	0.693		0.713
I.knew.what.my.opponents.was.trying.to.achieve	0.634		0.646
I.was.aware.that.my.opponents.might.work.out.my.goals	0.603		0.617
The.actions.of.my.opponents.affected.the.way.I.played	0.530		0.547
My.opponents.played.a.significant.role.in.my experience.of.the.game	0.502	0.537	
I.felt.I.affected.my.opponents.actions	0.699		0.737

Table 4.5: Behavioural & Cognitive Involvement MSA

Competitive Social Presence: Competitive Engagement

This module was designed to measure the involvement between respondents and their opponents in game, establishing a level of engagement under the assumption that a challenging opponent would create a greater sense social engagement and thus social presence. This module was based upon previous studies (such as the ambiguity studies) in which respondents generally assumed human opponents were a greater challenge than computer controlled opponents, and therefore demanded a higher state of awareness about one's opponent. The KMO score for this module was 0.6, the Cronbach α was 0.63 (Items: 9, Sample units: 49), and the MSA scores were almost all acceptably high (Table 4.6). This module contained a number of redundant items, some of which regarding players outwitting one another which were merged into one item. There were also a number of questions which did not moderately correlate with the other items (Table 7.10), for example 'I felt the need to beat my opponents' was removed. Another item removed was 'It was satisfying when I felt I got the upper hand', as the scores from the user data were almost all 5's, on reflection this was unsurprising. The Cronbach α of the modified Competitive Engagement module was 0.69 (Items: 4, Sample units: 49).

Item	MSA Score	MSA Score
It.was.satisfying.when.I.felt.I.got.the.upper.hand	0.621	
My.opponents.were.challenging	0.631	0.746
The.game.was.a.battle.of.skill	0.560	0.704
The.game.was.a.battle.of.wits	0.730	0.682
It.was.fun.to.play.against.my.opponents	0.616	0.621
I.could.easily.have.lost	0.607	
I.felt.the.need.to.beat.my.opponents	0.505	
I.tried.to.outwit.my.opponents	0.487	
I.think.my.opponents.were.trying.to.outwit.me	0.669	

Table 4.6: Competitive Engagement MSA

Competitive Social Presence: Competitive Sensation

This module was designed to measure the sensations of competitive play which gamers had mentioned experiencing in previous studies. Feelings such as being hunted, being tense, etc., occurred in games in which participants had to focus on their opponent, thus it was purported that these feelings might indicate competitive social presence. One item which did not fit, conceptually nor in terms of the correlations (Table 7.12) or MSA (Table 4.7), into this module was 'The presence of my opponents influenced my plans and actions during the game'. On removing this item the KMO score increased from the original 0.54 to 0.57. The Cronbach's α for Competitive Sensation was 0.61. While the feeling of being hunted is a powerful feeling in many competitive games, the concept is not suited to all competitive virtual environments (sports games for example). The items 'I felt tense on edge while playing my opponents' and 'My opponents created a sense of urgency' had a high level of correlation (0.61), however received highly similar scores sets in the user data. This could indicate that the items are measuring the same concept, rather than subtly different ones. In summary this module was reduced to a single question which was merged with another module.

Item	MSA Score
I.felt.the.sensation.of.being.hunted	0.683
I.felt.tense.on.edge.while.playing.my.opponents	0.523
My.opponents.created.a.sense.of.urgency	0.532
The.presence.of.my.opponents.influenced.my plans.and.actions.during.the.game	0.407

Table 4.7: Competitive Sensation MSA

Competitive Social Presence: Competitive Motivation

This module was designed to measure how the opponents of the respondents motivated them in game, previous studies in this thesis suggested that human opponents motivate gamers. While the KMO (0.59) and α (0.58) were not terrible, on reflection the concept that this module was measuring may appear somewhat suspect. The wording suggests that the items were measuring personality. The one item which did seem to reflect the awareness of others and the consideration of their minds within a shared environment is the item 'I wanted to appear capable to my enemies'. However the correlations and MSA scores within this module were reasonable (Tables 7.13 & 4.9), suggesting that there may have been more to the module than the face value of the wording. The results of this module may have been a factor of the game used in the study, and so more investigation would be needed before the module was edited further or cut from the questionnaire.

Item	MSA Score
The.desire.to.beat.the.enemy.motivated.me	0.565
I.wanted.to.appear.capable.to.my.enemies	0.703
Losing.made.me.want.to.try.harder	0.578

Table 4.8: Competitive Motivation MSA

Competitive Social Presence: Notes

Due to the issues noted above, the Competitive Sensation and Motivation (ego) modules were merged, the new module displayed acceptable MSA scores, and an α of 0.6.

Item	MSA Score
I.felt.tense.on.edge.while.playing.my.opponents	0.5792527
My.opponents.created.a.sense.of.urgency	0.5898367
I.wanted.to.appear.capable.to.my.enemies	0.7713410
Losing.made.me.want.to.try.harder	0.6098629

Table 4.9: Competitive Motivation MSA

Cooperative Social Presence: Team Identification

This module was designed to measure how aware participants were of their team-mates and how much they considered them while acting within the virtual environment. Each of the items had a reasonable but not consistently strong correlation with the other items (Table 7.14). 'I acted with my team-mates in mind' scoring the lowest over all correlations, however it achieved the highest MSA score. The overall the module was fairly successful, with a KMO of 0.62 and an α of 0.7.

Item	MSA Score
I.was.aware.of.my.team	0.6345
I.acted.with.my.teammates.in.mind	0.806
I.considered.my.team.mates.possible.plans.thoughts	0.6221
I.felt.like.I.was.part.of.a.team	0.599
I.felt.a.social.connection.to.my.team.mates..camaraderie.	0.599

Table 4.10: Team Identification MSA

Cooperative Social Presence: Team Security

This module was designed to measure how much participants felt that they could rely on their team-mates. Table 7.15 shows a moderate amount of correlation across most of the items. The MSA scores for this module were acceptable with the exception of the item 'I felt I had played my role in the team' (Table 4.11). Removing this item increased the MSA scores of the other items, increased the KMO score of the module from 0.55 to 0.63, and increased the α from 0.7 to 071. With this modification the module was improved.

Item	MSA Score	MSA Score
I.felt.my.team.mates.were.looking.out.for.me	0.574	0.622
I.felt.I.took.more.risks.in.game.when.I.had.my.team.mates.with.me	0.653	0.681
I.felt.I.contributed.to.the.team	0.656	0.783
I.felt.the.team.helped.me	0.511	0.587
I.felt.I.had.played.my.role.in.the.team	0.424	

Table 4.11: Team Security MSA

Cooperative Social Presence: Cooperative Motivation

The aim of this module was to measure to what extent the that being part of a team motivated the participant, the KMO score for this module is 0.66 and it had an α of 0.64. However the module was found to be far too long with multiple redundancies, for example the following pairs of items were too are far too similar: 'I wanted to appear capable to my team mates' & 'I wanted my team to value me', 'I didnt want my team to think Id let them down' & 'I did not want to let my team down', 'Being part of a team motivated me' & 'I felt that being part of my team increased my desire to keep playing', 'The performance of the team was most important to me' & 'My personal performance was most important to me'. These item pairs were merged. One of the items which gained low scores across the board was 'I felt responsible for achieving the teams objectives product of the game' (Tables 7.17 & 4.12). However this result may be due to the nature of the game used to the user study.

Items	MSA Score
The.performance.of.the.team.was.most.important.to.me	0.692
My.personal.performance.was.most.important.to.me	0.521
My.actions.were.determined.by.the.objectives.of.the.team	0.569
I.put.my.own.survival.above.the.immediate.team.goals	0.541
I.wanted.to.appear.capable.to.my.team.mates	0.717
I.didnt.want.my.team.to.think.Id.let.them.down	0.781
Being.part.of.a.team.motivated.me	0.650
I.felt.responsible.for.achieving.the.teams.objectives	0.476
I.wanted.my.team.to.value.me	0.698
I.did.not.want.to.let.my.team.down	0.765
I.felt.that.being.part.of.my.team.increased.my.desire.to.keep.playing	0.603

Table 4.12: Cooperative Motivation MSA

Cooperative Social Presence: Social Action

This module was designed to measure the perceived interplay between the actions of the participants and their team mates. The KMO (0.63), α (0.74), and MSA (Table 4.13) scores of this module were acceptable. However there were a number of redundancies within this module (Table 7.22). For example the following items were similarly worded, scored similarly in the user study, and had high correlations, 'I felt my actions affected my team mates actions' & 'I felt my actions made a difference to my team mates', 'My team mates actions affected my actions' & 'The actions of my team mates affected my thoughts and plans', 'My team mates played a significant role in my experience of the game' & 'My team mates played a significant role in my enjoyment of the game'. Considering these results the items in this module were merged to remove redundancy.

Item	MSA Score
I.felt.my.actions.affected.my.team.mates.actions	0.623
I.felt.my.actions.made.a.difference.to.my.team.mates	0.533
My.team.mates.actions.affected.my.actions	0.650
The.actions.of.my.team.mates.affected.my.thoughts.and.plans	0.637
My.team.mates.played.a.significant.role.in.my.experience.of.the.game	0.659
My.team.mates.played.a.significant.role.in.my.enjoyment.of.the.game	0.668

Table 4.13: Social Action MSA

Cooperative Social Presence: Social Commitments

This module was designed to measure how strongly committed the participants were to their team. The module was fairly successful with a KMO 0.72 and an α of 0.8. Despite strong MSA scores (Table 4.14) there were two items which were removed from the module. 'I felt obliged to help my team' was removed as it correlated less strongly with the rest of the module(Table 7.24), 'I wanted to help my team' was removed as it was very similar to 'I made an effort to work with my team mates'. While these items were by no means detrimental to the module the desire to reduce the number of items in the questionnaire was a high priority at this stage in the development. The removal of these items slightly alters the KMO (from 0.72 to 0.70), and the α from 0.8 (Items: 7, Sample units: 49) to 0.77 (Items: 5, Sample units: 49).

Item	MSA Score	MSA Score
I.felt.my.team.was.committed.to.working.together	0.801	0.755
I.made.an.effort.to.work.with.my.team.mates	0.739	0.633
I.felt.my.team.shared.a.common.overall.aim	0.608	0.773
I.felt.my.team.shared.common.short.term.goals	0.572	0.634
It.was.as.much.about.the.team.as.about.my.own.game	0.875	0.741
I.felt.obliged.to.help.my.team	0.658	
I.wanted.to.help.my.team	0.750	

Table 4.14: Social Commitments MSA

Cooperative Social Presence: Team-mate Value

This small module was designed to measure how much useful the participants perceived their team to be. This module scored high levels of correlation (Table 7.25), KMO, MSA, and an excellent α. However as this module was so small and measured a similar concept to the modified Social Commitment module above, the two modules were combined for joint analysis. While this slightly reduced the α from 0.91 (Items: 3, Sample units: 49) to 0.87 (Items: 8, Sample units: 49), it improved the KMO (from 0.72 to 0.83), and overall MSA scores (Table 4.15). This joint analysis showed that the two modules could indeed exist as a single relevant module.

Item	MSA Score	MSA Score	MSA Score
My.team.mates.were.useful	0.880	0.867	
My.team.mates.helped.me.achieve.my.objectives	0.677	0.809	
My.team.mates.contributed.to.the.success.of.the.team	0.669	0.815	
I.felt.my.team.was.committed.to.working.together		0.858	0.755
I.made.an.effort.to.work.with.my.team.mates		0.765	0.633
I.felt.my.team.shared.a.common.overall.aim		0.895	0.773
I.felt.my.team.shared.common.short.term.goals		0.796	0.634
It.was.as.much.about.the.team.as.about.my.own.game		0.842	0.741

Table 4.15: Team-mate Value & Combined MSA

Cooperative Social Presence: Communication

Communication is important in organising teamwork and this module was designed to measure how participants perceived the communication within their team. The KMO score for this module was 0.67, the α was 0.71, and the correlations were generally high (Table 7.26). The only consistently low scoring item within this module was 'I read the actions of my team ', which had the lowest MSA score (Table 4.16) and correlation. Removing this item increased the α of the module from 0.71 to 0.81, but did little to the overall MSA scores and only improved the KMO score by an insignificant amount. Another problem item within this module was 'I felt I could communicate effectively with my team in the game', which is quite ambiguously worded. This item could be considered to be asking participants about the user-friendliness or capability of the technology involved in communicating with team-mates, or asking about the perceived attitudes of the other players, and so the item was removed.

Item	MSA Score	MSA Score	MSA Score
My.team.communicated.well	0.666	0.689	0.747
I.read.the.actions.of.my.team	0.526		
The.team.had.a.mutual.understanding	0.747	0.738	0.779
I.felt.I.could.communicate.effectively with.my.team.in.the.game	0.631	0.625	0.710
I.felt.my.actions.made.a.difference.to my.team.mates			0.797
My.team.mates.actions.affected.my.actions			0.646
The.actions.of.my.team.mates.affected.my thoughts.and.plans			0.647
My.team.mates.played.a.significant.role in.my.experience.of.the.game			0.827

Table 4.16: Communication MSA

4.4 Stage 4

Introduction

Like Stage 3, this Stage was used to gather user data with which further item analysis could be conducted. The aim of this study was to provide an opportunity to test, analyse and improve the questionnaire. To this end a user experience survey using the questionnaire was carried out. The game used in this study was *Natural Selection 2* (*NS2*) an asymmetrical team-based online FPS game. While the aim of the previous Stage was primarily item reduction, this study aimed to refine and attempt to produce a close to final version of the CCPIG questionnaire. This Stage reduced the number of items from 42 to 40 and led to substantial restructuring.

Procedure & Participants

The CCPIGv0.6 used in this study can be found in Appendix 7.2.5. As in the previous Stage the CCPIG was created as an online questionnaire, a request for respondents was posted on the *Natural Selection 2* community forums and was available to self selecting respondents for 3 days. The study gained a total of 56 respondents, and participants in this study had the chance to be entered into a Prize draw for a Tablet computer (worth around £100). The statistical criteria remained the same for this Stage.

The Game

Natural Selection 2 is an asymmetrical team-based online FPS game, in which two teams play for control of a map. This game has the rather uncommon feature that the two teams are completely different, one being a team of humans with guns, while the other is made up of melee based aliens. Both teams are controlled by a commander who plays the game more like a traditional RTS, buying upgrades for his forces, instructing them, and so on. *NS2* was chosen to be used as a tool to develop the social presence questionnaire as it provided a variation on the intended target for this measurement tool (team based FPS games), and has a more complex mix of roles and tasks throughout the two teams than *Chivalry*.

Figure 4.2: Natural Selection 2 Gameplay

4.4.1 Results Summary

Following the previous Stage some modules had very few items and so, while the items were still performing well in the sections as a whole, some modules were far too small to work on their own. When taken as a whole the competitive section had a KMO score of 0.76, implying a adequate sampling adequacy. The Cronbach's α score could also be classed as 'Good'at 0.88. However throughout Stage 4 it was clear that the individual modules were not reflecting this collective success. The results from the first four modules of the questionnaire encouraged a re-evaluation of the item groups. It was considered that modules 1.1 & 1.4 (Sensation, Ego & Behavioural Involvement) were far too short to stand alone as individual modules, and thus would be merged with the other modules, so long as it was conceptually and statistically valid. As modules 1.1 & 1.2 had originally been the same module and were conceptually similar, both referring to actions and reactions. For example module 1.1 contained items such as 'I reacted to my opponents actions' and 'I acted with my opponent in mind', while module 1.2 contained conceptually similar items such as 'I knew what my opponent was trying to achieve' and 'I felt I affected my opponent's actions'. Thus it seemed logical to merge these modules back together with their newly reduced item numbers. Modules 1.3 & 1.4 were also considered to be conceptually similar, both referring to a more direct relation with one's in-game opponent. To test these merged modules all competitive modules were tested for correlations and it was found that modules 1.1 & 1.2, and 1.3 & 1.4, when merged into single modules, produced high levels of internal consistency and sampling adequacy (see Table 4.17).

When taken as a whole the cooperative section had a KMO score of 0.81, implying a good sampling adequacy. The Cronbach's α score of 0.95 could also be classed as 'Good'. Cooperative modules 2.1, 2.3 and 2.4 produced strong statistical results and only module 2.4 was modified at this stage. In this module the item "I was happy to take a boring role if it meant the team would win " was removed as it had a low MSA score, and while the item did correlate to some degree with the rest of the module, there were items which covered the same conceptual angles, such as "I put the performance of the team over my personal performance". The cooperative section also suffered from similar issues as the competitive, with some of the reduced modules not performing well. Modules 2.2 and 2.5 were somewhat less successful than the other cooperative modules, and because the modules were conceptually similar (both dealing primarily with team interaction) it was decided to attempt to reorganise the items by merging the modules. This larger module produced a far higher Cronbach's α, produced more consistently high MSA scores, and a higher KMO.

CCPIGv0.6					CCPIGv1			
Section	**Module**	**Items**	**Alpha**	**KMO**	**Module**	**Items**	**Alpha**	**KMO**
Competitive		15	0.88	0.76		14	0.88	0.76
	1.1. Behavioural Involvement	3	0.69	0.54	1.1+1.2	8	0.83	0.83
	1.2. Theory of Mind	5	0.69	0.73				
	1.3. Engagement	3	0.65	0.61	1.3+1.4	6	0.81	0.77
	1.4. Sensation & Ego	4	0.68	0.56				
Cooperative		27	0.95	0.81		26	0.95	0.80
	2.1. Team Identification	5	0.74	0.77		5		
	2.2. Team Security	4	0.60	0.61	2.2+2.5	9	0.83	0.75
	2.3. Motivation	6	0.81	0.75		6		
	2.4. Social Commitments & Team-mate Value	7	0.86	0.81	2.4	6	0.87	0.86
	2.5. Social Action & Communication	5	0.78	0.66				

Table 4.17: Module Analysis of CCIPIGv0.6 & CCIPIGv1

NS2 Stage did not lead to much of a reduction in item numbers (numbers went from 42 to 40) but to a restructuring of the questionnaire into a more meaningful and useful tool. The fact that many items worked well while having been used in response to an entirely different team-based game was encouraging, suggesting that the items were tapping into robust concepts related to social presence. The Stage also helped bring more conceptual coherence to the questionnaire. User feedback from the survey contained no complaints about the length of the questionnaire, suggesting the substantial reductions of Stage 3 were effective. At the end of Stage 4 the newly edited CCPIGv1 (see Appendix 7.2.9) had the following modules and structure:

Section 1: Competitive Social Presence
- Module 1.1: Competitive Behavioural Involvement & Theory of Mind (8 Items)
- Module 1.2: Competitive Engagement (incorporating Sensation) (6 Items)

Section 2: Cooperative Social Presence
- Module 2.1: Team Awareness (5 Items)
- Module 2.2: Cooperative Motivation (9 Items)
- Module 2.3: Social Action & Communication (incorporating Team Security) (6 Items)
- Module 2.4: Social Commitments & Team-mate Value (6 Items)

4.4.2 Detailed Results

Competitive Section

When taken as a whole the competitive section of the new questionnaire had a KMO score of 0.76, implying a adequate sampling adequacy. The Cronbach's α score could also be classed as 'Good'at 0.88. Both the KMO and α scores of the competitive module were lower than the cooperative module.

Cooperative Section

When taken as a whole the cooperative section of the CCPIGv0.6 had a KMO score of 0.81, implying a good sampling adequacy. The Cronbach's α score could also be classed as 'Good'at 0.95. The lowest scoring item in terms of MSA was "I felt I took more risks in game when I had my team mates with me". This means that this item could potentially have been pruned from the questionnaire, however doing so only increased the KMO of the complete cooperative set of items from 0.81 to 0.82, and only increases the α by 0.001. It is also the case that this item had high MSA scores within its individual module and so was not be removed.

Competitive: Behavioural Involvement

As an individual module Behavioural Involvement had a KMO score of 0.54, which implies an unconvincing level of sampling adequacy, and had a potentially 'Questionable' Cronbach's α of 0.69. The lower internal consistency score may be due to the issues shown in Table 4.18. This table of correlation shows that while the second item of the module correlates with both other items, the first and third items did not correlate with one another.

Item	1	2	3
1. I.acted.with.my.opponents.in.mind	-	0.58	0.22
2. I.reacted.to.my.opponents.actions	-	-	0.50
3. My.opponents.played.a.significant role.in.my.experience.of.the.game	-	-	-

Table 4.18: Behavioural Involvement Correlations

Item	MSA Score
I.acted.with.my.opponents.in.mind	0.54
I.reacted.to.my.opponents.actions	0.52
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.56
KMO	0.54

Table 4.19: Behavioural Involvement MSA

Competitive Module Combinations

It was clear that, while the competitive module scored well in the statistical tests as a whole, the individual modules were not reflecting this collective success. The results from the first four modules of the questionnaire motivated a revaluation of the item groups. It was considered that modules 1.1 & 1.4 (Sensation, Ego & Behavioural Involvement) were far too short to stand alone as individual modules. Thus all competitive modules were tested for correlations and it was found that module pairs 1.1 & 1.2, and 1.3 & 1.4, when merged into single modules, produced high levels of internal consistency and sampling adequacy. The only item removed from these merged modules was "I wanted my opponents to think I was capable" which received a low MSA score 4.21 and only showed a slight correlation with one other item "The presence of my opponents motivated me".

Cronbach's α for the merged modules

Modules 1 & 2

Items: 8

Sample units: 56

α: 0.828

Modules 3 & 4

Items: 7

Sample units: 56

α: 0.794

Modified Modules 3 & 4

Items: 6

Sample units: 56

α: 0.808

Figure 4.3: Competitive Module Combinations

Item	MSA Score		
I.acted.with.my.opponents.in.mind	0.54	0.82	
I.reacted.to.my.opponents.actions	0.52	0.82	
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.56	0.80	
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions		0.80	0.76
I.knew.what.my.opponents.were.trying.to.achieve		0.91	0.68
I.was.aware.that.my.opponents.might.work.out.my.goals		0.88	0.79
The.actions.of.my.opponents.affected.the.way.I.played		0.79	0.71
I.felt.I.affected.my.opponents.actions		0.89	0.80
KMO	0.54	0.83	0.73

Table 4.20: MSA/KMO scores of Modules 1.1 & 1.2 MSA

Item	MSA Score			
My.opponents.were.challenging	0.59	0.79	0.78	
The.game.was.a.battle.of.skill	0.74	0.67	0.65	
The.game.was.a.battle.of.wits	0.58	0.75	0.78	
I.felt.tense.while.playing.against.my.opponents		0.72	0.79	0.58
My.opponents.created.a.sense.of.urgency		0.73	0.77	0.54
I.wanted.my.opponents.to.think.I.was.capable		0.53		0.54
The.presence.of.my.opponents.motivated.me		0.76	0.83	0.59
KMO	0.61	0.73	0.77	0.56

Table 4.21: MSA/KMO scores of Modules 1.3 & 1.4 MSA

Cooperative: Team Identification

The cooperative module as a whole produced high scores on the statistical tests and the individual modules within the cooperative section also produced favourable results. The Team Identification module had a KMO score of 0.77 and an α of 0.74, suggesting a good sampling adequacy and internal consistency. The module also produced high MSA scores, as shown in Table 4.22, and reasonable correlations in Table 4.23.

Item	MSA Score
I.was.aware.of.my.team	0.77
I.acted.with.my.teammates.in.mind	0.77
I.considered.my.team.mates.possible.plans.thoughts	0.75
I.felt.like.I.was.part.of.a.team	0.81
I.felt.a.social.connection.to.my.team.mates..camaraderie.	0.74
KMO	0.77

Table 4.22: Team Identification MSA

Item	1	2	3	4	5
1. I.was.aware.of.my.team	1.0	0.41	0.51	0.44	0.12
2. I.acted.with.my.teammates.in.mind	0.41	1.0	0.58	0.42	0.32
3. I.considered.my.team.mates.possible.plans.thoughts	0.51	0.58	1.0	0.44	0.24
4. I.felt.like.I.was.part.of.a.team	0.44	0.42	0.44	1.0	0.31
5. I.felt.a.social.connection.to.my.team.mates..camaraderie.	0.12	0.32	0.24	0.30	1.0

Table 4.23: Team Identification Correlations

Cooperative: Social Commitments & Team-mate Value

In this module, while scoring well, there was room for improvement. As 7.42 shows the item "I was happy to take a boring role if it meant the team would win " has a low MSA score, and that the removal of which increased the module's KMO from 0.81 to 0.86 and the Cronbach's α from 0.86 to 0.87. While the item did correlate to some degree with the rest of the module7.41, there were items which covered the same conceptual angles, such as "I put the performance of the team over my personal performance".

Item	1	2	3	4	5	6	7
1. I.felt.the.team.was.committed to.working.together	1.0	0.46	0.56	0.70	0.52	0.61	0.31
2. I.made.an.effort.to.work.with my.team.mates	0.46	1.0	0.55	0.51	0.55	0.43	0.53
3. I.felt.my.team.shared.a common.overall.aim	0.56	0.55	1.0	0.58	0.71	0.57	0.35
4. I.felt.my.team.shared common.short.term.goals	0.70	0.51	0.58	1.0	0.51	0.69	0.11
5. It.was.as.much.about.the team.as.about.my.own.game	0.53	0.55	0.71	0.51	1.0	0.60	0.44
6. My.team.mates.were.useful	0.61	0.43	0.57	0.69	0.60	1.0	0.31
7. I.was.happy.to.take.a.boring role.if.it.meant.the.team.would.win	0.31	0.53	0.34	0.11	0.44	0.31	1.0

Table 4.24: Social Commitments & Team-mate Value Correlations

Item	MSA Score	
I.felt.the.team.was.committed.to.working.together	0.87	0.89
I.made.an.effort.to.work.with.my.team.mates	0.79	0.91
I.felt.my.team.shared.a.common.overall.aim	0.88	0.86
I.felt.my.team.shared.common.short.term.goals	0.72	0.82
It.was.as.much.about.the.team.as.about.my.own.game	0.86	0.82
My.team.mates.were.useful	0.85	0.86
I.was.happy.to.take.a.boring.role.if.it.meant.the.team.would.win	0.62	
KMO	0.81	0.86

Table 4.25: Social Commitments & Team-mate Value MSA

Cooperative Module Combination

As the previous two modules were somewhat less successful than the other cooperative modules it was decided to attempt to reorganise the items by merging the modules. This larger module produced a far higher Cronbach's α, from 0.60 & 0.78 on the individual modules to 0.83 on the merged module. The merged module also produced more consistently high MSA scores, and a higher KMO, see Table 4.26.

Item	MSA Score		
I.felt.my.team.mates.were.looking.out.for.me	0.59	0.75	
I.felt.I.took.more.risks.in.game.when.I.had.my.team.mates.with.me	0.85	0.78	
I.felt.I.contributed.to.the.team	0.77	0.74	
I.felt.the.team.helped.me	0.58	0.79	
I.felt.my.actions.made.a.difference.to.my.team.mates		0.75	0.83
The.actions.of.my.team.mates.affected.my.thoughts.and.actions		0.78	0.70
My.team.mates.played.a.significant.role.in.my.experience.of.the.game		0.71	0.61
The.team.communicated.well		0.72	0.51
The.team.had.a.mutual.understanding		0.81	0.66
KMO	0.62	0.76	0.66

Table 4.26: Modules 2+4 MSA

Additional Data

There were a number of components which were not changed or did not show any interesting statistical patterns, these included Competitive: Mind Theory, Competitive: Engagement, Competitive: Sensation & Ego, Cooperative: Motivation, Cooperative: Social Action & Communication, and Cooperative: Team Security. The results of the analysis of these modules were not commented on in this section, but can be found in Appendix 7.2.8.

4.5 Stage 5: Principal Component Analysis

Introduction

Principal Component Analysis is a common method to validate questionnaires. It is used to find the overall relationships between the items of the questionnaire, and in particular which items meaningfully group into subscales of the questionnaire. It is a purely statistical approach that does not assume a prior component structure but rather that the components emerge as a consequence of iteratively conducting the analysis and interpreting the components generated. Following typical practices Kline [2000], we used principal component analysis with the oblique rotation method, direct oblimin. Thus the final components are able to correlate and this can be an indication of the overall coherence of the questionnaire. The objective of this study was to gather a substantial amount of data, the original aim being over 200 participants worth, using the CCPIGv1 (Appendix 7.2.9). This data would then be used conduct principal component analysis. This study would hopefully serve as a step in validating the CCPIGv1 before it was used to measure social presence in future studies. Despite the CCPIGv1 had a number of predefined modules principal component analysis was used for this study rather than confirmatory factor analysis. The reason for this was that, as stated in the item generation section of this chapter, the modules were items grouped together based on common themes, created to aid the initial analysis rather than being rigid conception entities. All the items were created based upon the underlying concept of social presence in team-based digital games and thus there may have been relationships which existed which the original modules did not account for. Using principal component analysis allowed the data to reveal the real structure of the CCPIG questionnaire.

Procedure

The data for this study was gathered using the online community survey methodology as in the previous Stages, however as this study aimed to gather sufficient data for the PCA, multiple gaming communities were approached to take part. Once the data was gathered any erroneous data was removed (incomplete/blank/clearly bogus data submissions), leaving the data from a total of 237 respondents. The validation analysis (internal consistency and sampling adequacy) on the modules was completed using R, while the factor analysis (principal component analysis) was completed using SPSS. Factor analysis was conducted to deduce whether the questionnaire items fell into the modules to which they were originally assigned.

The Games

Various game communities were chosen for this large scale study to gain the required number of respondents and to provide a mix of user experiences across 6 variants of team-based online games. These games differ in genre, setting, play style and graphical style, but share the core element of two collaborating teams of players competing with each other. All peak daily player numbers represent the numbers taken from Steam Statistics[3] at the time of the study (06/2013).

Team Fortress 2. Much like *Unreal Tournament*, *Team Fortress 2* (*TF2*) is a classic team based FPS game. Players can chose one of 9 different classes, customise the appearance of their character to a small degree and teams have anywhere from 2 to 12 people in them (competitive *TF2* play is 9v9). This game was chosen as it had a healthy community, with up to 70,000 players online at anyone time, and because it represents a prototypical online FPS game.

[3] store.steampowered.com/stats

29th Infantry Division (*29th I.D*) is a realism gaming clan of around 200 gamers and is named after a real U.S. army infantry division. The clan operate primarily on a game known as *Darkest Hour: Europe '44-'45*, a *mod* of the game *Red Orchestra: Ostfront 41-45*, a WW2 based FPS game. The *29th I.D.* clan is organised with a military-esque hierarchy, with members joining as Privates as part of a squad and advancing (or not) to the roles of Sergeants, Corporals, Lieutenants, etc. The game of *Darkest Hour* has a very small community, with only around 150 players ever online at one time. *Darkest Hour* servers can hold up to 70 players and so teams can be upto 35 players per side. The game promotes realism and so while gameplay in *TF2* is fast, hectic and largely 'twitch' based, gameplay in *Darkest Hour* is generally more slow and tactical. The majority of the respondents from the *29th I.D* came from clan-members who had been playing in a realism 'drill'. These drills are weekly events in which squads of players take part in organized battles which predefined objectives and victory conditions. Before the drills the players are briefed, the players then play *29th I.D* for around an hour (all the time maintaining the hierarchy, then the players are debriefed. The highly structured cooperative and competitive nature of the inter and intra-clan gameplay it seemed highly relevant to the aims of the development of the CCPIG, however as a small community high participation in the study could not be guaranteed. To solve this problem and to gain as much participation from this clan as possible each respondent could enter themselves into a prize draw, giving them a chance to win a tablet computer (value approx. £100).

The various incarnations of *Mount & Blade* are medieval/renaissance era games in which players take on the role of infantry, archer/musket, or cavalry troops and take part in pitched battles, skirmishes and sieges on servers which can hold over 100 players. The community survey for this study focused on *Mount & Blade: Warband*. Like *Darkest Hour* this game is far slower paced than *TF2*, but unlike *Darkest Hour* the game play is based primarily around group melee and duels. *Mount & Blade* was chosen for this study as the community is healthy, with upto 10,000 players playing on of the various incarnations of the game at any one time, many clans, and a highly active mod community. The game also offers a very different variation on team based online games.

King Arthur's Gold (*KAG*) is another small community, with a similar peak player numbers to *Darkest Hour*. This game is rather different to many other team-based online games as it takes place in a 2D environment, in a fantasy/medieval setting, and contains dynamic environments which can be altered by the players (built and destroyed). Players chose one of three classes, knights, archers and builders, the latter of which can build fortifications, war machines, mines and bridges for their team. Like *TF2* this game has the usual modes of play for team based online games, including team deathmatch and capture the flag. This game was chosen for its mix of classic core concepts, with unique graphical style and game-play.

Planetside 2 identifies itself as a MMOFPS (massively multiplayer online first person shooter). Unlike the other games which communities were sources for this study, this game does not have individual matches or rounds of combat, nor does it have many separate servers or game modes. In *Planetside 2* the players share a server with thousands of other players in a persistent and huge battlefield. Thus while this is still a team-based online game, its scale is far beyond any of the other games. The community for this game is substantial, with daily peak player numbers of around 7000.

Dota 2 is a multiplayer online battle arena (MOBA) and was chosen for this study primarily due to the colossal player base, with peak daily player numbers of over 300,000, in the hope that this would provide a large number of respondents. Dota 2 is a 5v5 team based fantasy game, in which players take chose a hero character and attempt to help their team capture various points on a map. Dota and Dota 2 are hugely popular and there is a large competitive community.

4.5.1 Module Analysis

While the principal component analysis would be used to reveal the true structure of the CCPIG, the a priori modules in the CCPIGv1 show high levels of internal consistency (Cronbach's α) and sampling adequacy (KMO scores) throughout.

Section/Module	Cronbach's α	KMO
Competitive	0.81	0.81
Behavioural Involvement & Mind Theory	0.73	0.78
Competitive Engagement	0.76	0.81
Cooperative	0.94	0.94
Team Identification	0.82	0.80
Social Action & Communication	0.81	0.84
Motivation	0.79	0.79
Social Commitments & Team-mate Value	0.88	0.87

Table 4.27: Cronbach Alpha and KMO of the CCPIGv1 Modules

4.5.2 Factor Analysis

In this section the results of the Principal Component Analysis (PCA) are shown. The PCA was been interpreted using Eigen value scree plots and analysis of the structure matrices. While "the number of positive eigenvalues determines the number of dimensions needed to represent a set of scores without any loss of information" [Rietveld and Van Hout, 1993] the main method for interpreting the number of relevant factors in this study consisted of looking for the factors before the breaking point or 'elbow' on the scree plots [Rietveld and Van Hout, 1993, Field, 1993]. For example the Figure 4.5.2 below shows the scree plot for the entire data set, with a breaking point around the 6 factor mark. When analysing the factors, the structural matrix was used as a guide. There appears to be much debate throughout the statistics literature about whether to use the pattern or structure matrix, but ultimately this study followed the conclusions of Everitt [1993], who state "when undertaking an oblique rotation, the factor structure matrix should be the focus of factor identification and interpretation".

Tables 4.28 and 4.29 show the PCA results of both the competitive and cooperative sections of the dataset, when looking for two factors. While there was a split of sorts the results were not overly convincing. Tables 4.30 and 4.31 however show the same PCA results but when looking for three factors, interestingly this showed a clear split between the cooperative and competitive elements of the questionnaire. In this table there was also some interesting crossloading, for example the items 'The game was a battle of skill' and 'My opponent was challenging' loaded across both their own competitive factor and onto the cooperative factor. This may suggest that these two items, which focus on the competitive challenge of the opponents, contribute towards cooperative social presence. These results, though not predicted were unsurprising, as it is logical that a greater level of competitive challenge in a team based environment would likely increase the awareness of a player's team performance, and perhaps increase the need for teamwork to overcome greater challenge.

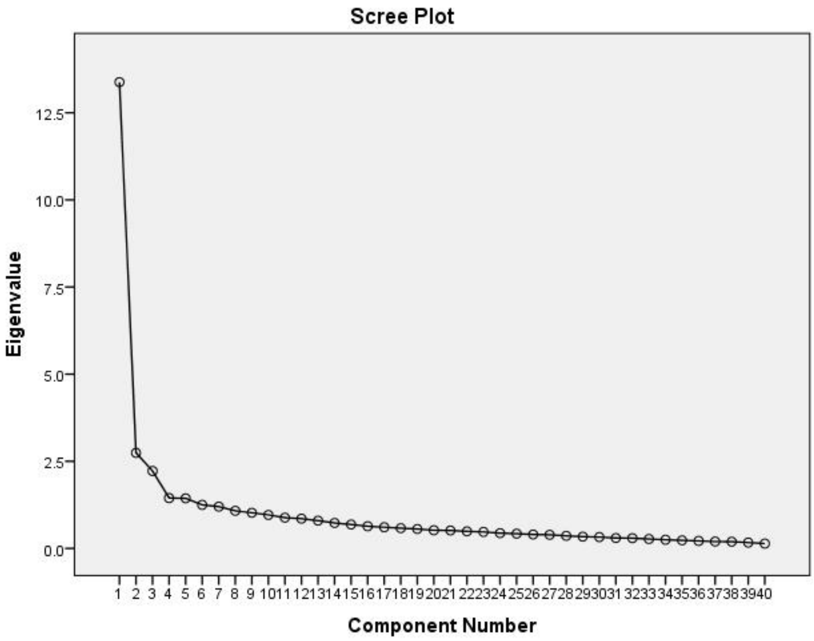

Figure 4.4: All Data. Rotation

Section	Item	Factor 1	Factor 2
1	Iactedwithmyopponentinmind	0.183	0.703
1	Ireactedtomyopponentsactions	0.327	0.651
1	Myopponentsplayedasignificantroleinmyexperienceofthegame	0.145	0.368
1	Itseemedasthoughmyopponentwasactingwithawarenessofmyactions	0.42	0.441
1	Iknewwhatmyopponentwastryingtoachieve	0.184	0.561
1	Iwasawarethatmyopponentmightworkoutmygoals	0.36	0.535
1	TheactionsofmyopponentsaffectedthewayIplayed	0.314	0.46
1	IfeltIaffectedmyopponentsactions	0.165	0.401
1	Myopponentwaschallenging	0.559	0.236
1	Thegamewasabattleofskill	0.489	0.296
1	Thegamewasabattleofwits	0.418	0.387
1	Ifelttensewhileplayingmyopponent	0.38	0.405
1	Myopponentcreatedasenseofurgency	0.442	0.311
1	Thepresenceofmyopponentmotivatedme	0.411	0.54

Table 4.28: Loadings over 0.4 highlighted. Section 1 = Competitive, Section 2 = Cooperative

Section	Item	Factor 1	Factor 2
2	Iwasawareofmyteam	0.525	0.542
2	Iactedwithmyteammatesinmind	0.587	0.487
2	Iconsideredmyteammatespossibleplansthoughts	0.593	0.4
2	IfeltlikeIwaspartofateam	0.808	0.422
2	Ifeltasocialconnectiontomyteammatescamaraderie	0.784	0.211
2	Ifeltmyteammateswerelookingoutforme	0.77	0.272
2	IfeltItookmorerisksingamewhenIhadmyteammateswithme	0.189	0.175
2	IfeltIcontributedtotheteam	0.137	0.48
2	Ifelttheteamhelpedme	0.705	0.276
2	Ifeltmyactionsmadeadifferencetomyteammates	0.329	0.611
2	Theactionsofmyteammatesaffectedmythoughtsandactions	0.657	0.47
2	Myteammatesplayedasignificantroleinmyexperienceofthe	0.69	0.447
2	Myteamcommunicatedwell	0.744	0.165
2	Theteamhadamutualunderstanding	0.735	0.227
2	Iputtheperformanceoftheteamovermypersonalperformance	0.591	0.265
2	Myactionsweredeterminedbytheobjectivesoftheteam	0.665	0.426
2	Iwantedmyteamtovalueme	0.497	0.484
2	Beingpartofateammotivatedme	0.803	0.375
2	Ifeltresponsibleforachievingtheteamsobjectives	0.456	0.569
2	IdidnotwantmyteamtothinkIhadletthemdown	0.538	0.424
2	Ifeltmyteamwascommittedtoworkingtogether	0.833	0.186
2	Imadeanefforttoworkwithmyteammates	0.684	0.346
2	Ifeltmyteamsharedacommonoverallaim	0.676	0.317
2	Ifeltmyteamsharedcommonshorttermgoals	0.721	0.466
2	Itwasasmuchabouttheteamasaboutmyowngame	0.728	0.321
2	Myteammateswereuseful	0.799	0.241

Table 4.29: Loadings over 0.4 highlighted. Section 1 = Competitive, Section 2 = Cooperative

Section	Item	Factor 1	Factor 2	Factor 3
1	Iactedwithmyopponentinmind	0.129	0.588	0.497
1	Ireactedtomyopponentsactions	0.308	0.633	0.330
1	Myopponentsplayedasignificantroleinmyexperie	0.085	0.174	0.474
1	Itseemedasthoughmyopponentwasactingwithawaren	0.343	0.144	0.682
1	Iknewwhatmyopponentwastryingtoachieve	0.168	0.567	0.244
1	Iwasawarethatmyopponentmightworkoutmygoals	0.307	0.358	0.532
1	TheactionsofmyopponentsaffectedthewayIplayed	0.265	0.294	0.479
1	IfeltIaffectedmyopponentsactions	0.148	0.375	0.224
1	Myopponentwaschallenging	0.495	-0.082	0.634
1	Thegamewasabattleofskill	0.442	0.069	0.514
1	Thegamewasabattleofwits	0.372	0.194	0.494
1	Ifelttensewhileplayingmyopponent	0.305	0.114	0.655
1	Myopponentcreatedasenseofurgency	0.370	0.001	0.647
1	Thepresenceofmyopponentmotivatedme	0.354	0.340	0.572

Table 4.30: Loadings over 0.4 highlighted. Section 1 = Competitive

Section	Item	Factor 1	Factor 2	Factor 3
2	Iwasawareofmyteam	0.509	0.476	0.368
2	Iactedwithmyteammatesinmind	0.575	0.417	0.353
2	Iconsideredmyteammatespossibleplansthoughts	0.587	0.334	0.311
2	IfeltlikeIwaspartofateam	0.810	0.348	0.342
2	Ifeltasocialconnectiontomyteammatescamaraderie	0.792	0.125	0.268
2	Ifeltmyteammateswerelookingoutforme	0.782	0.214	0.251
2	IfeltItookmorerisksingamewhenIhadmyteammateswithm	0.208	0.243	-0.021
2	IfeltIcontributedtotheteam	0.168	0.665	-0.075
2	Ifelttheteamhelpedme	0.704	0.183	0.304
2	Ifeltmyactionsmadeadifferencetomyteammates	0.345	0.721	0.110
2	Theactionsofmyteammatesaffectedmythoughtsandactions	0.638	0.352	0.425
2	Myteammatesplayedasignificantroleinmyexperienceofthe	0.667	0.306	0.454
2	Myteamcommunicatedwell	0.758	0.101	0.211
2	Theteamhadamutualunderstanding	0.753	0.193	0.190
2	Iputtheperformanceoftheteamovermypersonalperformance	0.581	0.156	0.319
2	Myactionsweredeterminedbytheobjectivesoftheteam	0.660	0.353	0.335
2	Iwantedmyteamtovalueme	0.498	0.479	0.245
2	Beingpartofateammotivatedme	0.797	0.261	0.385
2	Ifeltresponsibleforachievingtheteamsobjectives	0.454	0.579	0.256
2	IdidnotwantmyteamtothinkIhadletthemdown	0.535	0.384	0.277
2	Ifeltmyteamwascommittedtoworkingtogether	0.842	0.088	0.280
2	Imadeanefforttoworkwithmyteammates	0.678	0.248	0.340
2	Ifeltmyteamsharedacommonoverallaim	0.708	0.365	0.098
2	Ifeltmyteamsharedcommonshorttermgoals	0.713	0.379	0.377
2	Itwasasmuchabouttheteamasaboutmyowngame	0.732	0.251	0.289
2	Myteammateswereuseful	0.792	0.098	0.373

Table 4.31: Loadings over 0.4 highlighted. Section 1 = Competitive, Section 2 = Cooperative

Competitive

In the competitive section of the CCPIGv1 there were two modules consisting of 14 items. These two modules represented the two factors of Behavioural & Cognitive Involvement (including such concepts as Theory of Mind), and Competitive Engagement. The PCA results from this section confirmed that two factors was a reasonable interpretation of the items. The scree plot for the competitive section (Fig. 4.5.2) showed a breaking point of 2 components, and the structure matrix showed a clear split in components between the two pre-defined modules (Table 4.32). Table 4.33 shows a PCA attempting to find three factors, which added little new insight, showing that two factors was the more sensible interpretation. Two items in the competitive section did not load as expected were 'My opponents played a significant role in my experience of the game' and 'It seemed as though my opponent was acting with awareness of my actions'. These two items were originally in Module 1.1, designed to measure how the interplay between the player and their opponents affected their thoughts and actions, while they loaded onto Module 1.2, designed to measure the competitive feelings of the player. Conceptually these items were potentially applicable to either module, 'It seemed as though my opponent was acting with awareness of my actions' was created to draw on the Theory of Mind, but this concept of an opponent being aware of one's actions may, in the mind of the participant, be more closely related to the level of challenge an opponent presents. The concept of 'experience' in the item 'My opponents played a significant role in my experience of the game ', may also be conceptually closer to Module 1.2, as Module 1.1 is phrased in a more reflective way, Module 1.2 refers to the sensations of competitive play. The results of the PCA lead to a revaluation of where these items fitted conceptually, and it was decided that they would be moved from Module 1.1 to Module 1.2.

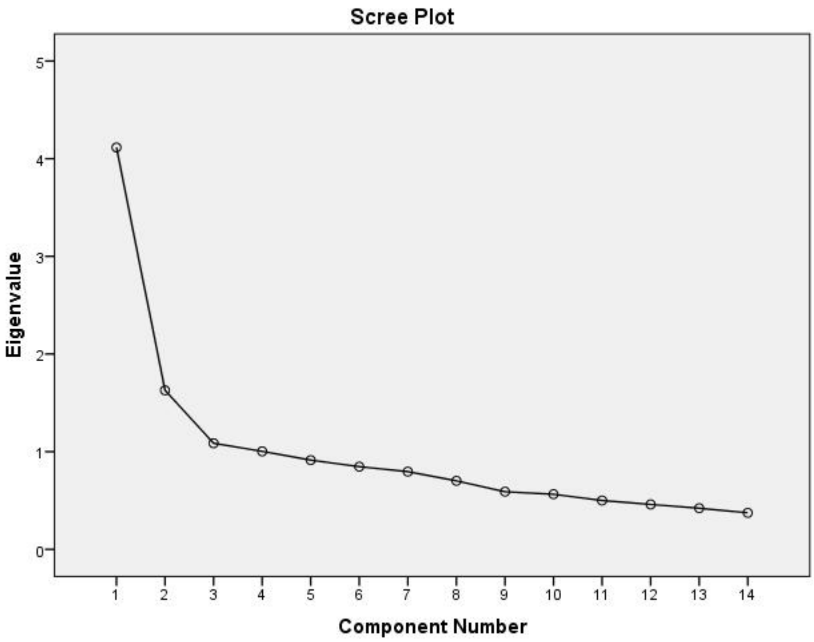

Figure 4.5: Competitive Data. Rotation

Module	Item	Factor 1	Factor 2
1	Iactedwithmyopponentinmind	.294	.699
1	Ireactedtomyopponentsactions	.261	.626
1	Myopponentsplayedasignifican...	.400	.298
1	Itseemedasthoughmyopponentwa...	.634	.392
1	Iknewwhatmyopponentwastrying...	.078	.697
1	Iwasawarethatmyopponentmight...	.442	.573
1	Theactionsofmyopponentsaffec...	.418	.474
1	IfeltIaffectedmyopponentsact...	.138	.577
2	Myopponentwaschallenging	.756	.112
2	Thegamewasabattleofskill	.639	.123
2	Thegamewasabattleofwits	.534	.335
2	Ifelttensewhileplayingmyoppo...	.685	.223
2	Myopponentcreatedasenseofurg...	.700	.121
2	Thepresenceofmyopponentmotiv...	.555	.442

Table 4.32: Two component PCA, loadings over 0.4 highlighted

Module	Item	Factor 1	Factor 2	Factor 3
1	Iactedwithmyopponentinmind	0.254	0.683	0.298
1	Ireactedtomyopponentsactions	0.229	0.717	0.021
1	Myopponentsplayedasignifican...	0.385	0.209	0.349
1	Itseemedasthoughmyopponentwa...	0.62	0.367	0.254
1	Iknewwhatmyopponentwastrying...	0.034	0.704	0.226
1	Iwasawarethatmyopponentmight...	0.415	0.608	0.152
1	Theactionsofmyopponentsaffec...	0.387	0.251	0.723
1	IfeltIaffectedmyopponentsact...	0.098	0.42	0.577
2	Myopponentwaschallenging	0.764	0.122	0.089
2	Thegamewasabattleofskill	0.65	0.306	-0.323
2	Thegamewasabattleofwits	0.527	0.447	-0.096
2	Ifelttensewhileplayingmyoppo...	0.684	0.241	0.102
2	Myopponentcreatedasenseofurg...	0.704	0.074	0.221
2	Thepresenceofmyopponentmotiv...	0.533	0.333	0.46

Table 4.33: Three component PCA, loadings over 0.4 highlighted

Cooperative

The PCA results for the cooperative section were less definitive than those of the competitive. The scree plot for the section suggested between three and five components which suited the presumed four modules quite well, however in general the structure matrix showed a great amount of cross loading and no convincing 4 component split. In short the cooperative section seemed to consist of 1 single component.

While this may not be as predicted the single component showed a lot of coherence, with the majority of the items loading strongly, the cooperative section as a whole having a KMO score of 0.94, and a Cronbach's α of 0.94. However this did not mean that the modules would be abandoned in favour of a single huge section. While the PCA showed the modules cannot be statistically separated from the overall concept of cooperative social presence, it was considered that they would show the breakdown of difference aspects of the concept. The subscales in the cooperative section also scored high KMO and Cronbach's α which suggests they did work well as subscales to the main section. This single component with sub-scales which are used to breakdown the concept they are measuring is similar to the IEQ [Jennett et al., 2008] and GEngQ [Brockmyer et al., 2009] questionnaires. The final trimming of the CCPIGv1 was done by removing the item 'I felt I took more risks in game when I had my teammates support'. This item did not load convincingly onto any component when considering the cooperative section as a whole and was considered conceptually too context dependant. There are games in which people cooperate and in which there are no risks to be taken, therefore the item was removed from the CCPIG on both statistical and conceptual terms.

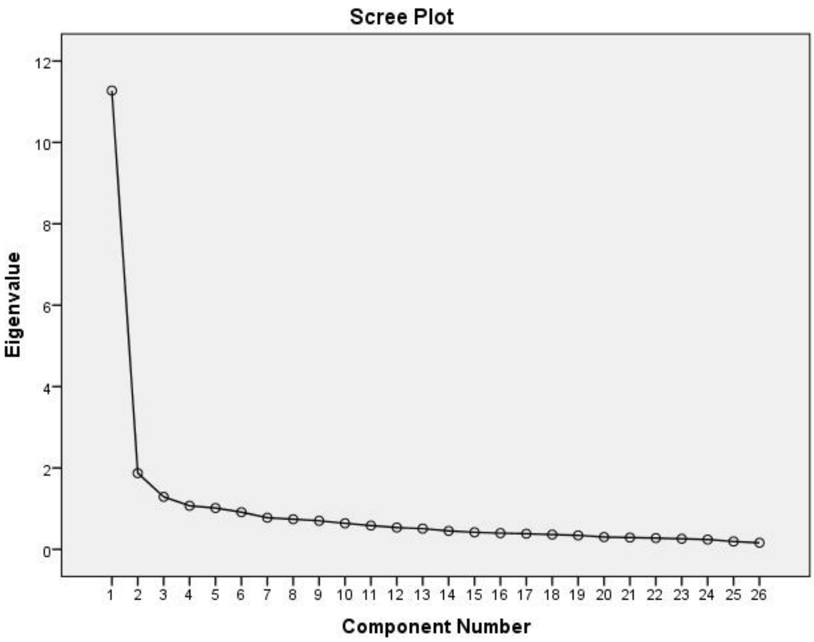

Figure 4.6: Cooperative Data. Rotation

Module	Item	Factor 1	Factor 2	Factor 3	Factor 4
3	Iwasawareofmyteam	.408	.003	-.697	-.322
3	Iactedwithmyteamm...	.482	.253	-.705	-.174
3	Iconsideredmyteam...	.565	.082	-.532	-.315
3	IfeltlikeIwaspart...	.786	.199	-.642	-.245
3	Ifeltasocialconne...	.819	.130	-.501	-.089
4	Ifeltmyteammatesw...	.786	.144	-.556	-.135
4	IfeltItookmoreris...	.188	.638	-.075	.158
4	IfeltIcontributed...	.086	.744	-.219	-.388
4	Ifelttheteamhelpe...	.735	.281	-.372	-.129
4	Ifeltmyactionsmad...	.296	.706	-.380	-.308
4	Theactionsofmytea...	.552	.074	-.701	-.354
4	Myteammatesplayed...	.592	.054	-.678	-.370
4	Myteamcommunicate...	.782	.064	-.477	-.062
4	Theteamhadamutual...	.768	.087	-.421	-.327
5	Iputtheperformanc...	.537	-.100	-.515	-.193
5	Myactionsweredete...	.605	.073	-.458	-.677
5	Iwantedmyteamtova...	.377	.427	-.749	-.037
5	Beingpartofateamm...	.755	.053	-.638	-.383
5	Ifeltresponsiblef...	.342	.284	-.439	-.782
5	Ididnotwantmyteam...	.378	.109	-.705	-.271
6	Ifeltmyteamwascom...	.867	.017	-.476	-.238
6	Imadeanefforttowo...	.620	.015	-.643	-.282
6	Ifeltmyteamshared...	.680	.234	-.386	-.518
6	Ifeltmyteamshared...	.697	.174	-.506	-.467
6	Itwasasmuchaboutt...	.707	.135	-.518	-.359
6	Myteammateswereus...	.826	.092	-.394	-.254

Table 4.34: Four component PCA, loadings over 0.4 highlighted

Module	Item	Factor 1	Factor 2
3	Iwasawareofmyteam	0.545	0.41
3	Iactedwithmyteamm...	0.582	0.51
3	Iconsideredmyteam...	0.62	0.325
3	IfeltlikeIwaspart...	0.814	0.382
3	Ifeltasocialconne...	0.79	0.188
4	Ifeltmyteammatesw...	0.782	0.256
4	IfeltItookmoreris...	0.132	0.366
4	IfeltIcontributed...	0.138	0.748
4	Ifelttheteamhelpe...	0.686	0.254
4	Ifeltmyactionsmad...	0.342	0.729
4	Theactionsofmytea...	0.66	0.434
4	Myteammatesplayed...	0.687	0.403
4	Myteamcommunicate...	0.754	0.131
4	Theteamhadamutual...	0.751	0.216
5	Iputtheperformanc...	0.588	0.155
5	Myactionsweredete...	0.665	0.399
5	Iwantedmyteamtova...	0.493	0.63
5	Beingpartofateamm...	0.807	0.341
5	Ifeltresponsiblef...	0.454	0.64
5	Ididnotwantmyteam...	0.514	0.476
6	Ifeltmyteamwascom...	0.839	0.14
6	Imadeaneffforttowo...	0.693	0.316
6	Ifeltmyteamshared...	0.684	0.388
6	Ifeltmyteamshared...	0.728	0.394
6	Itwasasmuchaboutt...	0.73	0.331
6	Myteammateswereus...	0.782	0.161

Table 4.35: Two component PCA, loadings over 0.4 highlighted

Module	Item	Factor 1	Factor 2	Factor 3
3	Iwasawareofmyteam	0.428	0.058	-0.709
3	Iactedwithmyteamm...	0.496	0.257	-0.659
3	Iconsideredmyteam...	0.576	0.145	-0.539
3	IfeltlikeIwaspart...	0.792	0.235	-0.603
3	Ifeltasocialconne...	0.815	0.137	-0.433
4	Ifeltmyteammatesw...	0.786	0.159	-0.497
4	IfeltItookmoreris...	0.183	0.564	0.019
4	IfeltIcontributed...	0.108	0.802	-0.257
4	Ifelttheteamhelpe...	0.732	0.297	-0.319
4	Ifeltmyactionsmad...	0.313	0.739	-0.376
4	Theactionsofmytea...	0.569	0.137	-0.709
4	Myteammatesplayed...	0.608	0.124	-0.69
4	Myteamcommunicate...	0.777	0.068	-0.41
4	Theteamhadamutual...	0.771	0.165	-0.426
5	Iputtheperformanc...	0.543	-0.061	-0.504
5	Myactionsweredete...	0.626	0.239	-0.562
5	Iwantedmyteamtova...	0.391	0.38	-0.662
5	Beingpartofateamm...	0.766	0.134	-0.646
5	Ifeltresponsiblef...	0.374	0.464	-0.576
5	Ididnotwantmyteam...	0.397	0.144	-0.699
6	Ifeltmyteamwascom...	0.866	0.073	-0.452
6	Imadeanefforttowo...	0.631	0.067	-0.635
6	Ifeltmyteamshared...	0.692	0.356	-0.439
6	Ifeltmyteamshared...	0.71	0.279	-0.541
6	Itwasasmuchaboutt...	0.716	0.212	-0.526
6	Myteammateswereus...	0.824	0.153	-0.378

Table 4.36: Three component PCA, loadings over 0.4 highlighted

4.5.3 Discussion

Overall then there was evidence that the CCPIGv1 was able to make a clear distinction between competitive and cooperative game play. The competitive section also seemed reasonably interpreted as two components of the awareness of other humans (previously called Behavioural Involvement & Theory of Mind) and actual engagement, the sensations and feelings of competitive play. In contrast, the cooperative section seemed to be measuring more holistic sensation, the overall cooperative experience of social engagement.

The CCPIGv1.1 (found in full in Appendix 7.2.11) the modules with unwieldy titles were re-named:

Final structure CCPIGv1.1

Section 1: Competitive

Module 1.1: Awareness

Module 1.2: Engagement

Section 2: Cooperative

Module 2.1: Team Identification

Module 2.2: Social Action

Module 2.3: Motivation

Module 2.4: Team Value

Section 1 is designed to measure ‘competitive social presence’, the social presence felt towards one’s opponents in a digital game. Module 1.1 measures competitive involvement, how the interplay between the player and their opponents affected the respondent’s thoughts and actions. The module is phrased in a fairly reflective way, it aims to measure the extent to which a respondent is using the Theory of Mind, and how aware they were of the behavioural and cognitive interplay between them and their opponent(s). Module 1.2 measures competitive engagement, and the sensations of competitive play with another human. Section 2 is designed to measure ‘cooperative social presence’, the social presence felt towards team-mates in cooperative digital games. As the PCA results from this study suggested this section functioned as a single component, and a number of concepts cut across the section, including Theory of Mind, and social *joint commitments*[Clark, 2006].

4.6 Chapter Summary

Questionnaire Development

This chapter documented the development of the Competitive and Cooperative Presence in Gaming (CCPIG) questionnaire, a measure for social presence specifically designed for use in team-based digital games. The development refined a sprawling list of 116 items into a 39 item tool which successfully measures the two distinct concepts of competitive and cooperative social presence. The development also helped hone the online community survey methodology, a method of deploying a questionnaire to gain both quantitative data, and qualitative user feedback to contextualize the results. Questionnaires are useful for gathering quantitative data and can reveal much about user experience, but it a pragmatic view of the data must be taken to gain valuable insights. In complex scenarios such as those found in team-based online games it is beneficial to combine the results of a questionnaire with observations of gameplay, and a knowledge of the games and game communities involved in the studies.

Social Presence

The studies in this chapter not only contributed to the development of the CCPIG, but enlightened more of the nature of social presence, and the user perceptions of social presence in team-based digital games. The development of the questionnaire confirmed that the experiential vignettes of the previous chapter were revealing reliable insights into social presence in team-based digital games. The items of the questionnaire were based upon the results of the vignettes, and the these coherence and reliability of these items shows that the results were valid. The CCPIG was further validated in Chapter 5 and the single factor structure of the cooperative section was rearranged and split into two factors following a principal component analysis with a larger data set.

Further Work

While the development of the CCPIG could be considered successful, in that it produced a functioning questionnaire, the structure of the cooperative section was still of some concern. It was expected that the cooperative section would split into a number of other factors, and the results which suggested it was in fact one single factor made the section seem large and ungainly compared to the competitive section. Therefore, rather than simply accept the results of the PCA analysis in this chapter, further factor analysis was be conducted using the far larger dataset gathered for the team trust study in the following chapter. This analysis would confirm that the cooperative section was not one single factor, but could be scored as two conceptually coherent factors, providing a far more useful and fine grain view of cooperative social presence in team-based games. The user feedback from the various studies also suggested a number of elements of gameplay context which might affect levels of social presence. Respondents suggested that playing with friends or strangers greatly affects the levels of social presence in team-based games, a concept which would be investigated in the final study of this thesis.

Chapter 5

Team Trust & Social Presence

5.1 Introduction

Following the development of the CCPIG questionnaire there existed a validated and suitable measure for social presence in team-based digital games, and so research into the core elements of social presence could continue. A meeting was conducted with the industry supervisor to discuss the outcomes from the previous Chapter and the direction of future research. The outcome of this discussion was that a related issue to social presence, team trust, was highly relevant but not yet well understood in relation to training in virtual environments, To provide an overview of the topic a literature review was conducted to establish insights into team trust in team-based virtual environments. During the course of reviewing the team trust literature there appeared to be a some interesting overlap between the core elements of team trust and cooperative social presence.

To investigate the conceptual crossover between the two concepts a user study was conducted, gathering data using the online community survey methodology with an online questionnaire consisting of the CCPIG, an established trust scale, and a number of other items measuring reported elements of trust. The study provided an opportunity to test the CCPIG on a larger scale, gain a better understanding of both social presence and team trust, and to explore the interplay between these concepts and a number of contextual gameplay elements. The data gathering was a success, attracting 821 respondents from across 8 difference gaming communities. The results of the study not only enlighten the similarities and differences between trust and cooperative social presence, but help give a greater understanding to the various antecedents, and variables which affect team trust and social presence in team-based digital games. The results of the literature review and subsequent investigation are reported in this Chapter.

5.2 Background

5.2.1 Trust in Teams

Of the numerous theories of trust from various domains this review will focus on trust in teams, and more specifically trust in virtual teams. Trust can be defined as "the extent to which a person is confident in, and willing to act on the basis of, the words, actions, and decisions of another"[McAllister, 1995], the willingness to become vulnerable [Zand, 1972], or more simply positive expectations about the conduct of another [Lewicki et al., 1998, Costa et al., 2001].

In terms of trust in teams, Kanawattanachai and Yoo [2002] argue that, in terms of face-to-face teams at least, establishing trust is important to working relationships [Bhattacharya et al., 1998, Mayer et al., 1995]. Kanawattanachai and Yoo [2002] go on to state that trust is reported to lead to more open communication [Smith and Barclay, 1997], team cooperation [Parks et al., 1996], better team decision-making [Zand, 1972], increased risk-taking [McKnight and Chervany, 2000] and satisfaction in the decision-making process [Driscoll, 1978]. In other words the literature suggests that trust may lead to higher team effectiveness [Handy, 1995, Poole, 1999, Dirks, 2000]. Costa et al. [2001] argue that trust is based on of four elements, propensity to trust, perceived trustworthiness, cooperation, and monitoring behaviours. Monitoring behaviour is seen by Costa et al. [2001] as evidence of a lack of trust, and Webber [2008] found that monitoring behaviours significantly decreased cognitive trust in teams. Additionally in distributed teams monitoring behaviour can reduce productivity by distracting team members from their core task [Wilson et al., 2006]. Costa et al. [2001] also argue that certain actions are indicative of trust, communicative openness, acceptance of influence, restraint from opportunism, and control reduction [Smith and Barclay, 1997]. Costa et al. [2001] state that propensity to trust is dependant on one's "life experiences, personality types, cultural background, education, and several other socio-economic factors"[Rotter, 2001, Mayer et al., 1995]. A low propensity to trust is similar to the concept of 'betrayal aversion' [Aimone and Houser, 2012] in which people avoid risk when dealing with other people. Perceived trustworthiness is the cognitive and emotional [Lewis and Weigert, 1985] assessment of the characteristics and actions of the trustee [Costa et al., 2001].

In a meta-analysis of trust literature Colquitt et al. [2007] support a multifaceted interpretation, stating that trust has antecedents and consequences. Antecedents include the perceived ability, benevolence and integrity of the trustee, and the propensity to trust of the individual. The consequences of trust are risk-taking behaviours, task performance, citizenship behaviour, and lack of counterproductive behaviour. Colquitt et al. [2007] also argue that their results show a "moderately strong relationships between trust and risk taking". Finally Colquitt et al. [2007] state that trustworthiness and propensity to trust facilitates social exchange relationships, "relationships that that entail unspecified future obligations"[Blau, 1964, Konovsky and Pugh, 1994], and that trust is a partial indicator of these social exchange relationships.

Trust can also be broken down into cognitive and affective elements, with the relative importance of these two elements depending on the context [Lewis and Weigert, 1985, Kanawattanachai and Yoo, 2002]. Cognitive elements of trust include the perceived competence, reliability, and professionalism of team members, while affective elements represent the emotional connection between team members [Kanawattanachai and Yoo, 2002]. Trust is regarded as especially critical in distributed virtual teams [Lawler, 1992, Mayer et al., 1995], and is essential for loose coupling teams to work well [Wilson et al., 2006]. Meyerson et al. [1996] argue that trust in virtual environments relies on cognitive elements to a greater extent than affective. Kanawattanachai and Yoo [2002] state that in virtual teams the "separation in time and space, possibly no history of working together, and limited options of communication channel"could lead to low trust and thus bad working relationships. However a study by Webber [2008] suggests that while "early trust is developed through prior familiarity, [...] familiarity does not significantly affect [...] trust later in the life of the team". In other words, familiarity only affects trust when there is no other evidence available available [Webber, 2008].

Virtual teams lack elements such as physically close relationships and the ability to easily observe team members, elements which are assumed to be necessary for the development of trust [Burt and Knez, 1996, Coleman, 1990, Wilson et al., 2006]. Trust is presumed to be more easily generated and maintained in co-located teams [Lewicki and Bunker, 1996] as this permits a knowledge of other team members and a greater sense of team identity [Wilson et al., 2006]. Orbell and Dawes [1991], Frank [1993] and Zucker [1986] argue that due to the lack of behavioural cues from other team members in distributed teams the ability to cooperate and trust is reduced. Wilson et al. [2006] go on to state that the reduced social cues in computer-mediated communication [Sproull and Kiesler, 1996] cause people to focus less on others [Kiesler et al., 1984] and leads to lower cohesiveness, less social conformity [Kiesler et al., 1985], and ultimately less interpersonal trust in a team[Rousseau et al., 1998]. However in a study of trust over time Wilson et al. [2006] found that while virtual teams had lower initial levels of trust than face-to-face teams, levels slowly increased to become comparable.

With relevance to a vignette in this EngD, Houser et al. [2006] ran a study in which participants played an investment (trust) game with either a human counterpart or a computer. Playing the human counterpart version of the game was seen as a series of trust decisions, where as the computer counterpart game was seen as a series of risk decisions. The study found that participants acted very differently depending on the condition, showing that the risk attitudes of the participants significantly correlated to decisions in the 'risk' game with computer counterparts, but did not correlated to decisions in the 'trust' game with human counterparts. "In particular, we found that subjects classified as 'risk seeking' by the [Holt and Laury [2002] risk attitude] procedure were significantly more likely to invest a significant amount when their counterpart was a computer, but not when their counterpart was a human"[Houser et al., 2006]. Not only does the Houser et al. [2006] study suggest risk-taking and trust are separate concepts, but again highlights that humans perceive and act differently depending on whether they are playing a game with humans or computer controlled entities.

One problem with trust research is that, in terms of interpersonal trust, studies often consist of simulated "interactions and games, such as the Prisoners Dilemma, under laboratory conditions"[Lewicki et al., 2006] rather than observations in 'the wild'. Therefore the ecological validity or relevance of this research to trust in virtual teams in practise cannot be assumed.

Trust Antecedents	Trust Evidence
Ability	Communication
Familiarity	Control Reduction
Interaction	Cooperation
Propensity to Trust	Monitoring Behaviour
Trustworthiness	Performance
	Positive Expectations
	Risk-taking
	Satisfaction
	Willing Vulnerability

Table 5.1: Elements of Trust

Table 5.1 is a summary of the various elements which the literature argues lead to, and are evidence of, trust.

5.2.2 Trust in Games

Literature regarding trust in games predominately relates to trust in the technology, or the game 'systems'[Wu and Liu, 2007] from an 'e-commerce' perspective. Similar to social presence studies, the rare cases of literature which do explore inter-player trust in multiplayer games discuss the concept in terms of MMORPGs, the du jour genre for games studies of the noughties. In terms of FPS games the concept is as yet largely unexplored, with only general statements appearing in the literature such as that players prefer to play with people they know and trust [Xu et al., 2011]. Using a third person shooter as their experimental environment, Waddell and Peng [2014] found that cooperative gameplay encouraged feelings of trust between players and that performance (winning or losing) significantly influenced the levels of trust. In terms of social relationships, Waddell and Peng [2014] found no difference in cooperative behaviour between teams of friends and strangers.

Jakobsson and Taylor [2003] state that MMORPG groups/guilds rely on concepts such as trust and reputation to self organize. Group members must trust each other to share loot, kills, and to return favours, much like the social exchange relationships mentioned previously. Reminiscent of general team trust literature, Jakobsson and Taylor [2003] argue that being in a group in these games "entails lowering your guard somewhat and trusting the collective to treat everyone fairly". The authors also argue that trusting team-mates in MMORPGs becomes more pronounced in more 'dangerous' (challenging) situations, in which a player's character is at great risk of a long and costly recovery should they die. For example if there were to drop the loot they had acquired during a long dungeon crawl or perhaps would have to make a lengthy journey to rejoin their party. Yee [2003a] supports the argument that challenge in MMO games encourages trust, stating that dungeon raids "force players to depend on each other, to trust each other and to work together as a team. These experiences are often very salient trust-building exercises for all the players involved". Yee [2003a,b] goes on to state that the emotional investment that players have in their characters and the frequency of these trust-building exercises means that MMORPGs "facilitate the 'jump-starting' of solid bonds between players"[Yee, 2003b]. As many team-based online games rely on team activities this might also be the case in other genres of games beyond MMORPGs. Similar to the workplace based team trust literature Guo et al. [2012] and Mason and Clauset [2013] argue that familiarity in team-based games leads to higher team and personal performance.

5.2.3 Measuring Trust

Trust in teams has been primarily measured using Likert scale questionnaires, and also by monitoring amounts of interaction between team members, or by establishing team performance. Questionnaires are a popular way to measure trust in teams, and the trend throughout the literature is for constructing and adapting new questionnaires from old ones. This leads to a situation in which there are various questionnaires designed to measure trust which contain the same or very similar items, intermixed with novel items and sections lifted from measures of other concepts which authors judge to be related to trust. One concern with this trend is that as sections of previous questionnaires are used, re-used and adapted, their validity becomes suspect and it is hard to determine if they are faithful the concepts which they originally measured.

Throughout the literature one of the most widely used questionnaires to measure trust in virtual teams is the McAllister [1995] questionnaire (see Appendix 7.3). The popularity of this questionnaire is likely due to the high reliability of the measure as reported by McAllister [1995]. This questionnaire consists of three sections of Likert scale items: Behavioral Response and Interpersonal Trust Measures which are based on literature on interpersonal trust, Exogenous Measures which are based on literature on organizational in-role behaviour, and Performance Measures based on a measure for reputational effectiveness.

Many studies have used the McAllister [1995] questionnaire including Dirks [2000], Webber [2008], Wilson et al. [2006], Kanawattanachai and Yoo [2002], among others. However, while the McAllister [1995] questionnaire has proved popular it was designed to be used with dyads and so is often adapted to suit particular studies. For example Wilson et al. [2006] modified the wording of the McAllister [1995] questionnaire to suit short-term groups, changing items such as 'We have a sharing relationship' and 'We can both freely share our ideas and feelings' to 'I can freely share my ideas and feelings in this group'. Wilson et al. [2006] used this modified McAllister [1995] questionnaire in combination with measures for participant views on teams versus individuals [Chan, 1998], within-group agreement [James et al., 1984], and interpersonal trust between individual members of each team [Johnson-George and Swap, 1982]. Wilson et al. [2006] also measured cooperation in the teams as while trust was their main focus "cooperation is among the most proximal behavioral manifestations of trust"[Rousseau et al., 1998], and cooperation was measured by comparing the amount participants used their resources to help the team rather than themselves.

Similarly Webber [2008] adapted the McAllister [1995] questionnaire to measure trust in teams over time, adding their own familiarity measure to a modified version of the original (see Appendix 7.3), and Kanawattanachai and Yoo [2002] used modified sections of the McAllister [1995] questionnaire in addition to measuring disposition to trust using a four-item scale developed by Pearce et al. [1992] (see Appendix 7.3). Kanawattanachai and Yoo [2002] argue that it is necessary to measure this concept as an individual's disposition to trust can influence their level of trust [McKnight et al., 1998]. Glaeser et al. [2000] developed a similar disposition to trust style of questionnaire based on a question used to measure 'trust and social capital' in the U.S. National Opinion Research Centers General Social Survey, "Generally speaking, would you say that most people can be trusted or that you cant be too careful in dealing with people?". The Glaeser et al. [2000] questionnaire consisted of questions such as "How often do you lend money to your friends?", "Have you or someone close to you recently lost something in the mail?", "How often do you intentionally leave your rooming groups hallway door unlocked (when nobody is home)?", and so on.

Jarvenpaa et al. [1998] developed adapted items from the trustworthiness measure of Pearce et al. [1992] and the Schoorman et al. [1996] measure for trust (see Appendix 7.3). This measure was also used by Benoit and Kelsey [2012] to measure trust and performance in virtual teams. While investigating if high levels of trust and high individual autonomy in teams can lead to low performance Langfred [2004] constructed a questionnaire from various existing measures Langfred [2004] conducted this study on student teams and measured individual performance in this study using the individual's Graduate Management Admission Test (GMAT, an assessment of general analytical, writing, quantitative, verbal, and reading skills) scores and team performance using the numerical score given by a panel of 'raters' to a team presentation and following question/answer session. Langfred [2004] found that "high trust was associated with higher team performance when individual autonomy was low but with lower performance when individual autonomy was high". Similarly Jarvenpaa et al. [2004] developed a questionnaire to measure trust over time by combining a number of existing measures (see Appendix 7.3). This measure was used in addition to non-self reported measures such as Task Performance, measured using the team's score in a team task, and communication level (the number of emails sent between team members).

While Likert scale style questionnaires are popular measures, they are not the only measure for antecedents and evidence for trust. In an investigation of trust in virtual temporary teams Iacono and Weisband [1997] coded email communication for 'interaction initiations' and responses, in other words like Jarvenpaa et al. [1998] and Jarvenpaa et al. [2004], Iacono and Weisband [1997] counted the number of interactions within a team.

In a PhD focusing on trust in organizations Costa [2010] developed a measure based on trust in teams working in medical and care organizations (see Appendix 7.3). The propensity to trust and perceived trustworthiness were adapted from the Philosophies of Human NatureRPHNS [Wrightsman, 1964] and the Organizational Trust InventoryOTI [Cummings and Bromiley, 1996], while the rest of the questionnaire was developed based upon the work of Costa [2010], Costa et al. [2001].

In summary, many studies of team trust rely on a mishmash of scales, adapted for use in a new context. While the literature has shown than there have been a variety of previous questionnaires adapted for use in this area of research, the McAllister [1995] and Pearce et al. [1992] questionnaires have been most commonly used, and thus potentially have a great influence over current theories of team trust.

5.2.4 Cooperative Social Presence & Trust

In reviewing the literature it appeared that conceptually trust in virtual teams has, at least at first glance, much in common with the concept of cooperative social presence. This conceptual cross-over will be explored in this section. However the interplay between trust and social presence had yet to be explored in previous research, especially in team-based games. It must be stated that while there appears to be crossover between the two concepts, the trust literature is primarily focused on teams from a managerial/organizational (work place) perspective. Therefore some theories present within the trust literature may not be applicable to gaming or virtual training, and there may be some concepts that initially seem similar but do not map smoothly from one domain to another.

The teams in the team-based digital games could be seen as similar to swift starting action teams (STATs) [Wildman et al., 2012] in the workplace/organizational based team trust literature. In online team-based games players often join a public server and join a team of predominantly strangers with which they must cooperate to succeed. STATs are teams in organizations which "are comprised of well-trained experts who have no previous work experience with one another", "perform their team task almost immediately on team formation", "face high stakes from their inception" [Wildman et al., 2012]. From this description of a STAT it is no great leap to see the similarities in team-based public server play. Wildman et al. [2012] goes on to state that, in addition to the standard antecedences and influences of trust, in STATs team members will make quick judgements about others based on surface-level/shallow cues, pre-existing relationships will affect trust across the whole team, emotions will have more impact than cognitive appraisals of others when forming trust, and task uncertainty will have a negative affect on trust. However the core difference is essentially that the management/organizational domain focuses on work, while team-based games are a method of play. While discussing the conceptual differences between work and play could be a PhD in itself, and there is no time here to delve into them, we can say that they do represent different social contexts, and thus might result in team trust being experienced differently.

Despite these concerns the conceptual cross-over between these two concepts was hard to ignore. Table 5.2 shows how various items from the CCPIG could be coded with the elements (antecedents and evidence) of trust, and thus are potentially measuring elements of team trust. This coding was purely subjective and simply highlights the superficial conceptual crossover of trust and cooperative social presence. The literature states that trust is displayed via communicative openness and cooperative behaviour, and it is no surprise that cooperative behaviour also features heavily in the CCPIG. The trust element of interaction was not been included in Table 5.2 as interaction is a core component of games and therefore the majority of items could be coded as relating to interaction.

CCPIG Cooperative Items	Trust Antecedents & Evidence
I was aware of my team	
I acted with my team-mates in mind	
I considered my team-mates possible plans/thoughts	
I felt like I was part of a team	
I felt a social connection to my team-mates (camaraderie)	
I felt my team-mates were looking out for me	Willing Vulnerability
I felt I contributed to the team	Cooperation
I felt the team helped me	Cooperation
I felt my actions made a difference to my team-mates	
The actions of my team-mates affected my thoughts and actions	
My team-mates played a significant role in my experience of	
My team communicated well	Communication
The team had a mutual understanding	Communication
I put the performance of the team over my personal performance	
My actions were determined by the objectives of the team	Control Reduction, Cooperation
I wanted my team to value me	
Being part of a team motivated me	
I felt responsible for achieving the objectives of the team	Control Reduction
I did not want my team to think I had let them down	
I felt my team was committed to working together	Cooperation, Satisfaction
I made an effort to work with my team-mates	Cooperation
I felt my team shared a common overall aim	Cooperation
I felt my team shared common short term goals	Cooperation
It was as much about the team as about my own game	Control Reduction
My team-mates were useful	Ability, Satisfaction

Table 5.2: Cursory coding of the CCPIG using the elements of trust.

The concept of perceived trustworthiness is difficult to compare with scales such as the CCPIG, as the specifically CCPIG is designed to measure the social experience of players post-gameplay, rather than expectations about future gameplay. Perceived trustworthiness is based upon the perceived competence and emotional connections of the team members, or an assessment of the characteristics and actions of the trustee [Costa et al., 2001].

The main problem with trustworthiness within the trust literature is that it is referred to in both predictive, present, and retrospective terms. For example the Jarvenpaa et al. [2004] questionnaire uses the Pearce et al. [1992] measure for trustworthiness which contains predictive items such as "We will have confidence in one another on this team" and "Overall, the people will be very trustworthy". The Costa [2010] questionnaire on the other hand measures trustworthiness with items phrased to refer to a current team such as "People deceive each other within my working unit" and "Some people in my working unit are successful at the expense of others". Thus it is difficult to establish based on the literature if perceived trustworthiness is generally held to be a prediction of a future team, or an assessment of a current team.

The CCPIG does contain concepts which do not relate to the core elements of trust as defined by the literature. Team identity, the social significance of one's actions, how the team affects one's experience, and motivation and commitment to the team are not concepts which relate team trust as the literature defines it. There are also elements of trust which do not feature in the CCPIG model of cooperative social presence. For example the concept of risk-taking was once represented by an item in the CCPIG, however this item was found to be statistically and conceptually irrelevant to the core experience of cooperative social presence in games. Thus while the literature states that risk taking is evidence of trust, it is not an essential component of social presence, suggesting some conceptual differences.

Familiarity with one's team members is not a concept that is included in the CCPIG, however throughout the development of the CCPIG respondents were asked in the preamble questions whether they were playing with friends, clan-mates or strangers to help contextualize the data. The literature suggests that trust in virtual teams increases over time, and familiarity is an important factor in the early formation of trust. This implies that the perceived trustworthiness of friends and clan members in games is likely to be higher than strangers. This echoes the patterns in the CCPIG development data which suggest social presence was higher when playing games with familiar people rather than strangers.

Propensity to trust, positive expectations and other general character traits are not measured by the CCPIG. This is because it is assumed that each participant will have any number of slightly different feelings towards other humans and motivations for playing certain games which would affect social presence. It is simply impractical to attempt to form a psychological profile of each respondent to a gaming experience questionnaire.

Monitoring behaviour is not covered in the CCPIG but can be compared to elements of social presence. For example, Schouten [2011] argues that social presence is a concept built around the evidence of other humans within a virtual environment, and that simple cues such as the score of other players is enough to increases social presence. It could be argued that checking the scores of other players in a game is a form of monitoring behaviour. However while monitoring behaviour in games can be seen as actively increasing one's awareness of others, monitoring behaviour in the trust literature is conceptually distrustful and involves checking on others to make sure they are completing their work. This is an example of the misfit between the focus of the majority of trust research, work place teams, and teams in games. The predominant reasons one checks one's score and the score of others within a team-based online game is different from the reasons one would check the performance of work colleagues. In games scores are there to provide performance data, to establish who is performing the best, for competitive, cooperative, and/or ego purposes. While in some cases there may be a competitive element in monitoring the performance of one's colleagues, when the monitoring in the workplace is due to issues of trust it might no longer be equivalent to monitoring other players in games.

While personal contribution to the team appears in the CCPIG, the performance of the team does not feature. While the model of social presence in the CCPIG does not contain the concept winning or losing as a core element, that is to say, winning is not essential to social presence, performance does seem to influence the level of cooperative social presence experienced [Wang, 2013], a forecast born out by the study in this chapter. In the study by Wang [2013], cooperative social presence was higher for players which were in the winning team, while the competitive social presence remained stable in victory and defeat. The lower cooperative social presence may have been due to the losing team members assigning blame to the team, or perhaps the team lost due to a lack of cooperation. Either way, perceived and/or actual performance of a team appears to affect the level of cooperative social presence felt by its members, while high team performance and satisfaction with one's team is seen as evidence of trust.

If we compare the concepts of cooperative social presence in the CCPIG to the concepts of team trust in the literature we can see some cross-over and some disparity. Interestingly the CCPIG also contains some elements which are similar to the variables measured in the various trust questionnaires presented above. For example Langfred [2004] compared trust with team performance and the concept of individual autonomy [Breaugh, 1989]. The concept of individual autonomy (or lack of) runs throughout the cooperative section of the CCPIG, in such items as 'My actions were determined by the objectives of the team', 'I made an effort to work with my team-mates', 'I considered my team-mates possible plans/thoughts', with low scores on these items suggesting high individual autonomy/low control reduction. The Jarvenpaa et al. [2004] questionnaire contains the cohesion item 'I feel that I am a part of the team' which is almost identical to a CCPIG item. Table 5.3 presents an alternative way of conceptualizing the overlap from a trust perspective.

Trust Antecedents		**Trust Evidence**	
Ability	✓	Communication	✓
Familiarity		Control Reduction	✓
Interaction	✓	Cooperation	✓
Propensity to Trust		Monitoring Behaviour	
Trustworthiness		Performance	
		Positive Expectations	
		Risk-taking	
		Satisfaction	✓
		Willing Vulnerability	✓

Table 5.3: Elements of trust present within the CCPIG (✓).

5.2.5 Old Rope

If we retrospectively examine the initial experiential vignettes, the issue of trust appears absent. In the Social Gaming study in Chapter 3.2 for example, there were a number of comments relating to players 'having each other's backs', a number of respondents stated that team-play increased their motivation and emotional attachment to the game, however there were very few comments which directly related to issues

Comments from the Social Gaming Study

[The team are] there for you, you're there for them. You always know someone's "got your back".

I do feel more motivated when I am part of a squad. I feel like they have my back, and I have theres. I feel like I need to prove myself, and I feel like they are going to try and prove themselves too. Overall, I play harder when I know I am being counted on, and when I am counting on others.

You have a shared responsibility to watch each others backs.

I pay closer attention to my squad mates. If I know they are watching my back, and I am able to do more, and vise versa. If we all watch each other and know each others movements, we are an effective combat force that can perform so much more than when a person 'lone wolfs' it.

When you are watching the back of the squad mate, they put a lot of trust into you, and you return that trust with a damn right effort to keep them alive.

[Team play] gives [the game] more intense feelings and emotions, because alone, it's just you but if you're in a squad, you know that there's someone covering you, or that you have someone's back. It gives a strong connection.

[In team games] there's rewards and recognition. As well knowing that someone has my back and vice-versa.

Knowing I have someone who really will watch my back, and I theirs, motivates me to become a better combat pilot.

I trust my teammates to do the right thing, given a constant stream of information from your clan mates it allows you to have a mental map of the battlefield so you know at all times what your heading into, a missed link in there, from an uncalled c4 or enemy could mean the game.

Playing with a squad of people u know fairly well in personal and skill wise manner allows for more trust as I know what my team mates can accomplish and what requests are to demanding and it also is generally more fun to play with people you know.

of trust. Statements which did seem to be conceptually speaking of trust are listed below (Table 5.2.5), but while they share a common theme, these few comments do not represent the majority of the 30,000+ words gathered for the study. In the Social Gaming study, when respondents spoke of team-based games, working towards a common team goal and the concept of camaraderie seemed to be more important that issues of trust.

In line with the Houser et al. [2006] risk/trust study, the *Tetris* study saw participants perceiving computer and human counterparts rather differently. Houser et al. [2006] found that people made trust decisions when playing a game with humans, while saw playing with a computer in terms of risk. Participants in the *Tetris* study stated that they would play differently when playing with a bot than with a human, with a general consensus being that bots cannot be 'relied upon'. While the results of the *Tetris* study were not considered in terms of trust, one can draw parallels in the 'computer counterparts as risky' perceptions within the Houser et al. [2006] study, and the perceptions of the *Tetris* participants that bots could not be relied upon.

Literature, reviewed in the introduction to the experiential vignettes, discussed the conceptual differences players have between having human and computer controlled team-mates. However while the literature suggested that people have a greater sense of engagement [Weibel et al., 2008], physiological arousal[Lima and Reeves, 2010], and notice risk taking and reciprocate [Merritt et al., 2011, Merrit, 2012] when playing with humans, there was no mention of trust. Merrit [2012] states that participants in their study felt that computer controlled team-mates needed more help than human team-mates "because human team-mate can more easily adapt to the situation", and that participants also "felt obligated to reciprocate for protective [behaviour] of their human team-mate"(social exchange relationship), but while these issues are undoubtedly social, they are not necessarily issues of trust.

In addition to the literature, trust did not feature in the participant feedback for the *UT* ambiguity study, nor did it in any of the respondent feedback for the CCPIG development. This may lead one to question why there appears to be some conceptual crossover between the CCPIG and the core elements of team trust. As we can safely assume most people play games as a source of enjoyment, the concept of such a serious notion as trust may not be at the forefront of a players mind when responding to questions about their leisure activity. Alternatively it may be that trust is not one of the core elements of team-based gaming. If so this might be due to the inherently transient nature of players in team-based online games. While many players cooperate and compete with clan-members and friends, outside of organised clan matches online game servers are populated with gamers from around the world. With thousands of gamers playing concurrently across hundreds of servers, when one joins a server to play a typical team-based online game, it is likely one will be teaming up with strangers. Over the course of a gaming session players will join and leave, meaning that one might be playing with certain strangers for minutes or hours, perhaps the players encounter each other on the same server for years, or never see each other again. Players change their handles, move from game to game, and so on. All this means that in online gaming, even establishing early trust in team-mates might be an unreasonable expectation for 'pub play'.

5.3 The Study

5.3.1 Aims & Expectations

The conceptual cross over between social presence and team trust is interesting yet in need of clarification. Is the crossover simply a coincidence due to a shared focus on cooperation, are the concepts the same in some regard, or are social presence and team trust separate concepts, occurring within the same situation, but conceptually distinct? As there are a number of core elements of team trust, to understand the interplay between team trust and social presence both concepts must be measured in relevant team-based gaming environments. A variety of games were chosen for this study to compare not only the core concepts of trust and social presence, but establish what effect contextual gameplay elements and the games themselves have on the experience. It may be that some games contain elements which promote trust while others suppress it, indeed there results of the study show a great variety in the level of team trust from game to game.

This study aimed to gather user experience data which would be used to examine the interplay between trust and social presence across a variety of game scenarios. This study will measure various elements of trust such as outlined in the literature such as familiarity and performance as variables.

Trust and Cooperative Social Presence:

To establish if conceptual crossover between team trust and cooperative social presence was more than simply coincidence or semantics, the levels of these concepts experienced by gamers in team-based games was be measured. This data was used to establish any correlation between the two scales. It was expected that due to the conceptual crossover the levels of trust and cooperative social presence would correlate.

Performance:

The team trust literature suggested that high trust leads to high performance, and the Wang [2013] study suggested that performance affects cooperative social presence. However more evidence was needed to confirm the findings of the Wang [2013] study, which had a small sample size. This study measured performance by asking players if their team won or lost, and compared the team trust and cooperative social presence scores of the winning and losing participants. The expectation based on the Wang [2013] study was that high performance would lead to high cooperative social presence but would not affect competitive social presence. As performance is claimed to be evidence of trust, these two concepts were expected to correlate.

Familiarity:

The trust literature argued that familiarity affects early trust in teams, while data from the development of the CCPIG suggested that familiarity may lead to higher social presence. The relation between familiarity, trust, and social presence in games needed to be explored for this relationship to be clarified. It was expected that high degree of familiarity would lead to higher levels of trust and cooperative social presence.

Trust and Danger/Challenge:

The MMO literature suggested danger/challenge in games is a trust builder, but does this carry across to team-based games? To explore this question the interplay between between perceived overall challenge, competitive social presence (of which challenge is a factor) and team-mate trust was explored. It was expected from arguments made in literature that the level of danger/challenge would correlate with the team trust scores.

Monitoring Behaviour in Games:

While the trust literature states that monitoring team-members is evidence of a lack of trust, social presence literature would suggest this activity would increase social presence. By comparing the amount of monitoring behaviour to the level of trust it was be possible to establish whether it could be considered evidence of a lack of trust in the context of team-mates games. As this study was dealing with gaming, it was expected that monitoring behaviour would correlate with social presence.

5.3.2 Procedure

The data for this study was gathered using the online community survey methodology. The online questionnaire was designed and lightly customised for each game community asked to participate in this study. Once the online questionnaire had been constructed the calls for participants were posted on the community forums, and before posting permission from the forum moderators was gained. The calls offered respondents a chance to win Steam games (worth around £20) by entering an optional random prize draw when submitting their data. Based on previous experience it was expected that a the call for participants would gain a response rate of one respondent per ten thread views, and so to encourage thread views links to the calls were posted on reddit. The online questionnaire was generally left active for seven days, after which the prize draw was conducted, winners contacted and results announced on the forums. The data was then compiled, coded, and factor analysis was conducted using and SPSS. The remaining statistical analysis was conducted using R.

Measures

In this study the following concepts were measured:

- Social Presence
- Trust
- Familiarity
- Performance
- Monitoring Behaviour
- Game Information

Familiarity, performance, monitoring behaviour and game information are all simple concepts which were measured relatively easily using self reported information, while social presence was of course be measured using the CCPIG. A full list of the questionnaire items can be found in Appendix 7.3. Game information, such as the game, game-mode, and team role a participant was playing, is information which was gathered throughout the development of the CCPIG and so forms part of the standard introduction section of any online CCPIG.

Familiarity was rated by respondents by checking relevant options in the following question:

How familiar were you with the other players?
Please show who you were sharing the server with by choosing any number of the following:
☐ Real-Life Friends
☐ Online Friends
☐ Clan-mates
☐ Acquaintance (server regulars)
☐ Strangers

These options were then converted to numerical values from 1-5, with 'Real-Life Friends' having a value of 5, 'Strangers' of 1, and so on. From these values it was possible to establish the minimum, maximum and mean levels of familiarity that a respondent had with the other players in their game. For example if a respondent stated they were playing with 'Clan-mates' and 'Strangers' their maximum familiarity score would be 3, their minimum would be 1, and their mean familiarity would be 2. An alternative familiarity measure could have been the four item familiarity scale found in the [Webber, 2008] trust questionnaire, however the items in this scale were work-place centric, with little relevance to online gaming scenarios. For this reason and to keep the number of total items to a minimum the simple check-box measure was used. While this is a rather crude scale the item has high face validity and the resulting numbers give a good impression of who the player was sharing a virtual environment with.

Performance was measured with both numerical and binary measures. Performance was established using simple explicit questions, asking participants game specific performance questions (e.g. did your team win/lose?), and about how they would rate their team's overall performance. Monitoring behaviour too was measured using straight-forward questions, where relevant, asking participants how much they checked the scores of their team-mates throughout the gaming session. While the Cummings and Bromiley [1996] monitoring measure from the Langfred [2004] questionnaire could have been used, the four item scale seemed a unnecessarily repetitive, with items such as 'We watch to make sure everyone in the team meets their deadlines', rather irrelevant to gaming. In most team-based games there are a number of ways to monitor the activity of one's team, checking a map of the game environment, using in-game communication, etc. However these methods are not available in all games, thus the core measure for monitoring behaviour this study will be checking the player score board, a monitoring action available in most games.

Information about the game the respondents were playing was also gathered. This information included their team size, their role, class or equipment in the game (if relevant), and whether they were playing in a public (pub) or organized setting. In this study 'pub play' is defined as any gaming session which took part on a server which is open to the public and which a player joined without specifically pre-planning. The alternative to pub play in this study is organized play (org) which consists of various types gaming sessions, for example data categorized as organized play in this study includes play in passworded servers, clan matches, clan practise sessions, participation in regular or pre-scheduled community events, and so on. This information was gathered based on previous user feedback from the CCPIG development studies (see Appendix 7.2.13) in which users argued that organized and pub pay were very different experiences.

Measuring the complex concept of team trust needed a little more contemplation. While popular in its original and adapted forms the McAllister [1995] questionnaire was far too long to be used in combination with the CCPIG. The Webber [2008] is short, contains a section on monitoring, and contains a familiarity section which is similar to the measure of friends vs strangers vs clan-mates which was a feature of the CCPIG introduction items throughout the development. However the citizenship and reliability sections are too similar to CCPIG items regarding cooperative behaviour and team-mate value. While similarities between trust questionnaires and the CCPIG may be expected due to "cooperation [being] among the most proximal behavioral manifestations of trust"[Rousseau et al., 1998], the development of the CCPIG has shown that it is important to reduce repetition in questionnaires to avoid participant frustration. Similarly the Jarvenpaa et al. [1998] and Costa [2010] questionnaires cover all the core concepts of trust in teams but are again too long to accompany the CCPIG in full.

Much of the questionnaires documented in the literature review are constructed from combinations of novel items, adapted items, and established measures. While the Costa [2010] questionnaire is the closest in required content it was, as stated, too lengthy to include with the CCPIG. The Costa [2010] contains an adaptation of a well established Cummings and Bromiley [1996] measure of organizational trust, which was also too long to accompany the CCPIG, at 62 items [Vidotto et al., 2008]. It would have been possible to do as previous team trust studies had, to take sections of other questionnaires, adapt them to be more relevant to the research domain, and use them to measure the concept of trust. However as sections from validated measures are cherry-picked and adapted, it becomes increasingly difficult to establish if they are still valid and have not drifted conceptually from their original focus. For example, the Langfred [2004] questionnaire contained a four-item scale based on the Simons and Peterson [2000] trust scale, however the two seem to bare little resemblance. The Simons and Peterson [2000] scale contained five-items (Cronbach's α of 0.89 in the original study) with a very narrow focus on interpersonal trust between executives, while the Langfred [2004] items simply refer to trust (Table 5.4).

Langfred [2004] Items	Simons and Peterson [2000] Items
We trust each other a lot in my team	We absolutely respect each other's competence
I know I can count on the other team members	Every executive present shows absolute integrity
The other team members know they can count on me	We expect the complete truth from each other
I trust all of the other team members	We are all certain that we can fully trust each other
	We count on each other to fully live up to our word

Table 5.4: Comparison of Trust Items

However despite the unrelated appearance the Langfred [2004] version achieved a Cronbach's α of 0.83 in their study, suggesting the scale remained internally consistent, perhaps due to the similarity of the items and the fact that all but one item contains the word trust. The early trust section within the Jarvenpaa et al. [2004] questionnaire is similar in that it too was taken from another source ([Schoorman et al., 1996]) yet achieved reasonably high Cronbach's α scores (0.77 & 0.80) when user in a different context. These two scales were concise enough to be used with the CCPIG without over-inflating the overall number of items. Table 5.5 shows a comparison of the Langfred [2004] adapted Simons and Peterson [2000] scale and the Jarvenpaa et al. [2004] adapted [Schoorman et al., 1996] scale. Both scales have their strengths and weaknesses, the Langfred [2004] items are simple but rather general, where as the Jarvenpaa et al. [2004] items are more task oriented but would need to be more heavily adapted for use in games. For example item three is largely the same as item one, yet with a focus on monitoring behaviour, as discussed, while monitoring behaviour is seen as evidence of a lack of trust in workplace teams, it is unclear if this concept carries across to gaming.

Langfred [2004] Items	Jarvenpaa et al. [2004] Items
We trust each other a lot in my team	I feel comfortable depending on my team members for the completion of the project
I know I can count on the other team members	I feel that I will not be able to count on my team members to help me
The other team members know they can count on me	I am comfortable letting other team members take responsibility for tasks which are critical to the project, even when I cannot monitor them
I trust all of the other team members	I feel that I can trust my team members completely

Table 5.5: Comparison of the Trust Scales

Once the scales were adapted for use in a gaming context (Table 5.6) it was decided that the Langfred [2004] items would be used due to their simplicity, face validity, and concise nature. This decision was supported with the feedback from a number of gamers and colleagues.

Contextualized Langfred [2004] Items	Contextualized Jarvenpaa et al. [2004] Items
I felt the team trusted each other a lot	I felt comfortable depending on my team members for the completion of team goals
I knew I could count on the other team members	I knew I could count on the other team members to help me (reversed)
I felt the other team members could count on me	I was comfortable letting other team members take responsibility for critical tasks in game
I trusted the other team members	I feel that I could trust my team members completely

Table 5.6: Scales Contextualized for Gaming

Statistical Criteria

This study aimed to investigate the interplay between various concepts, primarily social presence, trust and contextual variables. This investigation was achieved by establishing correlations between scales, and exploring the statistical significance and effect size of differences between variables. As the data set is so large and varied that the effect size of any differences was considered as a counterpoint to significance, as significance was likely to appear from small differences in such a large data set [McCluskey and Lalkhen, 2007]. The statistical significance of any conditions, such as winning and losing, on concepts such as social presence were measured with a T-test, with a $P < 0.05$ being considered significant. While many T-tests are documented throughout this study effect size was used as the focus of analysis and so over-testing should not be a concern. To measure effect size Cohen's D was used, with a score of 0.2-0.5 considered as a small effect size, 0.5-0.8 as medium, and 0.8 or more considered a large effect size[Cohen, 1992].

Establishing the Cronbach's α of sub-scales was used to ascertain the internal reliability of each sub-scale, and establishing the measures of sampling adequacy (MSA) and Kaiser-Meyer-Olkin (KMO) scores was used to determine sampling adequacy. These statistics indicate the degree to which the items as a whole provide a consistent statistical structure. KMO and Cronbach α scores of over 0.6 are desirable indicators of statistically reliable items (Table 5.3.2)[Kline, 1999, Everitt, 1993, Nakazawa, 2007].

Cronbach's α	Internal Consistency
< 0.9	Excellent
0.9 - 0.8	Good
0.8 - 0.7	Acceptable
0.7 - 0.6	Questionable
0.6 - 0.5	Poor
$0.5 >$	Unacceptable

Correlations between the concepts measured by each sub-scale were tested to reveal any potential interplay, a "correlation coefficient is an index of agreement between two sets of scores 1 is perfect, 0 is no agreement, and -1 complete disagreement" Kline [1998]. In this study correlation scores of 0.3 - 0.5 being considered weak correlations, while correlations scores over 0.5 were considered strong. While a correlation of 0.3 may not usually be considered weak these distinctions are meaningful within the context of this study as correlations range from non-existent to extremely high (over 0.8), and so these distinctions help to create a more fine-grained analysis of the data, especially when comparing individual game data sets. Correlations of course do not imply causation but the strong correlations seen throughout these results are perhaps indicative of underlying common mechanisms. Throughout the study such mechanisms are hypothesised about, though acknowledging that in all cases they would need to be investigated more rigorously through more controlled studies.

To make the results more readable scores of note in tables are colour coded, with weak-medium scores being coloured blue, and strong in green, for example correlations of over 0.3 will be blue, over 0.5 will be green, Cohen's D's over 0.3 will be blue, over 0.7 will be green, and so on. The R codes used for the statistical methods can be found in Appendix 7.3.

Game Communities

Respondents were be gathered from a variety of game communities which centred around team-based online games. Some game communities were chosen as they were involved in previous studies and provided valuable feedback, others were chosen due to their player base or because they offered a novel team-based experience. Calls for participants were posted on community forums, and links to that post were also submitted to the relevant sub-Reddits.

Arma

The call for participants from the *Arma* community was posted on the general section of the *Arma 3* forum[1]. While most of the communities focus on one game, communities such as the *Arma* forums cater to all the *Arma* games in the series. The call for participants on the *Arma* community was posted in the *Arma 3* forum, and it was requested that people play *Arma 3* before responding to the questionnaire. However responses based on *Arma 2* were not discounted as both games provide very similar experiences/core game mechanics, with *Arma 3* providing upgrades to fidelity aspects such as graphics, physics, animations and sounds. *Arma 3* was released in 2013, while *Arma 2* was released in 2009. 75% of respondents based their answers on *Arma 3*, however for simplicity sake the data collected from the this community will simply be refereed to as *Arma* throughout this study. *Arma* is a modern military FPS game which shares its engine with military training simulators. It is described as a 'military sandbox', providing a large virtual environment (290 km) in which players can design their own scenarios, or play pre-made missions. *Arma* can be played player versus player (PvP), player versus computer controlled enemies (cooperative only), or in 'Zeus' in which players cooperate in a scenario controlled by a human games master. *Arma* is a combined arms game, with players having access to ground, air and sea vehicles, and realistic weapons and equipment. *Arma* aims to be close to simulation, and as such a player's character moves realistically and is very vulnerable to damage and bleeding, with only a few bullets being enough to kill a character. The *Arma* series of games shares many elements with the *Virtual Battle Space* series of military simulation software and is based upon the same game engines.

Chivalry: Medieval Warfare

The call for participants for the *Chivalry: Medieval Warfare* (*Chivalry*) was posted on the general sections of the Torn Banner forums [2]. Released in 2012, *Chivalry* is a first person melee game, in a fictional medieval setting. There are a number of game modes but the respondents to this study predominantly played team death-match, and team objective modes. In team objective mode there are a series of objectives that one team must accomplish while the other team defends. Players can chose from a variety of weapons and from one of four classes classes, a highly armoured and powerful Knight, a Vanguard which favours Polearms and Greatswords, a lightly armoured but very swift Man-at-arms, and an Archer. While *Chivalry* is somewhat 'arcady' in that players can take a significant amount of damage before dying, the combat system is highly skill based, easy to learn and difficult to master. In *Chivalry* the majority of the combat is at close quarters, and map and team sizes are comparable to many other contemporary team-based FPS games.

Counter Strike: Global Offensive

Counter Strike: Global Offensive (*CS:GO*) was released in 2012 and is an objective-based team-based first-person shooter. The gameplay style of *CS:GO* is prototypical of online FPS games, in which players having a high degree of mobility and cross-hairs on screen to denote their aim. The key mechanics of the primary game mode in *CS:GO* are that players have only one life and re-spawn when the next game round begins, players can purchase new weapons each round and gain money based in their performance, and

[1] forums.bistudio.com

[2] forums.tornbanner.com

rounds are over when either one team are all dead or an objective is complete. These mechanics lead to rapid bursts of gameplay, with those dying early in a round having to sit and watch the other players until the round is complete. The *Counter Strike* series has been around since 1999 and has a strong competitive scene. Team sizes in *CS:GO* are generally 5 players and map sizes are fairly small with multiple choke points to ensure player contact. The call for participants for the *CS:GO* community was posted on the Steam *CS:GO* forum[3].

Dota 2

Dota 2 (*Dota*) is a multiplayer online battle arena (MOBA), a real-time strategy (RTS) style team-based game. In *Dota* two teams of five players select 'Hero' characters, and work together the destroy their opponent's base. *Dota* has both PvP and PvE elements, with computer controlled towers and units ('creeps'), which populate the three paths ('lanes') which lead from one team base to the other. *Dota 2* is free to play (f2p) and like most RTS games *Dota* is played from a top-down perspective. *Dota 2* was released in 2013 and the call for participants was posted on the Play Dota forums[4].

Mount & Blade

The call for participants for the *Mount & Blade* (*MnB*) community was posted on the *Mount & Blade: Warband* section of the series forums[5]. There are a number of *Mount & Blade* games which offer online team-based multiplayer game modes, however *Warband* is by far the most populous. *Mount & Blade* was released in 2010 and focuses on melee based combat. It is predominantly played in a third person perspective, but first person perspective is used for ranged based weapons. Players can chose from three main character classes (Archer, Cavalry, and Infantry) and can select various weaponry and armour. *Mount & Blade* has game modes which include castle sieges and pitched battles for upto 250 players.

Natural Selection 2

Natural Selection 2 (*NS2*) is an asymmetrical team-based FPS/RTS hybrid, in which two teams (predominantly melee based Aliens and ranged based Marines) aim to destroy their opponent's base. Each team has a commander who views the virtual environment from a top down RTS perspective and directs their team. Teams not only fight one another, but build and defend their infrastructure. *NS2* was released in 2012 and like *Chivalry* has comparable map and team sizes to many other contemporary team-based FPS games. The call for participants for the *NS2* community was posted on the general section of the Unknown Worlds forum[6].

War Thunder

War Thunder (*WT*) is primarily an aircraft based team-based combat game. Players can chose planes from pre-World War II to Korean War time periods. Virtual environments in this game are large, with maps from 65 km x 65 km to 200 km x 200 km square, and servers can generally host up to 32 players. The call for participants was posted on the Arcade section of the *War Thunder* forums[7]. *War Thunder* has three different gameplay types, Arcade, Realism, and Simulation. Arcade mode is a simplified and accessible air combat experience, the player's plane can be viewed from a third person perspective and there is various

[3] forums.steampowered.com
[4] playdota.com/forums
[5] forums.taleworlds.com
[6] forums.unknownworlds.com
[7] forum.warthunder.com

HUD information to aid players in combat. Realism mode has more realism physics, damage and control mechanics, ammunition must be reloaded at airfields, and there are less HUD aids for players. Simulator mode is a the next step from Realism mode, it limits players to first person (cockpit) view of the world, contains realistic physics, requires a joystick, and essentially presents its self as a combat flight simulator. Arcade was chosen for this study as this game is free to play, and Arcade most is the most accessible mode, it was assumed that there would be a large player base in Arcade mode.

29th I.D. Clan

The *29th I.D.* clan is a realism based gaming clan which predominantly plays the World War II era combined arms game *Darkest Hour: Europe '44-'45*, released in 2008. The data gathered from this community is referred to as *29th I.D.* rather than *Darkest Hour* as the data represents the idiosyncratic gameplay of the clan servers and matches rather than a general *Darkest Hour* experience. It was chosen for this study to offer a different gaming context to the other gaming communities and because the community had contributed to previous studies. The call for participants was posted on the *29th I.D.* clan forums[8].

5.4 Results

The following section documents the data analysis of the data gathered from the online community survey conducted for this study. The strategy of analysis was to first establish if measures used in the study were working as expected. This was achieved by conducting principal component and module analysis on the on data, the results of which established the factors that existed in the data, their internal consistency, and sampling adequacy. Following this the statistical analysis focusing on the variables was conducted in tow rounds of analysis. First the whole dataset was analysed to establish the interplay between team trust and cooperative social presence, and the effects of contextual gameplay elements on user experience. In this analysis there was no differentiation between data from the various game communities and the analysis produced a set of general insights into team-based gaming from the one large dataset. The second stage of the analysis was a comparative analysis between the data from the various game communities, exploring the differences in the interplay between the variables of the study from game to game. Following these stages are summaries of the interplay between the variables, for example the effect of performance on social presence, and so on. As each game community dataset contained unique patterns in the statistical results, a summary of from each dataset is also given. Finally following the suggestions from a study of community feedback (see Appendix 7.2.13) the statistical differences between public and organized gameplay is analysed. However first we begin with an overview of the collected data.

5.4.1 The Data

The study gained a total of 821 respondents, excluding erroneous data entries such as flatlines, excessive missing data, etc. Table 5.7 shows the number of respondents across the various game communities approached to take part in this study.

[8]29th.org/forums

Community Forum	Respondents
Mount & Blade	238
War Thunder	169
Dota 2	91
Chivalry	78
Natural Selection 2	78
Arma	77
CS:GO	47
29th ID	43
Total	821

Table 5.7: Respondent numbers

Table 5.8 shows the demographic information of the respondents, while Figure 5.1 shows the range of ages in each game community data set. While gender and age were not being considered as meaningful variables in this study, it is interesting to see the demographic information and get a picture of the population who took part in the study.

Community Forum	Average Age (sd)	Male/Female
Mount & Blade	20 (4.1)	236/2
War Thunder	24 (7.9)	165/2
Dota 2	20 (4.0)	85/6
Chivalry	23 (6.3)	76/1
Natural Selection 2	24 (5.3)	74/4
Arma	24 (7.4)	77/0
CS:GO	22 (4.7)	44/1
29th I.D.	21 (5.1)	43/0
Total	22 (6.0)	98% Male

Table 5.8: Respondent demographic information across games, age (standard deviation), and ratio of male to female respondents. (NA answers excluded)

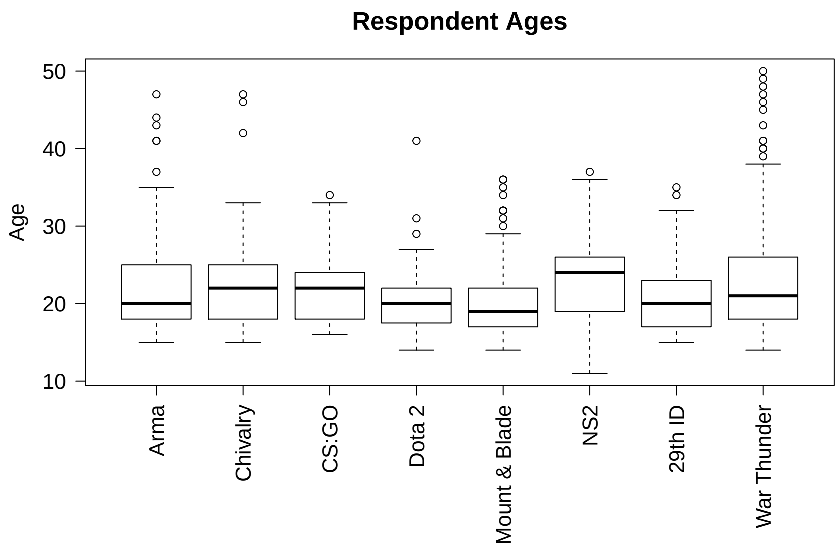

Figure 5.1: Ages of respondents by game

Table 5.9 shows information about the context of play across the various game communities, including average team sizes and proportion of respondents basing their experiences of public (pub) play rather than any sort of organized game. Table 5.9 shows that most game experience in this study is based upon public play, with only the *Arma* community and the *29th I.D.* clan basing their experiences on predominantly organised play.

Community Forum	Average Team Size	Percentage Pub Play
29th ID	32	32.6%
Mount & Blade	22	74.9%
Arma	16	41.6%
Chivalry	11	84.8%
War Thunder	10	95.2%
Natural Selection 2	9	92.3%
CS:GO	5	91.5%
Dota 2	5	94.6%
All Data	14	79.5%

Table 5.9: Context of Play, (NA answers excluded)

Table 5.10 shows the number of respondents in relation to the number of views the call for participants forum thread received, in addition to the daily peak players of each game around which the communities were based (not including *Chivalry* and *29th I.D.* due to missing forum view data). The results shows that on average for every eight people that viewed a forum thread, one person proceeded to take part in the survey. This is close to the one in ten of previous studies, with the increase likely due to the offer of the game prize draw.

Community Forum	Respondents	Thread Views	Response/View Rate	Peak Players
Mount & Blade	239	2427	1/10	8000
War Thunder	169	884	1/5.2	9000
Dota 2	92	717	1/7.8	600,000
Arma 3	78	702	1/9	21,000
Natural Selection 2	78	534	1/6.8	1000
CS:GO	47	357	1/7.6	110,000
Total	703	5621	1/8	

Table 5.10: Responses and Thread Views of all community forums. Peak daily Player counts are rounded down to the nearest thousand, are based upon numbers from the Steam statistics site (store.steampowered.com/stats/) from March 2014. *Chivalry* and *29th I.D.* not included due to missing forum view data.

5.4.2 Factor Analysis

Principal component analysis was conducted on the data set to explore if the sub-scales were measuring factors as expected. Conducting factor analysis on a validated questionnaire is advocated by Kline [2014] when using multiple scales. In addition, the large data-set provided an opportunity to re-evaluate the structure of the questionnaire following the inconclusive results of the cooperative module in the previous Chapter. The factor analysis was conducted following Kline [2000] with the oblique rotation method, direct oblimin. The scales used in this study were the CCPIG and the Langfred [2004] trust scale. The CCPIG contains competitive and cooperative sections which aim to measure separate (but related) concepts, and thus the items in these sections are expected to load onto distinct factors. The competitive section contains two modules which were also expected to be separate factors, and a cooperative section which previous analysis had established as one large factor. It was expected the the trust scale would measure a fourth factor. While the factor analysis confirmed the competitive/cooperative split, and the separate competitive modules (Table 5.11), the cooperative and trust modules did not split as expected. In the following tables showing the results of the PCA, loadings of over 0.4 are considered noteworthy and are highlighted in blue to denote factor loadings.

Scales	Item	Comp. 1	Comp. 2	Comp. 3	Comp. 4
Comp 1	Iactedwithmyopponentsinmind	.130	.401	.525	.077
	Ireactedtomyopponentsactions	.111	.274	.644	.118
	Iknewwhatmyopponentsweretryingtoachieve	.027	.220	.477	-.014
	Iwasawarethatmyopponentsmightworkoutmygoals	.093	.480	.267	.086
	TheactionsofmyopponentsaffectedthewayIplayed	.077	.504	.439	.182
	IfeltIaffectedmyopponentsactions	.218	.351	.585	.030
Comp 2	Myopponentswerechallenging	.239	.687	-.177	.092
	Thegamewasabattleofwits	.333	.551	.285	.171
	Thegamewasabattleofskill	.354	.437	.338	.024
	Ifelttensewhileplayingmyopponents	.078	.604	-.012	.111
	Myopponentscreatedasenseofurgency	.134	.698	.020	.136
	Thepresenceofmyopponentsmotivatedme	.158	.588	.222	.192
	Myopponentsplayedasignificantroleinmyexperienceoftheg	.116	.624	.255	.132
	Itseemedasthoughmyopponentswereactingwithawarenessofm	.262	.614	.175	.077
Coop	Iwasawareofmyteam	.389	.155	.342	.502
	Iactedwithmyteam-matesinmind	.482	.169	.232	.744
	Iconsideredmyteam-matespossibleplansthoughts	.381	.079	.182	.701
	IfeltlikeIwaspartofateam	.821	.245	.194	.544
	Ifeltasocialconnectiontomyteammatescamaraderie	.757	.199	.175	.562
	Ifeltmyteammateswerelookingoutforme	.771	.081	.175	.512
	IfeltIcontributedtotheteam	.251	-.082	.712	.321
	Ifelttheteamhelpedme	.817	.204	.096	.432
	Ifeltmyactionsmadeadifferencetomyteam-mates	.389	-.017	.643	.395
	Theactionsofmyteammatesaffectedmythoughtsandactions	.372	.124	.235	.652
	Myteam-matesplayedasignificantroleinmyexperienceofthe	.497	.240	.040	.622
	Myteamcommunicatedwell	.754	.032	.092	.504
	Theteamhadamutualunderstanding	.803	.101	.182	.474
	Iputtheperformanceoftheteamovermypersonalperformance	.480	.055	-.082	.657
	Myactionsweredeterminedbytheobjectivesoftheteam	.406	.093	.307	.550
	Iwantedmyteamtovalueme	.361	.257	.117	.570
	Beingpartofateammotivatedme	.659	.305	.062	.619
	Ifeltresponsibleforachievingtheobjectivesoftheteam	.214	.116	.415	.496
	IdidnotwantmyteamtothinkIhadletthemdown	.383	.118	-.017	.588
	Ifeltmyteamwascommittedtoworkingtogether	.823	.066	.180	.530
	Imadeanefforttoworkwithmyteam-mates	.548	.129	.120	.715
	Ifeltmyteamsharedacommonoverallaim	.679	.165	.271	.310
	Ifeltmyteamsharedcommonshorttermgoals	.650	.189	.195	.320
	Itwasasmuchabouttheteamasaboutmyowngame	.523	.142	.030	.704
	Myteam-mateswereuseful	.817	.166	.059	.399
Trust	Ifelttheotherteammemberscouldcountonme	.284	-.103	.611	.435
	Itrustedtheotherteammembers	.835	.138	-.020	.470
	IknewIcouldcountontheotherteammembers	.863	.156	.084	.501
	Ifelttheteamtrustedeachotheralot	.859	.123	.106	.473

Table 5.11: PCA of all scales, 4 factor split, over 0.4 highlighted

When testing only the CCPIG data (Table 5.12), there is a clear split between the cooperative and competitive sections, showing that the questionnaire is broadly measuring the factors as it should.

Item	Comp. 1	Comp. 2	Comp. 3
Iactedwithmyopponentsinmind	.124	.373	.545
Ireactedtomyopponentsactions	.131	.237	.655
Iknewwhatmyopponentsweretryingtoachieve	.006	.190	.505
Iwasawarethatmyopponentsmightworkoutmygoals	.115	.453	.330
TheactionsofmyopponentsaffectedthewayIplayed	.143	.457	.510
IfeltIaffectedmyopponentsactions	.179	.321	.586
Myopponentswerechallenging	.204	.704	-.144
Thegamewasabattleofwits	.304	.556	.300
Thegamewasabattleofskill	.275	.435	.312
Ifelttensewhileplayingmyopponents	.102	.617	.031
Myopponentscreatedasenseofurgency	.151	.715	.051
Thepresenceofmyopponentsmotivatedme	.187	.584	.246
Myopponentsplayedasignificantroleinmyexperienceoftheg	.139	.613	.295
Itseemedasthoughmyopponentswereactingwithawarenessofm	.226	.616	.200
Iwasawareofmyteam	.502	.135	.389
Iactedwithmyteam-matesinmind	.670	.157	.302
Iconsideredmyteam-mates-possibleplansthoughts	.578	.058	.257
IfeltlikeIwaspartofateam	.810	.256	.217
Ifeltasocialconnectiontomyteam-matescamaraderie	.770	.206	.197
Ifeltmyteam-mateswerelookingoutforme	.759	.097	.179
IfeltIcontributedtotheteam	.329	-.110	.689
Ifelttheteamhelpedme	.764	.221	.107
Ifeltmyactionsmadeadifferencetomyteam-mates	.460	-.040	.638
Theactionsofmyteam-matesaffectedmythoughtsandactions	.555	.102	.301
Myteam-matesplayedasignificantroleinmyexperienceofthe	.625	.233	.104
Myteamcommunicatedwell	.746	.046	.102
Theteamhadamutualunderstanding	.766	.115	.188
Iputtheperformanceoftheteamovermypersonalperformance	.627	.056	-.008
Myactionsweredeterminedbytheobjectivesoftheteam	.536	.091	.337
Iwantedmyteamtovalueme	.510	.256	.129
Beingpartofateammotivatedme	.738	.318	.107
Ifeltresponsibleforachievingtheobjectivesoftheteam	.372	.099	.452
IdidnotwantmyteamtothinkIhadletthemdown	.537	.135	-.015
Ifeltmyteamwascommittedtoworkingtogether	.804	.084	.183
Imadeanefforttoworkwithmyteam-mates	.701	.127	.191
Ifeltmyteamsharedacommonoverallaim	.626	.166	.257
Ifeltmyteamsharedcommonshorttermgoals	.608	.192	.177
Itwasasmuchabouttheteamasaboutmyowngame	.685	.142	.107
Myteam-mateswereuseful	.740	.186	.052

Table 5.12: PCA of CCPIG, over 0.4 highlighted

When taken on its own, the competitive section splits clearly into its respective modules (Table 5.13).

Item	Comp. 1	Comp. 2
Iactedwithmyopponentsinmind	.293	.675
Ireactedtomyopponentsactions	.167	.701
Iknewwhatmyopponentsweretryingtoachieve	.077	.573
Iwasawarethatmyopponentsmightworkoutmygoals	.404	.439
TheactionsofmyopponentsaffectedthewayIplayed	.385	.623
IfeltIaffectedmyopponentsactions	.276	.646
Myopponentswerechallenging	.741	.026
Thegamewasabattleofwits	.544	.411
Thegamewasabattleofskill	.435	.400
Ifelttensewhileplayingmyopponents	.632	.138
Myopponentscreatedasenseofurgency	.743	.187
Thepresenceofmyopponentsmotivatedme	.579	.307
Myopponentsplayedasignificantroleinmyexperienceoftheg	.608	.354
Itseemedasthoughmyopponentswereactingwithawarenessofm	.637	.311

Table 5.13: PCA of CCPIG competitive modules, over 0.4 highlighted

Table 5.11 shows that the cooperative section contained a high degree of cross-loading, suggesting it was measuring one single factor as in previous studies. However if we take a more pragmatic approach we can see that the majority of cross-loading items load far more strongly on one of the two factors (Table 5.14). The following table highlights loadings greater than 0.6, rather than 0.4.

Item	Coop. 1	Coop. 2
Iwasawareofmyteam	.472	.531
Iactedwithmyteammatesinmind	.595	.676
Iconsideredmyteammatespossibleplansthoughts	.495	.612
IfeltlikeIwaspartofateam	.835	.493
Ifeltasocialconnectiontomyteam-matescamaraderie	.774	.503
Ifeltmyteammateswerelookingoutforme	.769	.472
IfeltIcontributedtotheteam	.230	.630
Ifelttheteamhelpedme	.822	.344
Ifeltmyactionsmadeadifferencetomyteam-mates	.364	.673
Theactionsofmyteammatesaffectedmythoughtsandactions	.479	.613
Myteammatesplayedasignificantroleinmyexperienceofthe	.596	.483
Myteamcommunicatedwell	.770	.400
Theteamhadamutualunderstanding	.804	.421
Iputtheperformanceoftheteamovermypersonalperformance	.577	.486
Myactionsweredeterminedbytheobjectivesoftheteam	.447	.612
Iwantedmyteamtovalueme	.428	.515
Beingpartofateammotivatedme	.730	.505
Ifeltresponsibleforachievingtheobjectivesoftheteam	.238	.649
IdidnotwantmyteamtothinkIhadletthemdown	.474	.479
Ifeltmyteamwascommittedtoworkingtogether	.823	.459
Imadeanefforttoworkwithmyteam-mates	.635	.621
Ifeltmyteamsharedacommonoverallaim	.674	.342
Ifeltmyteamsharedcommonshorttermgoals	.670	.315
Itwasasmuchabouttheteamasaboutmyowngame	.626	.574
Myteammateswereuseful	.820	.302

Table 5.14: PCA of CCPIG cooperative section, over 0.6 highlighted

These strongly loading items can be split into two distinct modules with coherent themes. Items in the first cooperative factor, which we shall call Module 2.1, predominately refer to the cohesion and effectiveness of the team, while items in the second factor (Module 2.2) refer to the interplay and involvement between the player and the team. In broad terms Module 2.1 appears to be measuring perceived team cohesion, while Module 2.2 seems to be measuring the player's involvement or investment in the team.

Cooperative Module 2.1 Perceived Team Cohesion	Cooperative Module 2.2 Team Involvement
I felt like I was part of a team	I was aware of my team
I felt a social connection to my team-mates/camaraderie team-mates/camaraderie	I acted with my team-mates in mind
I felt my team-mates were looking out for me	I considered my team-mates possible plans/thoughts
I felt the team helped me	I felt I contributed to the team
My team-mates played a significant role in my game experience	I felt my actions made a difference to my team-mates
My team communicated well	The actions of my team-mates affected my thoughts and actions
The team had a mutual understanding	My actions were determined by the objectives of the team
I put the performance of the team over my personal performance	I wanted my team to value me
Being part of a team motivated me	I felt responsible for achieving the objectives of the team
I felt my team was committed to working together	I made an effort to work with my team-mates
My team-mates were useful	I did not want my team to think I had let them down had let them down
I felt my team shared a common overall aim	
I felt my team shared common short term goals	
It was as much about the team as about my own game	

Table 5.15: Cooperative Social Presence Items split in to Modules 2.1 & 2.2

When a PCA was performed on the data from both the cooperative social presence and team trust measures (Table 5.16), the two scales appeared to be measuring a single factor. The results show a large amount of cross loading across the cooperative scale, and that the majority of the team trust scale strongly loaded onto the first factor. The preliminary factor analysis of all the scales (Table 5.11) suggested that team trust and cooperative social presence shared common factors, while Table 5.16 confirmed there is no clear split between the two scales. While it was expected that there was some conceptual crossover between team trust and cooperative social presence the results of the PCA suggest a strong conceptual link between the two scales.

Item	Comp. 1	Comp. 2
Iwasawareofmyteam	.477	.500
Iactedwithmyteam-matesinmind	.610	.619
Iconsideredmyteam-mates-possibleplansthoughts	.514	.548
IfeltlikeIwaspartofateam	.837	.449
Ifeltasocialconnectiontomyteam-matescamaraderie	.783	.455
Ifeltmyteam-mateswerelookingoutforme	.776	.440
IfeltIcontributedtotheteam	.240	.705
Ifelttheteamhelpedme	.809	.301
Ifeltmyactionsmadeadifferencetomyteam-mates	.375	.715
Theactionsofmyteam-matesaffectedmythoughtsandactions	.489	.567
Myteam-matesplayedasignificantroleinmyexperienceofthe	.607	.398
Myteamcommunicatedwell	.767	.363
Theteamhadamutualunderstanding	.799	.394
Iputtheperformanceoftheteamovermypersonalperformance	.591	.394
Myactionsweredeterminedbytheobjectivesoftheteam	.459	.602
Iwantedmyteamtovalueme	.435	.489
Beingpartofateammotivatedme	.729	.437
Ifeltresponsibleforachievingtheobjectivesoftheteam	.265	.646
IdidnotwantmyteamtothinkIhadletthemdown	.472	.455
Ifeltmyteamwascommittedtoworkingtogether	.822	.430
Imadeanefforttoworkwithmyteam-mates	.651	.548
Ifeltmyteamsharedacommonoverallaim	.643	.356
Ifeltmyteamsharedcommonshorttermgoals	.639	.327
Itwasasmuchabouttheteamasaboutmyowngame	.634	.488
Myteam-mateswereuseful	.811	.270
Ifelttheotherteammemberscouldcountonme	.316	.728
Itrustedtheotherteammembers	.844	.256
IknewIcouldcountontheotherteammembers	.859	.341
Ifelttheteamtrustedeachotheralot	.844	.338

Table 5.16: PCA, over 0.4 highlighted

5.4.3 Module Analysis

The main scales used in this study were the Langfred [2004] four item trust scale, and the CCPIG, consisting of a two factor competitive social presence section and newly established two factor cooperative social presence section. The following statistics show that each scale had good KMO and Cronbach α scores. The only scale which failed to achieve a strong Cronbach's α was the competitive Module 1.1, however as a whole the competitive section had strong internal consistency. Therefore, the data seems to suggest that the reliability of the scales was adequate, and the factor analysis showed that the CCPIG was broadly working as expected.

To summarize the scales/modules used in the data analysis:

Competitive & Cooperative Presence in Gaming (CCPIG) Questionnaire

Section 1: Competitive Social Presence - This section of the CCPIG measures the level of social presence a respondent felt towards their opponent.

Module 1.1: Awareness - Measures how aware a respondent was of their opponent.

Module 1.2: Engagement - Measures how challenging and engaging a respondent felt their

opponents were.

Section 2: Cooperative Social Presence - Section 2 measures the level of social presence a respondent

felt towards their team-mates.

Module 2.1: Cohesion - Measures a how cohesive and effective a respondent felt their team was.

Module 2.2: Involvement - Measures how involved and invested a respondent felt they were in

their team.

Trust - The Langfred [2004] scale measures the level of trust a players perceived existed in their team.

A full list of items can be found in the Appendix.

Cronbach's α for the '**Competitive**' data-set

Items: 14

Sample units: 821

α: 0.807

KMO: 0.855

Cronbach's α for the '**Competitive 1.1 Awareness Module**' data-set

Items: 6

Sample units: 821

α: 0.675

KMO: 0.767

Cronbach's α for the '**Competitive 1.2 Engagement Module**' data-set

Items: 8

Sample units: 821

α: 0.773

KMO: 0.841

Cronbach's α for the '**Cooperative**' data-set

Items: 25

Sample units: 821

α: 0.942

KMO: 0.952

Cronbach's α for the '**Cooperative 2.1 Cohesion Module**' data-set

Items: 14

Sample units: 821

α: 0.935

KMO: 0.951

Cronbach's α for the '**Cooperative 2.2 Involvement Module**' data-set

Items: 11

Sample units: 821

α: 0.841

KMO: 0.856

Cronbach's α for the '**Trust**' data-set

Items: 4

Sample units: 821

α: 0.813

KMO: 0.766

5.4.4 Data Analysis: Complete Data

This section documents the analysis of the data from all game communities, treating it as one large data set. This data gives an overview of game experience from across a number of games without differentiating between them, but instead focusing on the key dependent variables such as team trust, social presence, familiarity, etc.

Trust and Cooperative Social Presence

The expectation of this study was that, due to the conceptual crossover between social presence and trust, levels of trust and social presence should correlate. It was also expected that trust would specifically correlate with high communication scores in the CCPIG, due to open communication being cited as evidence of trust. The scatter plot of the sums of each respondent's team trust and cooperative social presence scores clearly shows a strong correlation, and a correlation score of 0.85 between the two scales confirms this. Therefore, due to the linear correlation between team trust and cooperative social presence it would seem that there is a strong positive relationship between the two concepts.

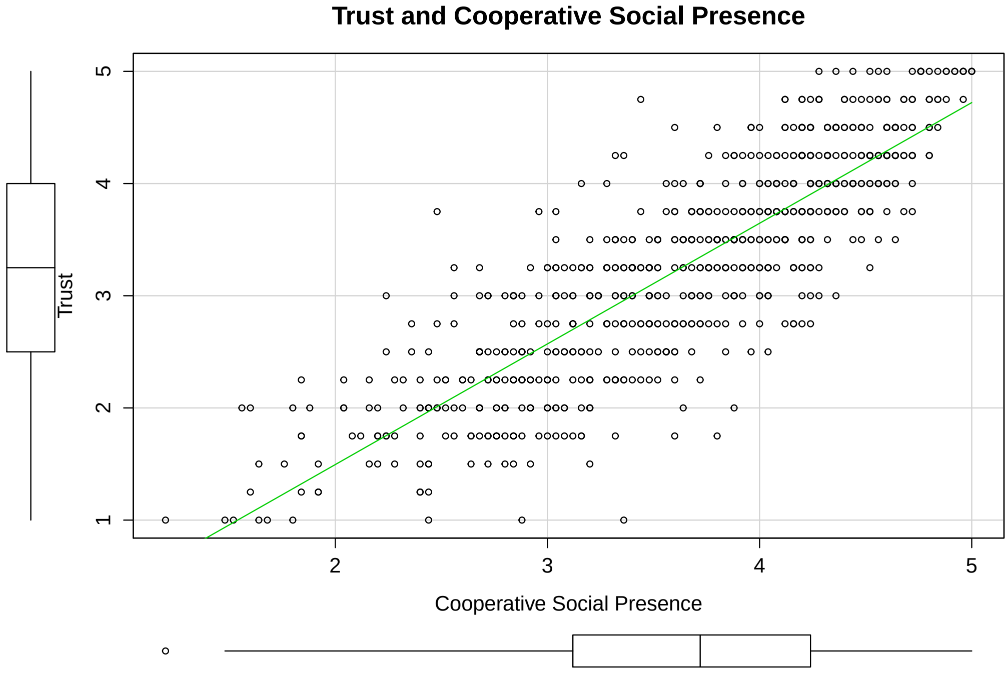

Figure 5.2: Trust and Cooperative Social Presence

Interestingly the two cooperative modules which emerged from the factor analysis correlate differently with the trust scale, Module 2.1 (cohesion) having a correlation score of 0.88, and Module 2.2 (involvement) scoring 0.65. While both these scores suggest a high degree of correlation between trust and cooperative social presence, it would seem that perceiving a team as a cohesive unit is more strongly linked to the concept of trust than one's level of involvement in that team. This echoes model of trust in virtual teams as presented by Jarvenpaa et al. [2004], who argue that the concepts of team trust and team cohesion have a positive relationship.

Performance: Winning, Losing and Perceptions of Performance

The expectation based on the Wang [2013] study was that high performance would lead to high cooperative social presence, but would have little effect on competitive social presence. To first get a picture of how players perceive winning and losing in terms of performance, the 'Team Performance' rating was compared between players that won or lost their games.

Welch Two Sample t-test: **Perceived Team Performance Win/Loss**
$t = -15.5076$, $df = 280.46$, p-value $= < 0.001$
Cohen's $D = 1.444$

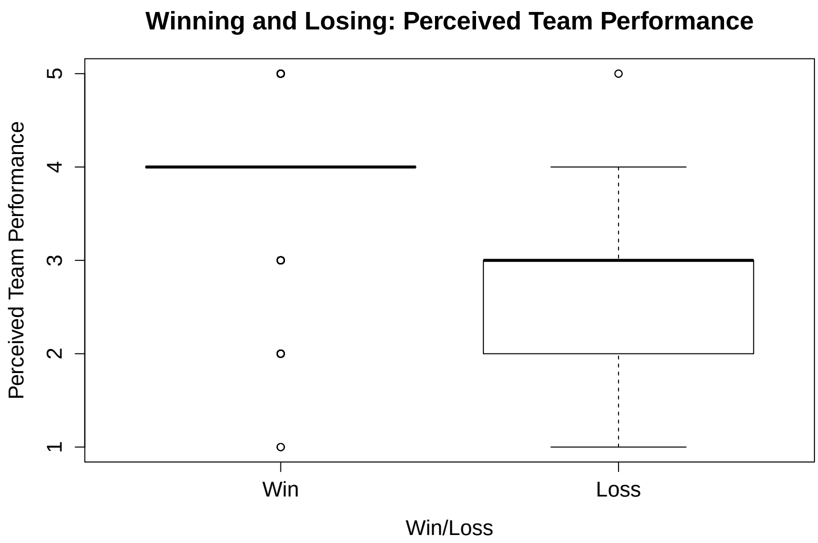

Figure 5.3: Effects of winning and losing on Team Performance scores

While it is probably unsurprising that respondents rated their team's performance as higher when they won, if we are using a team win/loss as a key variable it is insightful to find a significant difference in perceived performance between winning and losing. It is also interesting to note the consistency of the winning team performance scores, being primarily rated at 4. Rather incredible considering the number of participants and variety of game communities.

Performance & Social Presence

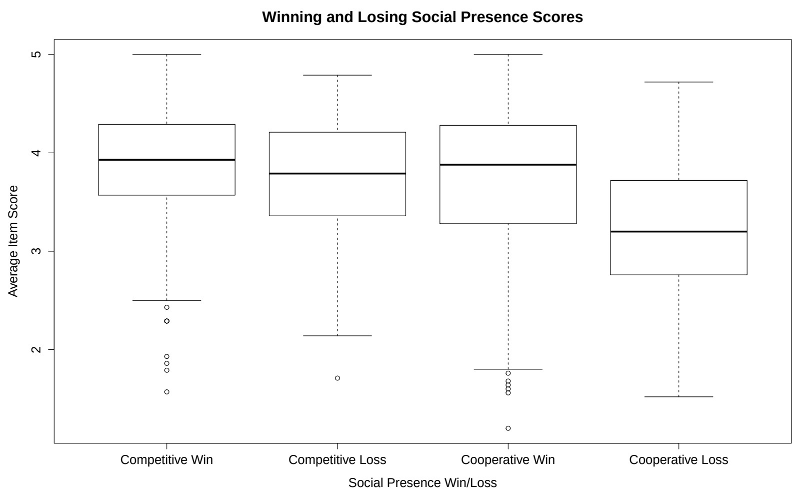

Figure 5.4: Effects of winning and losing on social presence

As predicted whether respondents experienced a win or a loss significantly affected their reported level of cooperative social presence. Against expectations winning and losing also appeared to affect competitive social presence, however the Cohen's D and T-test results show that this effect is far less substantial than in cooperative social presence. The Cohen's D scores show the difference in effect size between competitive and cooperative social presence, and Figure 5.4 clearly shows this difference in the effect of performance.

Welch Two Sample t-test: **Competitive Social Presence Win/Loss**

t = -2.4805, df = 302.23, p-value = 0.014

Cohen's D = 0.219

Welch Two Sample t-test: **Cooperative Social Presence Win/Loss**

t = -7.5513, df = 314.579, p-value = < 0.001

Cohen's D = 0.656

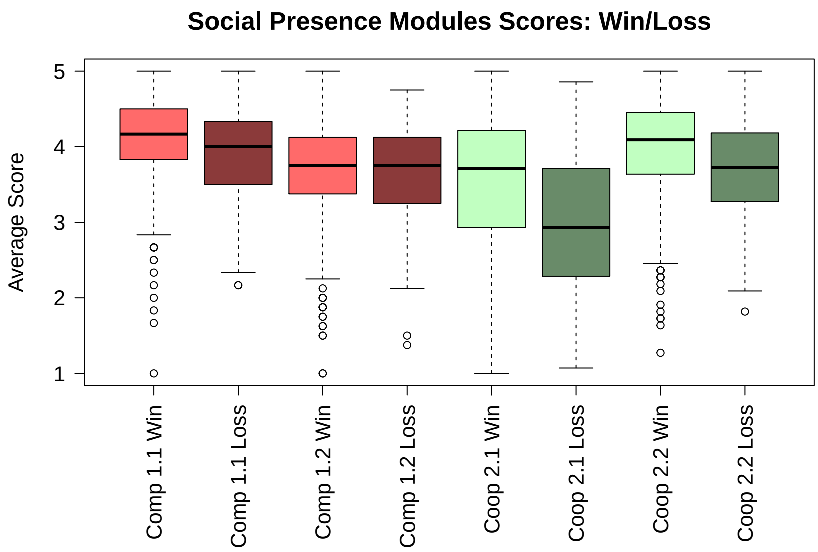

Figure 5.5: Effects of winning and losing on CCPIG module scores

Figure 5.5 shows how winning and losing affected the various social presence modules of the CCPIG, the competitive Modules 1.1 (awareness of one's opponent) & 1.2 (engagement with one's opponent), and cooperative Modules 2.1 (perceived team cohesion) & 2.2 (involvement).

The box plot suggests that performance has little effect on Module 1.2, but has a small effect of Module 1.1. While Module 1.2 shows no significant difference in user scores, Module 1.1 is highly significant, also while the Cohen's D is negligible in Module 1.2, Module 1.1 shows a moderate effect size. A reduced awareness of an opposing team when losing may seem counter-intuitive, after-all in team-based games we lose because the other team has won, their actions have caused our loss. Thus one may expect players to be more aware of their opponent during a loss. However, if we view the results from another perspective, it may be that those players with a greater awareness of their opponents helped them contribute to their teams and led to the victory. Alternatively it may be that losing caused a feeling of reduced Theory of Mind, as respondents felt the could not simulate the minds of their opponents or had little effect on the actions and plans of the opposing team, or perhaps a feeling of helplessness as they failed to affect their opponents. The game and game type may also have an effect on the extent to which performance effects competitive social presence, which will be explored in more detail later in the analysis.

The box plot (Figure 5.5) suggests that cooperative modules are also affected to different extents by team performance, with Module 2.1 being affected far more than Module 2.2, something which the effect sizes (Cohen's D) below confirm. These results show that perceived team cohesion is affected by performance far more than a player's sense of involvement in their team.

Welch Two Sample t-test: **Module 1.1 Competitive Awareness Win/Loss**

$t = -4.1077$, $df = 292.45$, p-value $= < 0.001$
Cohen's $D = 0.372$

Welch Two Sample t-test: **Module 1.2 Competitive Engagement Win/Loss**

$t = -0.8045$, $df = 326.384$, p-value $= 0.422$
Cohen's $D = 0.068$

Welch Two Sample t-test: **Module 2.1 Cooperative Cohesion Win/Loss**

$t = -7.5694$, $df = 301.437$, p-value $= < 0.001$
Cohen's $D = 0.669$

Welch Two Sample t-test: **Module 2.2 Cooperative Involvement Win/Loss**

$t = -5.7072$, $df = 326.308$, p-value $= < 0.001$
Cohen's $D = 0.380$

Performance & Trust

As the team trust literature suggested that performance could be considered as evidence of team trust, it was expected that performance and trust would correlate. The correlation score between perceived team performance and trust was a fairly substantial 0.53, which suggests the two concepts are linked. If we consider winning and losing as our main variables, Figure 5.6 shows a clear difference in trust scores between the two conditions, which a T-test proves to be significant, with a substantial effect size. These results show a significant interplay between team trust and performance.

Welch Two Sample t-test: **Trust Win/Loss**

$t = -8.7524$, $df = 321.042$, p-value $= < 0.001$

Cohen's $D = 0.750$

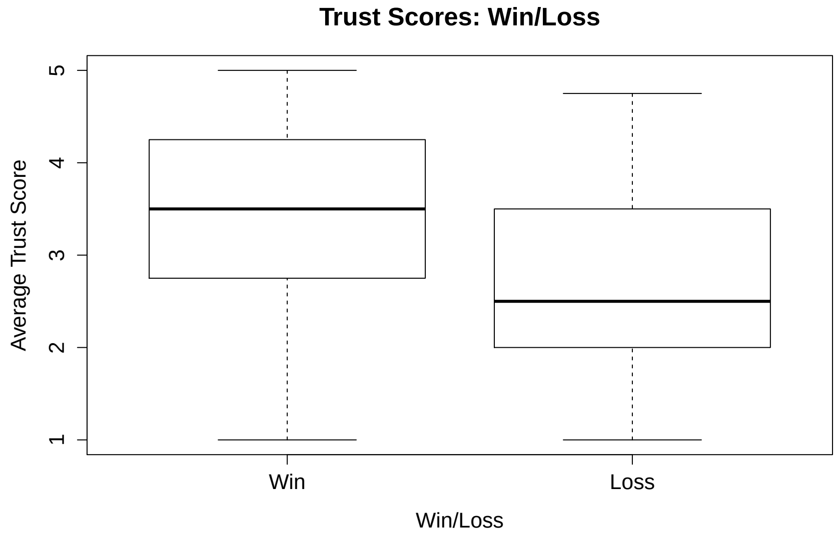

Figure 5.6: Effects of winning and losing on trust

Familiarity

Familiarity was rated by respondents by checking the Real-Life Friends, Online Friends, Clan-mates, Acquaintance (server regulars) and/or Strangers options of the familiarity questionnaire item. These options were then converted to numerical values from 1-5, with 'Real-Life Friends' having a value of 5, 'Strangers' of 1, and so on. From these values it was possible to establish the minimum, maximum and mean levels of familiarity that a respondent had with the other players in their game. For example if a respondent stated they were playing with 'Clan-mates' and 'Strangers' their maximum familiarity score would be 3, their minimum would be 1, and their mean familiarity would be 2. For the purposes of the analysis the mean familiarity value will be used. As the correlations with other concepts are much the same as the maximum and minimum values (Table 5.17), thus the mean familiarity scores provide a adequate numerical value with which use in the analysis of the data.

	Maximum Familiarity	Mean Familiarity	Minimum Familiarity
Competitive SP	0.090	0.080	0.039
Cooperative SP	0.362	0.404	0.335
Trust	0.373	0.444	0.406
Monitoring	0.155	0.170	0.136
Performance	0.233	0.256	0.207
Challenge	0.090	0.103	0.090

Table 5.17: Correlation scores for Max, Mean and Min Familiarity

Based on the team trust literature it was expected that a high degree of familiarity would lead to higher levels of trust. The data seems to support this expectation with a correlation of 0.44. In addition to trust and familiarity the correlation between mean familiarity and cooperative social presence was also considered. Figure 5.7 suggests that a greater level of familiarity does indeed lead to a greater level of cooperative social presence, and the two concepts have a similar correlation score (0.40) to mean familiarity and trust. In terms of the cooperative modules, Module 2.1 has a higher correlation score (0.41) than Module 2.2 (0.31), suggesting there is a greater interplay between familiarity and perceived team cohesion than with team involvement.

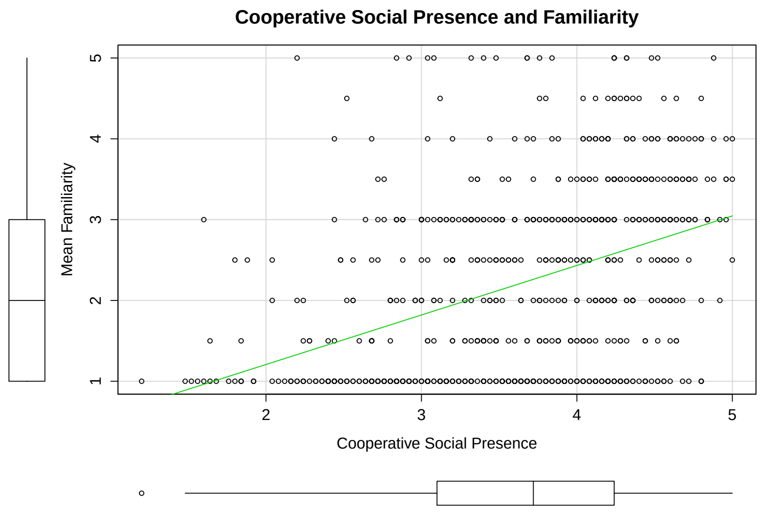

Figure 5.7: Mean Familiarity and Cooperative Social Presence

Moderate correlations seem to suggest that while familiarity does affect the experience of team-based gaming in terms of team trust and cooperative social presence, it is perhaps not an antecedent of these concepts, but merely acts as social grease, allowing these concepts to be experienced more readily. This would echo the team trust literature which argues that while over time teams made up of either strangers or familiar colleges will reach similar levels of trust, familiar team-mates trust much more quickly, with a concept known as 'early trust' being far higher in familiar teams. In the literature is it argued that familiarity in team-based games leads to higher team and personal performance[Guo et al., 2012, Mason and Clauset, 2013]. Overall in this data the difference between levels of familiarity in the winning and losing conditions was significance ($P < 0.001$) however the data showed only a low effect size of 0.350. This suggests that while there is some interplay between familiarity and performance within this data set, the interplay is small and that familiarity is perhaps a minor element of performance.

Challenge

The gaming literature suggested that danger/challenge in a game can lead to trust among players Jakobsson and Taylor [2003], Yee [2003a,b]. However this literature was based upon the player vs environment (PvE) 'raid' experiences of MMORPGs and not the team-based combat style games of this study. Figure 5.8 shows a negligible increase in trust as challenge increases, and Table 5.18 suggests very little correlation between the two concepts. It was expected that challenge would correlate with competitive social presence, as challenge is expected to heighten the engagement with one's opponents, and there is a moderate correlation between the two concepts as shown in Table 5.18. Interestingly there is a greater correlation between the concepts of trust and competitive social presence than trust and challenge, yet this correlation is still fairly weak (Table 5.18, Figure 5.9). These results might suggests that challenge has little interplay with trust, at least in this selection of team-based games taken together as one large data set.

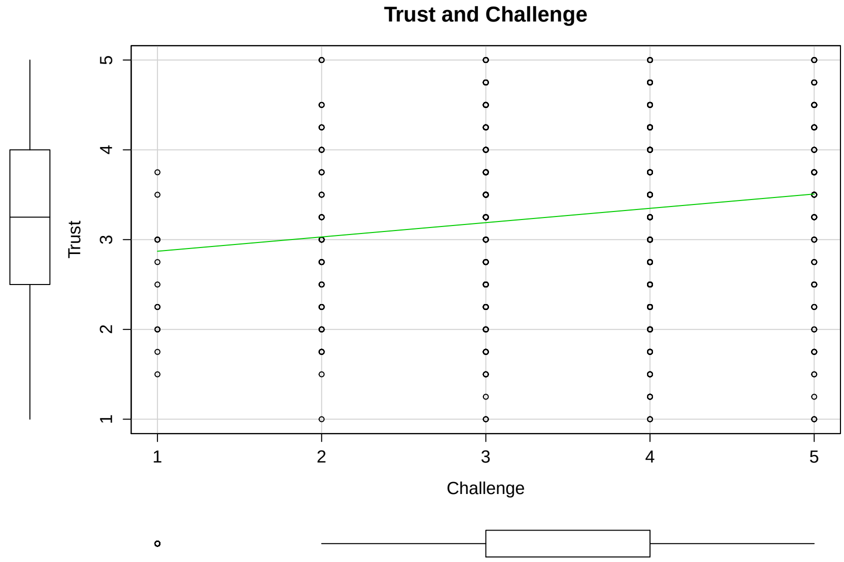

Figure 5.8: Trust and Challenge

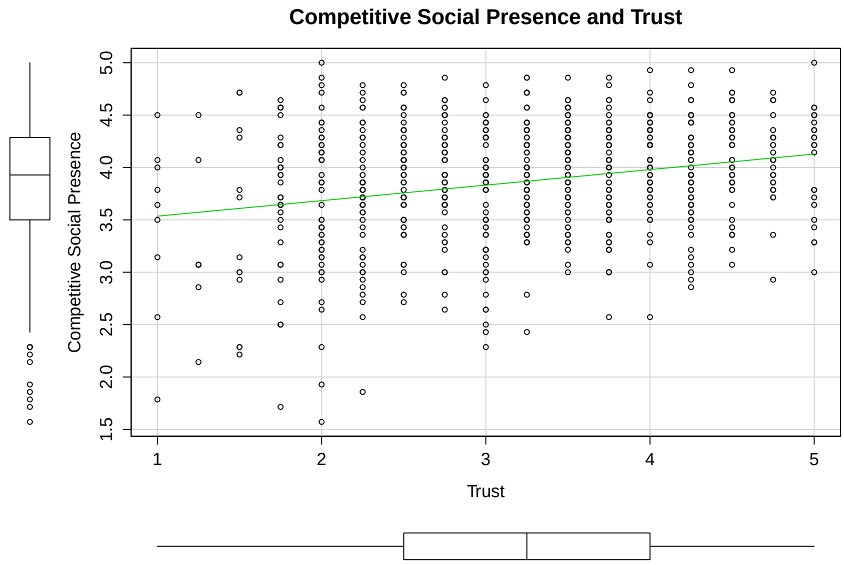

Figure 5.9: Trust and Competitive Social Presence

	Trust	Competitive SP
Challenge	0.15	0.38
Trust	-	0.25

Table 5.18: Correlations of Challenge, Trust and Competitive Social Presence

As the correlation between competitive social presence, trust and challenge was surprisingly low, the correlations between the individual competitive modules was explored. Table 5.19 shows that while competitive Module 1.1 (awareness) does not correlate with challenge, Module 1.2 (engagement) does show a Moderate correlation (0.45). Module 1.1 measures the extent to which participants feel their thoughts and actions were dependent on their opponent, and the extent to which the participants theory of mind was at play, while Module 1.2 measures how engaging the participant felt their opponent was. Thus while challenge does not seem to lead to a higher mindfulness of one's opponents, it does seem to lead to a higher sense of engagement. This seems logical given that Module 1.2 includes such items as 'The game was a battle of skill', 'My opponents created a sense of urgency', and so on.

	Module 1.1	Module 1.2
Challenge	0.12	0.45
Trust	0.17	0.25

Table 5.19: Competitive module correlations with trust and challenge

Monitoring Behaviour

While one can watch the actions of team-mates in games the most accessible way to monitor other players in team-based games in to check the score board. These often show not only a kill count for each player, but often have points systems linked to achieving team objectives, and so on. Thus one can check the scoreboard to find out who in the team has performed team-based actions and who is killing/dying the most. While the gaming literature suggested that checking the scores of other players would increase social presence, the literature on team trust suggested monitoring behaviour is a sign of distrust. The data from this study suggests that neither is the case, with monitoring behaviour correlating with no other factor measured by the questionnaire (Table 5.20). Therefore if would seem that, in terms of the one large data set, the interplay between monitoring behaviour and other concepts in team-based games is inconclusive. Monitoring behaviour appears to neither stimulate social presence nor correlate with trust levels. However the monitoring behaviour across all the games is be analysed below to investigate whether this lack of correlation is a general feature of team-based games or otherwise.

Factors	Correlation with Monitoring
Trust	0.15
Challenge	0.02
Cooperative SP	0.19
Competitive SP	0.01
Performance	0.11
Mean Familiarity	0.17

Table 5.20: Correlations various factors with Monitoring Behaviour

5.4.5 Complete Data Summary

Table 5.21 gives an overview of the correlations (or lack thereof) across all the main numerical variables of the study, weaker correlations (greater than 0.3) are denoted by blue, while stronger correlations (greater than 0.5) are donated by green.

	Cooperative	Trust	Monitoring	Familiarity	Performance	Challenge
Competitive	0.347	0.250	0.012	0.080	0.210	0.377
Cooperative	-	0.852	0.188	0.404	0.532	0.159
Trust	-	-	0.151	0.444	0.533	0.154
Monitoring	-	-	-	0.170	0.112	0.025
Familiarity	-	-	-	-	0.256	0.104
Performance	-	-	-	-	-	0.079

Table 5.21: Overall correlations between competitive & cooperative (social presence), trust, monitoring (behvaiour), mean familiarity, perceived team performance, and overall game challenge. Blue = over 0.3, Green = over 0.5

Apart from the correlations discussed below the Table shows the interesting relationship between cooperative and competitive social presence. The Table suggests that cooperative and competitive social presence are separate concepts as, while they correlate with each other, do not share any other correlations.

Trust and Cooperative Social Presence: Trust and cooperative social presence correlated strongly in the large data set, suggesting that there is a high degree of conceptual crossover between team trust and cooperative social presence as expected. Module 2.1, perceived team cohesion, correlated with a score of 0.85, while Module 2.2, team involvement, showed a score of 0.65.

Performance: In this study performance was measured in two simple ways, a binary measure of whether a respondent's team won or lost, and a Likert scale item measuring the participant's perceptions of their team's level performance. The expectation based on the Wang [2013] study was that performance would affect cooperative social presence but would not affect competitive social presence. In the large data set cooperative social presence was indeed affected by performance, with a significant difference in the levels of cooperative social presence between winning and losing players, a substantial effect size (0.66) between the conditions. Moving from the binary measure for performance (winning/losing) to the numerical measure of perceived team performance, this concept showed a moderate correlated with cooperative social presence of 0.53 (Table 5.21). As suggested by the team trust literature, performance also correlated with trust (0.53), and showed large effect sizes between winning and losing team, with levels of trust in winning teams being significantly higher than those in losing teams.

While performance in team-based digital games clearly affects cooperative social presence and trust, the exact nature of this interplay is as yet unclear. Does winning create a high sense of cooperative social presence, or are the teams with high cooperative social presence more effective? The team trust literature suggests that performance is evidence of trust, but perhaps winning and losing change the levels of trust players feel towards their team post-game. Because the online questionnaire used in this study was a self reported retrospective measure, it is impossible to determine the exact nature of the interplay without further analysis. The more fine grained analysis of these issues below may go some way to answering this, as the data from each game is examined independently.

Trust and Familiarity: Overall it would seem that higher familiarity with players on an online game leads to higher trust, though the correlation between these two concepts is a moderate (0.44). Familiarity also correlates to a similar degree with social presence (0.40). Therefore it could be argued that familiarity with other players slightly increases the the level of trust and cooperative social presence in team-based games. As discussed, while these results suggest familiarity affects trust and social presence, the issue of familiarity is perhaps not central to the experience of these concepts, but might merely enhance or encourage them. It may also be the case that because games are a form of play, the joint social commitments which occur within them are considered with varying degrees of significance to different players. In other words, some people will take the game 'seriously' while others will not, some people will play games to share the experience with friends, or help their team to succeed, while others just want to get a high 'Kill-to-Death' ratio.

Trust and Challenge: The levels of challenge and competitive social presence did not strongly correlate with the levels of trust. Therefore it could be argued that in general challenge does not increase competitive social presence or trust in team-based digital games, however as the assertion that challenge leads to trust was made in relation to a difference genre of game (MMORPGs) it could be that the game type has an effect on interplay between these concepts, something which will be explored in the following section.

Monitoring Behaviour: The monitoring behaviour did not correlate substantially with other concepts measured in this study. The results suggest that in team-based digital games, monitoring behaviour is neither a sign of distrust, nor does it lead to heightened social presence. Monitoring behaviour in this study was measured by asking respondents how often they checked the scores of the other players. It may be that checking the scoreboard on team-based digital game is perhaps more of an ego based action, in which players are comparing their performance to others, rather than monitoring the behaviour of others.

5.4.6 Comparative Analysis: Games as Variables

The following section presents a comparative analysis of the data from each game community. While the all the responses gathered for this study create a substantial data set, we cannot ignore the fact that this data represents user experience from across 8 different game communities. While the games all share the trait of being team-based digital games, they have different game-play mechanics, themes, team sizes, communities, and so on, offering hugely disparate experiences.

Figure 5.10 shows the differences from game to game in the core measures of this study, competitive social presence, cooperative social presence, and team trust. Given the apparent differences in these core concepts there was an apparent need to explore the games as variables, to establish if the correlations and patterns which exist in the large data set hold across the games. The games in Figure 7.11 and future boxplots are arbitrarily organised by the boxplot levels of cooperative social presence for consistency.

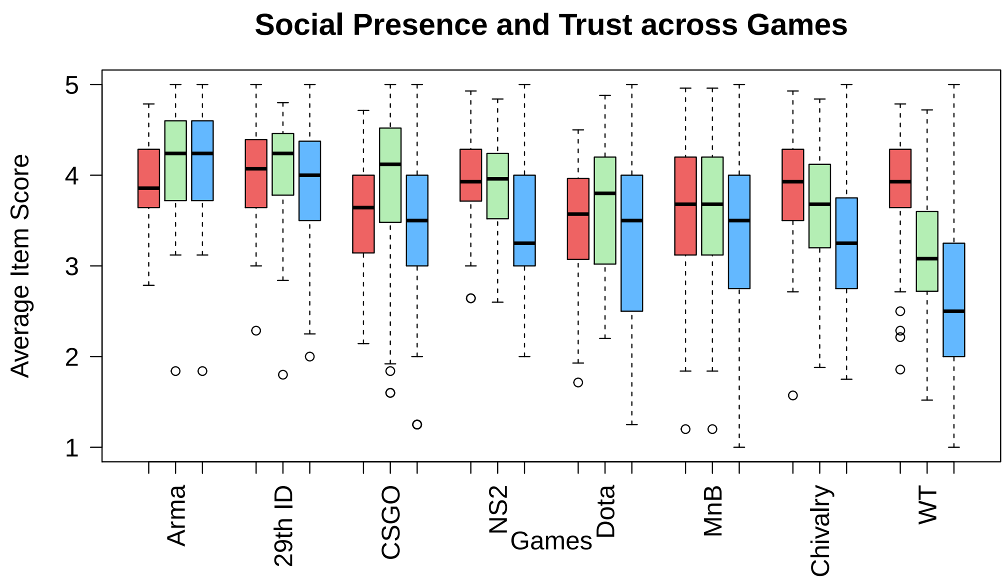

Figure 5.10: Competitive Social Presence, Cooperative Social Presence, and Trust scores across all games. Arranged in order of cooperative social presence levels.

Figure 5.11 shows the breakdown of the CCPIG modules across the games. While there is variety most games share a similar pattern. In terms of competitive social presence, Module 1.1 (awareness of one's opponents) is generally scored higher than Module 1.2 (engagement and challenge). In terms of cooperative social presence, Module 2.2 (player involvement with their team) is generally scored higher than Module 2.1 (perceived team cohesion). It is likely that high player involvement is due to the nature of the respondents in the study. Respondents were recruited from game community forums and thus we can safely assume have an interest in the game they played. The respondents were not given a game to play, but played a game they already owned and choose to play. As respondents choose to play team-based games in the first place it seems logical that respondents in this study felt involved and invested in their teams. A player's involvement in a team is dependant only on the player, however the cohesion of the team is dependant on others, and thus is perhaps subject to greater variety, or at least greater variety of interpretation.

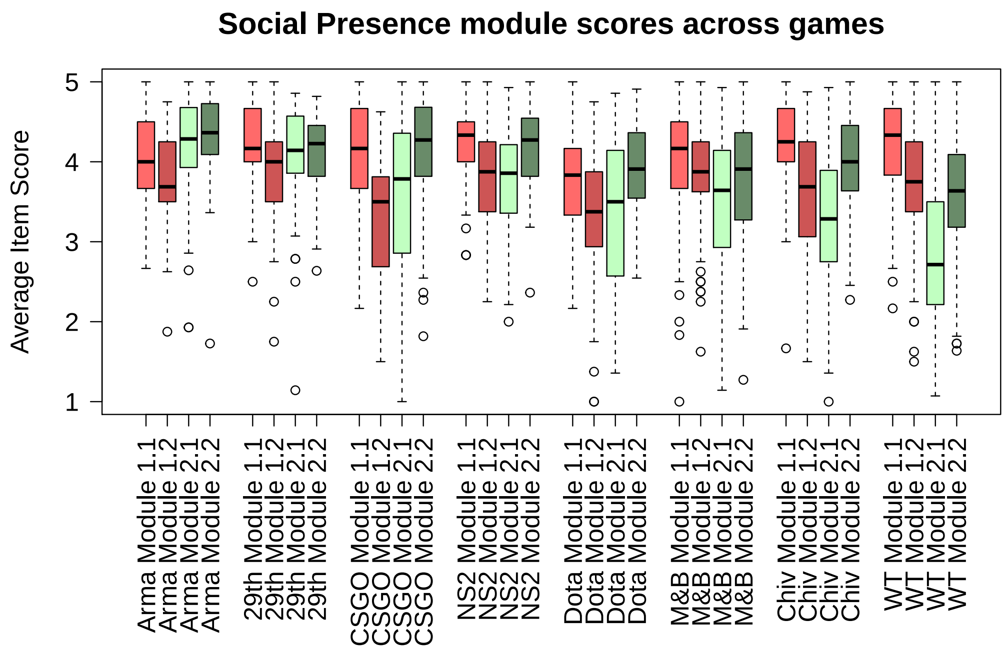

Figure 5.11: Competitive Social Presence Modules, Cooperative Social Presence Modules, scores across all games. Arranged in order of cooperative social presence levels.

Trust & Social Presence

Table 5.22 shows that while the levels of cooperative social presence and trust may vary across the games, the correlation between the two scales are consistently high. In terms of individual modules, Module 2.1 (perceived team cohesion) is fairly consistent, while the correlations between Module 2.2 (involvement) and trust vary more greatly from game to game. As with the overall data set, this confirms that team cohesion has a strong interplay with feelings of trust, and that the type of team-based game does little to affect this interplay.

	Trust & Cooperative Social Presence	Cooperative Module 2.1	Cooperative Module 2.2
All	0.85	0.88	0.65
CS:GO	0.92	0.92	0.84
Dota 2	0.89	0.89	0.70
29th ID	0.84	0.87	0.62
Chivalry	0.83	0.86	0.62
War Thunder	0.82	0.87	0.56
Arma	0.78	0.85	0.58
Mount & Blade	0.78	0.82	0.61
Natural Selection 2	0.74	0.77	0.42

Table 5.22: Correlation Trust and Cooperative Social Presence across games

Natural Selection 2 has a markedly low correlation, suggesting that a player's involvement in their team has the least affect on the level of trust. This is presumably due to the RTS elements of the game, in that a player's team is not simply a group of people who choose their level of cooperation, but is explicitly directed by a commander. It may be that in *NS2*, because players follow orders and thus have conceptually less autonomy in their action, trust in a team is based primarily on the commander. Alternatively it might be that as players are choosing to play an RTS focused FPS in which building the team's strength is part of the game, their level of involvement in their team is almost predetermined to be high, irrespective of concepts such as trust. At the other end of the scale we see that games such as *CS:GO* and *Dota 2* have above average correlation scores between the player involvement (Module 2.2) and trust.

Performance & Cooperative Social Presence

The combined data set showed that winning and losing affects the cooperative social presence a player feels towards their team. Figure 5.12 and Table 5.23 would suggest that the extent to which performance affects cooperative social presence varies greatly from game to game. In some data sets, such as *29th I.D.* and *Chivalry*, there is little difference in cooperative social presence between winning and losing. This suggests that in these games cooperative social presence is largely unrelated to the performance of the team. Other games, particularly *CS:GO* and *Dota 2*, have comparatively large differences in cooperative social presence, suggesting their cooperative experience hinges upon success or failure of the team.

CS:GO and *Dota 2* share high correlations between team trust and cooperative social presence, and large effect sizes of performance on cooperative social presence. The one thing these games have in common, setting them apart from the other games in this study, is that both have very small teams, usually of 5 players per side. This may mean that players have a more direct link to what happens in their team, and that their own involvement is perhaps more noticeable to their team-mates. The small team sizes may also make levels team cohesion more the apparent to players. As individual players make up a relatively large proportion of the team in these games, one of five rather than one of thirty of so, player involvement may become a more intimate experience, less about contributing to a 'force greater than one's self', and more about interacting and cooperating with individuals.

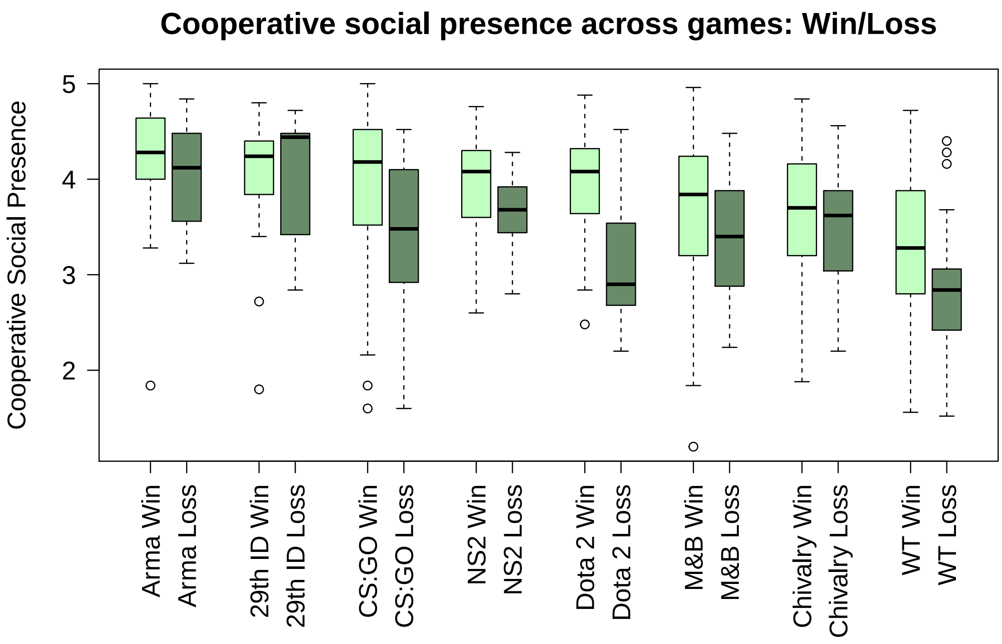

Figure 5.12: Winning Cooperative Social Presence, Losing Cooperative Social Presence

Data	T-Test P-Value	Cooperative Cohen's D
All	< 0.001	0.656
Dota 2	< 0.001	1.371
War Thunder	< 0.001	0.740
CS:GO	0.234	0.592
Natural Selection 2	0.036	0.577
Arma	0.170	0.474
Mount & Blade	0.018	0.377
Chivalry	0.535	0.223
29th I.D.	0.743	0.162

Table 5.23: Significance and effect size in cooperative social presence between winning and losing.

If we take a more fine grained view of the cooperative social presence data we can see that the cooperative modules are affected to different extents in different game (Figure 5.13 & Table 5.24).

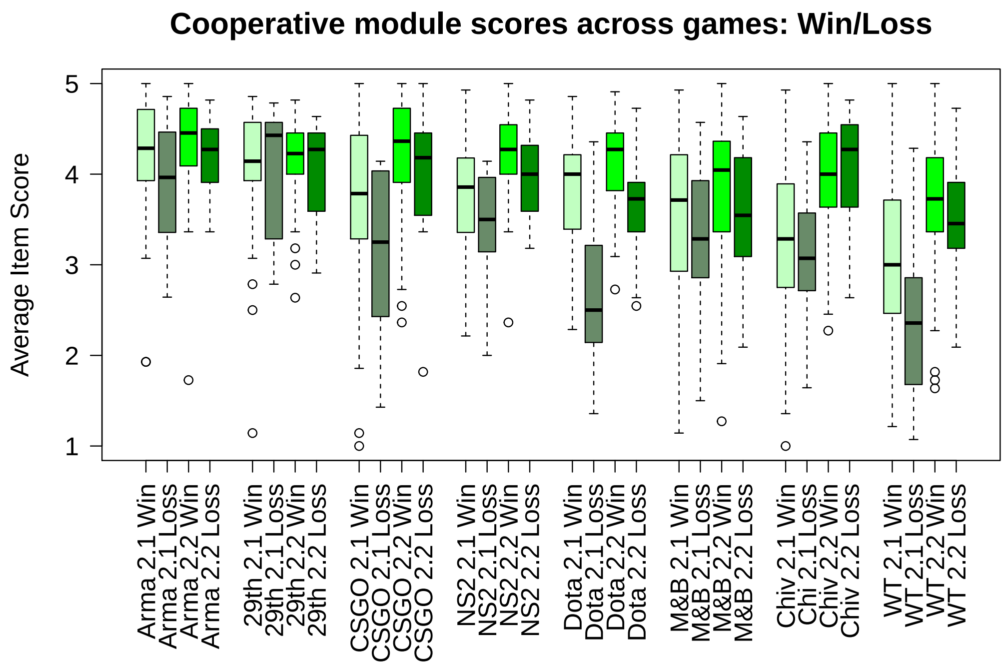

Figure 5.13: Winning Cooperative Social Presence, Losing Cooperative Social Presence

Table 5.24 shows T-Test P and Cohen's D values, carried out on the winning and losing data for each game. The T-Test results show if the difference in scores between winning and losing for each module is significant, Cohen's D shows the actual size of any difference.

When considering the data set as a whole both Module 2.1 & 2.2 have significantly different levels of cooperative social presence between winning and losing, with Module 2.1 having a far larger effect size than 2.2. This suggests that overall performance effects all aspects of cooperative social presence, but has a greater affect on Module 2.1 (percieved team cohesion), than on Module 2.2 (player involvement).

Data	T-Test Module 2.1 P-Value	T-Test Module 2.2 P-Value	Cohen's D Module 2.1	Cohen's D Module 2.2
All	< 0.001	< 0.001	0.669	0.488
Dota 2	< 0.001	< 0.001	1.501	0.875
War Thunder	< 0.001	0.027	0.875	0.369
CS:GO	0.232	0.439	0.491	0.441
Natural Selection 2	0.114	0.080	0.468	0.545
Arma	0.198	0.270	0.454	0.319
Mount & Blade	0.075	0.006	0.284	0.457
Chivalry	0.400	0.867	0.277	0.066
29th I.D.	0.786	0.576	0.121	0.279

Table 5.24: Significance and effect size in cooperative modules between winning and losing. T-Test P & Cohen's D values

In most games in this study Module 2.1 is more greatly affected by performance than Module 2.2, suggesting respondent's attributed a lack of team cohesion to their team's loss, or good teamwork to a win.

However, only *Dota 2* and *War Thunder* fully reflect the pattern of the overall data. *Dota 2* stands out as having a huge effect size in the difference between winning and losing in Module 2.1, meaning perceived team cohesion is severely affected by losing, or perhaps losing is the cause of low team cohesion and that respondents were more aware of this. Like the correlations between trust and cooperative social presence it could be argued that this gulf in perceived team cohesion is due to the small team sizes in *Dota 2*, however *CS:GO* has similar team sizes and has similar effect sizes in both cooperative modules. Thus team size cannot be the primary issue here. It may be that as *Dota 2* is a MOBA, considered a sub-genre of RTS games, strategy elements are more central to the gameplay. Thus a need for strategy from all team-members, combined with the small team sizes, could mean that in *Dota 2* any lack of cohesion is highly noticeable to players. For example, in arcade style FPS games such as *CS:GO*, while team-work helps, skilled players can often dominate a match, while in *Dota 2* it would be hard for a single player to control the whole map. The only other game which shows a large effect size on Module 2.1 is *War Thunder*, which shares very little in terms of game-play mechanics, themes, team sizes, etc. with *Dota 2*. The reason for the large effect size in this game are possibly related to the game mode in which respondents played to take part in this study. The effects of game modes in *War Thunder* and a discussion of community attitudes can be found in the games summary section.

Arma, *CS:GO*, and *Natural Selection 2* all have fairly similar effect sizes in Modules 2.1 & 2.2, suggesting that in these games, perceived team cohesion and player involvement are equally affected by performance. The *29th I.D*, *Chivalry* and *Mount & Blade* have very low effect sizes in Module 2.1, suggesting that in these game experiences perceived cohesion is not affected by performance. Table 5.24 shows that in both the *29th I.D* and *Chivalry* data cooperative social presence is not affected by performance.

Mount & Blade and *Natural Selection 2* do not follow the trend of the whole data set, and have higher effect sizes in Module 2.2, with *Mount & Blade* showing no effect of performance on Module 2.1. If a player's perceived team cohesion is not affected by performance, this would suggest that the respondents did not consider team coherence as an important factor in their team's performance. This could mean that player's regarded the skill of each individual in their team as more important than the overall level of team-work, or perhaps in the case of *NS2* players were attributing their performance to their commander over their team.

Performance & Team Trust

In line with the high correlation between trust and cooperative social presence, team trust too displays a similar pattern to cooperative social presence between winning and losing (Figure 5.14). However the effects of performance on team trust were far more consistent than cooperative social presence, for example while the *29th I.D.* and *Chivalry* data showed no effect size in cooperative social presence, performance created substantial effect sizes across all the game data sets.

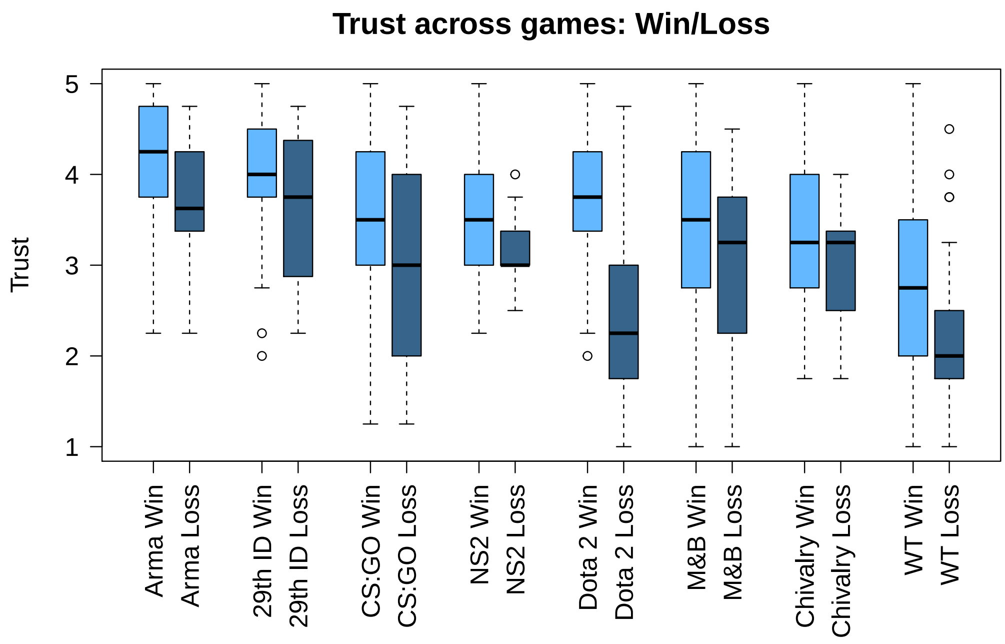

Figure 5.14: Winning and losing trust scores across games

Data	T-Test P-Value	Trust Cohen's D
All	$<$ 0.001	0.750
Dota 2	$<$ 0.001	1.552
War Thunder	$<$ 0.001	0.790
Arma	0.061	0.649
Natural Selection 2	0.040	0.519
CS:GO	0.327	0.483
Mount & Blade	0.009	0.454
29th I.D.	0.399	0.450
Chivalry	0.251	0.325

Table 5.25: Significance and effect size in trust between winning and losing.

Performance & Competitive Social Presence

The differences in competitive social presence also appear to vary from game to game. However, the variation is far less than cooperative social presence, with only *CS:GO* standing out as a game in which competitive social presence is affected by winning or losing.

Data	T-Test P-Value	Competitive Cohen's D
All	0.014	0.219
CS:GO	0.050	1.282
Arma	0.543	0.284
Natural Selection 2	0.386	0.258
Chivalry	0.482	0.244
Mount & Blade	0.249	0.185
Dota 2	0.473	0.159
War Thunder	0.730	0.058
29th I.D.	0.901	0.037

Table 5.26: Effect size in competitive social presence between winning and losing.

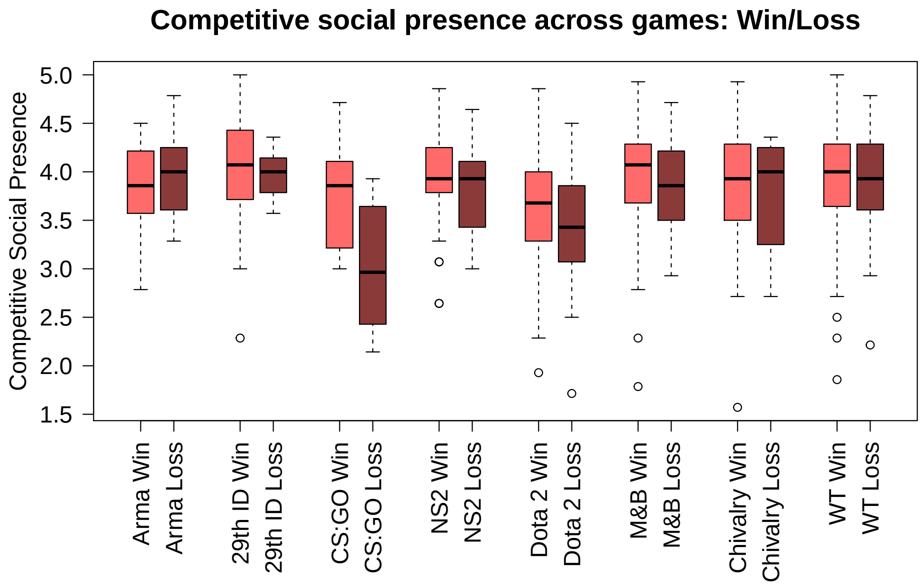

Figure 5.15: Winning Competitive Social Presence, Losing Competitive Social Presence

Figure 5.16 gives a more fine grained view of the interplay between the competitive modules and performance. The Figure suggests that while Module 1.2 (competitive engagement) remains largely static over the win/loss conditions, Module 1.1 (competitive awareness) appears to be more greatly affected. Table 5.27 confirms this, showing that with the exception of *CS:GO*, only Module 1.1 has substantial effect sizes across the games.

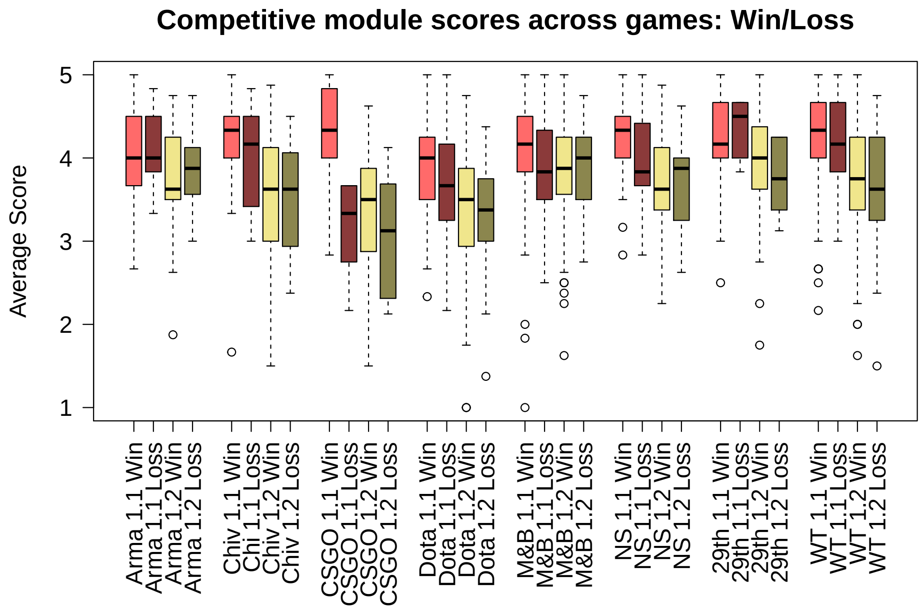

Figure 5.16: Winning Module 1.1, Losing Module 1.1, Winning Module 1.2, Losing Module 1.2

Module 1.2 measures the sense of competitive engagement a player has with their opponents, it contains items such as 'My opponents were challenging', 'I felt tense while playing my opponents', 'The presence of my opponents motivated me', 'My opponents played a significant role in my experience of the game' and so on. The fact that no game except *CS:GO* showed any change in Module 1.2 based on performance suggests that winning or losing did not alter respondent's perception of the challenge presented by their opponents, nor how much affect their opponents had on their experience of the game. It might be expected that respondents would have felt that their opponents had more of an effect on their experience having lost, however it seems that respondents were equally engaged with their opponents no matter what the outcome. This may be due to team-based digital games being a form of 'co-created media'[Morris, 2003], their experience relying as much on the other players as the game itself. In these games it might be that because one's opponents form a consistent proportion of the game experience, winning or losing is irrelevant. The consistency of Module 1.2 might also be due to other issues, in team-based digital games one can face a challenging opponent and still win, and due to the variety of personal motivation winning or losing may have little to do with how much an enemy has motivated a player, and so on.

	T-Test Module 1.1	T-Test Module 1.2	Cohen's D Module 1.1	Cohen's D Module 1.2
All	<0.001	0.422	0.372	0.068
CS:GO	0.001	0.352	1.941	0.420
Arma	0.623	0.569	0.210	0.236
Natural Selection 2	0.084	0.996	0.638	0.001
Chivalry	0.247	0.769	0.466	0.099
Mount & Blade	0.019	0.616	0.416	0.077
Dota 2	0.103	0.960	0.367	0.011
War Thunder	0.626	0.772	0.080	0.050
29th I.D.	0.349	0.647	0.303	0.155

Table 5.27: Significance and effect size in competitive modules between winning and losing. T-Test P & Cohen's D values

With the exception of *Arma* and *War Thunder*, performance affected Module 1.1. Module 1.1 measures how aware players were of the interplay between them and their opponents, it asks players about their Theory of Mind, about the extent to which they reacted to their opponents and considered their opponent's thoughts. The fact that the average losing score for this module was lower for almost all the games in this study suggests that losing leads to a reduced awareness and consideration of one's opponents, perhaps the feeling that one was unable to accurately simulate the minds of one's opponents, or possibly the feeling that one has had little noticeable effect on the opposing team.

This may be due to a sense of helplessness or loss of control from being part of an unavoidable defeat, for example if a player is part of a team being outclassed, then they may not have the time to evaluate the opponents. It may be that players on a losing team are more concerned with their team than their enemies, or perhaps being on a losing team equated to less time spent actively playing the game. Being on the losing team in team-based digital games often leads to dying more frequently, and in these games dying usually means less time playing and more time waiting to respawn, this reduced time in game may have caused respondents to consider their enemies less.

War Thunder stands out in Table 5.27 as being almost unaffected by performance in terms of competitive social presence, *Arma* also shows a very limited effect. This suggests that in these games the level of awareness players have for their opponents, and the extent to which they are engaged with them, is not affected by performance. What these games have in common is expansive virtual environments in which gameplay occurs, for example the default map of *Arma 2* is over 200 square kilometres and *War Thunder* has maps ranging from 60km x 65km to 200km x 200km in size. As this is one of the only common features of both games it may be that these large environments change the way players perceive their opponents, creating a conceptual as well as (virtual) physical distance.

CS:GO stands out in particular as being having the most striking difference between winning and losing in terms of competitive social presence. It is the only game to have a noticeable affect in Module 1.2, and has the largest effect size by a large margin of Module 1.1. The effect on Module 1.2 suggests that in *CS:GO* the losing respondents were less mindfully engaged by their opponents, they considered them to have less of an effect on their experience of the game, and perhaps that the game was less about their opponents being more tactical or strategic than them, but simply being better at the core mechanics of the game.

Familiarity

While it may seem that the cooperative social presence and team trust scales had measured the same concept in this study, the variety of familiarity correlations across games show that the two were perhaps not measuring identical concepts (Table 5.28). The team trust literature stated that high familiarity has a positive relationship with trust, and as with the overall dataset, the data from each game concurred with this assertion. While there is variation from game to game, familiarity correlates with team trust in each game, suggesting that team trust is consistently higher if respondents know their team-mates.

Data	Familiarity & Trust	Familiarity & Cooperative SP	Familiarity & Module 2.1	Familiarity & Module 2.2
All	0.44	0.40	0.41	0.31
29th ID	0.59	0.51	0.61	0.24
Arma	0.58	0.47	0.53	0.33
Chivalry	0.37	0.26	0.29	0.16
CS:GO	0.31	0.34	0.32	0.34
Dota 2	0.32	0.24	0.22	0.18
Mount & Blade	0.35	0.40	0.43	0.27
Natural Selection 2	0.40	0.28	0.27	0.19
War Thunder	0.41	0.31	0.30	0.30

Table 5.28: Correlation between Mean Familiarity and Trust/Cooperative Social Presence (Cooperative SP)

The two groups of respondents which display strong correlations between trust and familiarity are *Arma* and *29th I.D.* clan. These two groups of respondents reported the highest proportion of organized play, both over 50%, which is likely to be a factor in the these results. *Arma* and *29th I.D.* clan also have fairly high correlations between overall cooperative social presence but have interesting differences between the cooperative modules.

While *Arma* shows correlations between both Module 2.1 & 2.2 and familiarity, *29th I.D.* data only shows a correlation on Module 2.1. This suggests that while in *Arma* there is an interplay between familiarity and both perceived team cohesion and player involvement, in *29th I.D.* familiarity only affects perceived team cohesion. This difference in player experience may be due to the different communities, or the differences in gameplay. While both data sets have a similar percentage of organized play (60-70%), similar average familiarity levels (Figure 5.4.6), and both are based on games which focus on realism, their are many differences between the two in terms of theme, virtual environments, functionality, and so on.

Chivalry, *Dota 2* and *Natural Selection 2* show no strong correlation between cooperative social presence and mean familiarity, suggesting that in team-based games, though being familiar with one's team-mates always increases trust to some degree, it does not necessarily affect social presence. However it is hard to discern a common factor between these three games which might lead to these shared results. While all show fairly low average familiarity scores (Figure 5.4.6), other games with low familiarity scores such as *Mount & Blade* and *War Thunder* do not share this lack of correlation. It might be that the communities of these games share common traits or that the players of these games share similar expectations of the game experience.

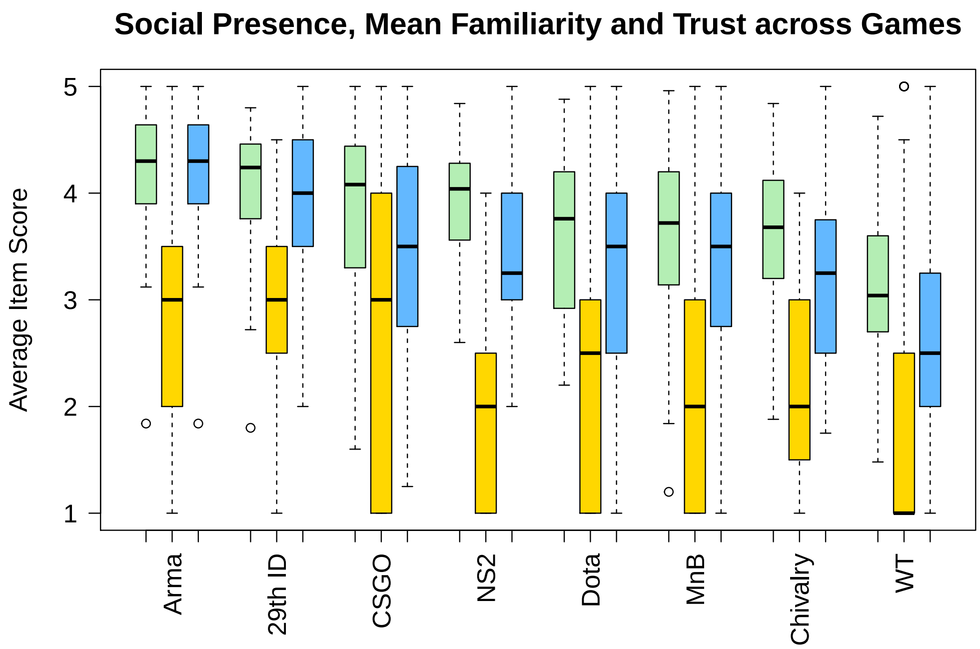

Figure 5.17: Cooperative Social Presence, Mean Familiarity, and Trust scores across all games. Arranged in order of cooperative social presence levels.

In terms of competitive social presence the only game which showed any correlation with familiarity was *Chivalry*, with overall competitive social presence scoring 0.47, Module 1.1 0.08, and Module 1.2 0.57. These correlation scores are middling but are likely to be reflecting the competitive focus of the game. In the literature is it argued that familiarity in team-based games leads to higher team and personal performance. If this is the case we could expect levels of familiarity to be higher in the winning condition, Figure 5.4.6 and Table 5.29 shows the results over the individual games. Overall the difference in familiarity between winning and losing is significant, yet with a low effect size. *War Thunder* reflects the overall results, and *Mount & Blade* is close to significance. The *29th ID* and *Natural Selection 2* data show no significance yet show low effect sizes between the two conditions. So what does this tell us about the interplay between familiarity and performance in these games? Like the results in table 5.28, the results here show a sporadic interplay across the various games, while there are some games in which we can see some relationship between familiarity and performance, the results are not marked enough to lead to strong conclusions.

Data	T-Test P-Value	Familiarity Cohen's D
All	< 0.001	0.350
29th ID	0.199	0.459
Arma	0.463	0.269
Chiv	0.812	0.093
CSGO	0.783	0.116
Dota	0.629	0.106
MB	0.052	0.351
NS	0.150	0.416
WT	0.005	0.427

Table 5.29: Familiarity in winning and losing teams.

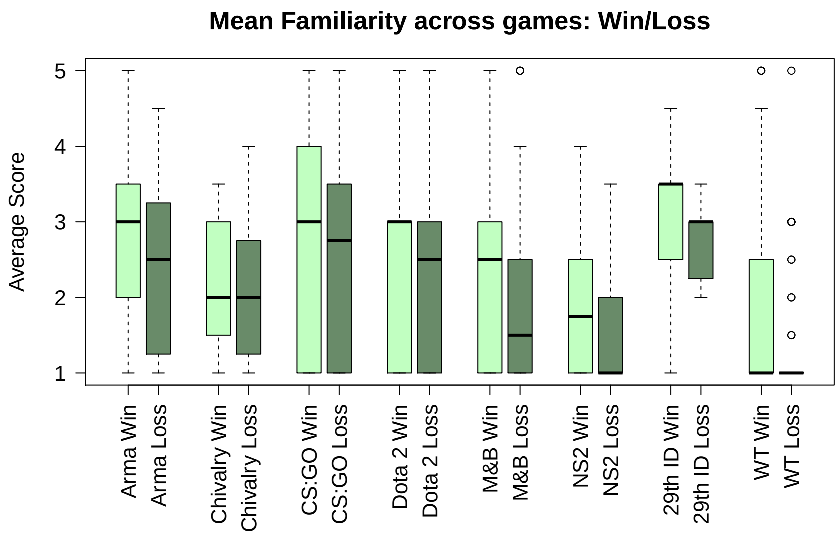

Figure 5.18: Mean familiarity, winning and losing across all games.

Challenge

The literature suggests that increased danger or challenge can increase trust in games, however the overall data set found that this was not the case, and that there was no strong correlation between trust and either challenge or competitive social presence.

The three measures in this section consist of:

- The trust scale, measuring the level of team trust.
- The challenge score, based on the average scores from the preamble item 'In general how challenging was the game?'
- The competitive social presence scale from the CCPIG.

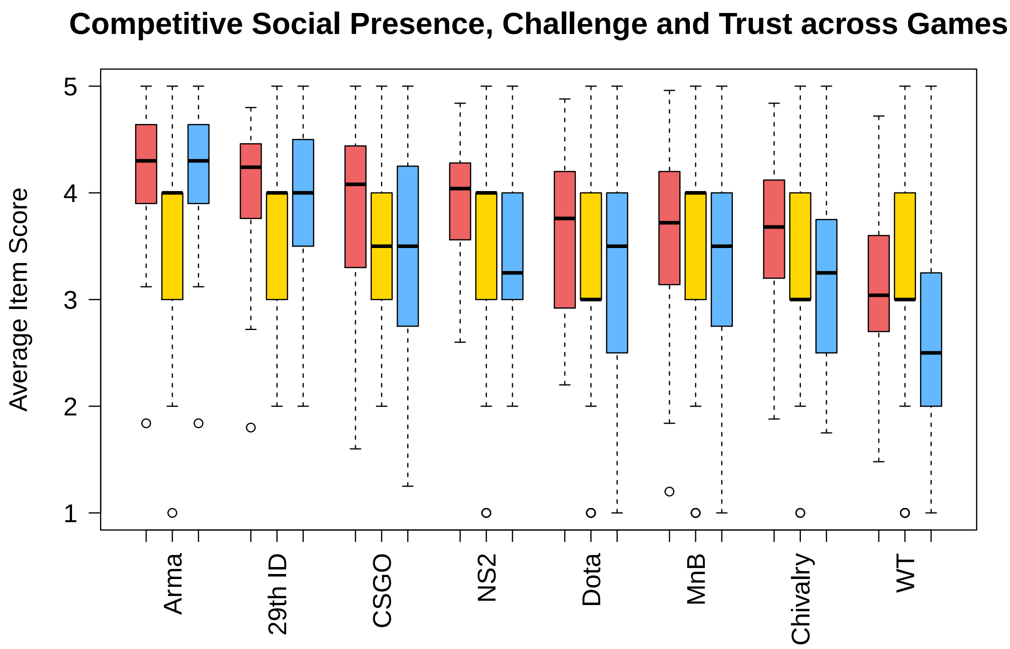

Figure 5.19: Competitive Social Presence, Challenge, and Trust scores across all games. Arranged in order of cooperative social presence levels.

The challenge score is a rather crude scale but has high face validity. Competitive social presence measures engagement with one's opponent and may reflect challenge/danger as ones opponent in team-based games is the biggest threat, and challenge is a key component of competitive social presence. Table 5.30 shows the correlations between team trust & challenge, trust & competitive social presence, and challenge & competitive social presence.

Data	Trust and Challenge	Trust and Competitive SP	Challenge and Competitive SP
All	0.15	0.25	0.38
29th ID	0.38	0.42	0.58
Arma	0.36	0.25	0.28
Chivalry	0.53	0.47	0.70
CS:GO	0.05	0.39	0.19
Dota 2	0.13	0.45	0.34
Mount & Blade	-0.01	0.22	0.22
Natural Selection 2	0.37	0.19	0.56
War Thunder	-0.07	0.13	0.39

Table 5.30: Correlation between Trust and Challenge/Competitive Social Presence (Competitive SP)

In terms of trust & challenge it would seem that for half of the games challenge has no relation to team trust, while for three of the remaining four games, the weaker correlations would suggest that challenge is a minor factor in the development of trust. *Chivalry* stands out in this section as having a strong correlation between challenge and trust, suggesting that in this game challenge did promote trust in the respondent's

team.
In terms of trust & competitive social presence, half of the games in this study appear to foster some interplay between the concepts, however only two of the games share an interplay between trust and both challenge and competitive social presence.

Chivalry, *29th I.D.* and *Natural Selection 2* have strong correlations between challenge & competitive social presence suggesting that the difficulty of the game has a great effect on the connection players have to their opponents. *Chivalry* and *Natural Selection 2* both contain first person melee based combat, and therefore it might to be a factor in the way players perceive and connect with their opponents, however the similar pattern may simply be coincidence. In the case of *29th I.D.* the strong correlation may be due to the predominately clan based nature of the gameplay. The only games in which challenge and competitive social presence do not correlate to some degree are *Mount & Blade*, *CS:GO*, and *Arma*. In these games then is would seem than how challenging the game is has little to do with the extent to which respondents felt a social connection to their opponents.

Data	Trust and Module 1.1	Trust and Module 1.2	Challenge and Module 1.1	Challenge and Module 1.2
All	0.17	0.25	0.12	0.45
29th ID	0.05	0.50	0.13	0.65
Arma	0.13	0.26	0.00	0.48
Chivalry	0.37	0.42	0.49	0.69
CS:GO	0.33	0.35	-0.10	0.35
Dota 2	0.36	0.41	0.03	0.44
Mount & Blade	0.21	0.17	0.05	0.30
Natural Selection 2	0.12	0.20	0.24	0.62
War Thunder	0.09	0.15	0.13	0.65

Table 5.31: Correlation between Trust/Challenge and the competitive social presence modules (1.1 & 1.2)

If we examine the relation between trust, challenge and the individual competitive modules (Table 5.31), we can see that in terms of trust, the modules have largely similar levels of correlation.
The exception to this is the *29th I.D.*, in which there is no relationship between an awareness of one's opponent, but a strong relationship between engagement with opponents and trust. It could be that is due to the nature of the gameplay experience of the *29th I.D.* organized play, in which the majority of players are following orders, therefore an awareness of one's opponent has little to do with the player's relationship to their team. Table 5.31 also highlights that challenge correlated predominantly with Module 1.2, while this is unsurprising, the variety in levels of correlation are interesting, suggesting that challenge affects the competitive experience to different extents across the various games.

Monitoring Behaviour in Games

Monitoring behaviour was measured via a Likert scale item which asked respondents how often they checked the scores of other players. As with the large data set the monitoring behaviour in this study has almost no relation to any other concept. The *29th I.D.* data produced a weak negative correlation between monitoring behaviour and trust, meaning that the less a respondent trusted their team, the more they monitored them, and so on.

Data	Monitoring and Trust	Monitoring and Coop. SP
All	0.15	0.19
29th ID	-0.34	-0.05
Arma	0.11	0.25
Chivalry	0.26	0.11
CS:GO	-0.07	-0.08
Dota 2	-0.05	0.02
Mount & Blade	0.15	0.20
Natural Selection 2	-0.00	-0.01
War Thunder	0.03	0.03

Table 5.32: Correlation between Monitoring Behaviour and Trust and Cooperative Social Presence (Coop. SP)

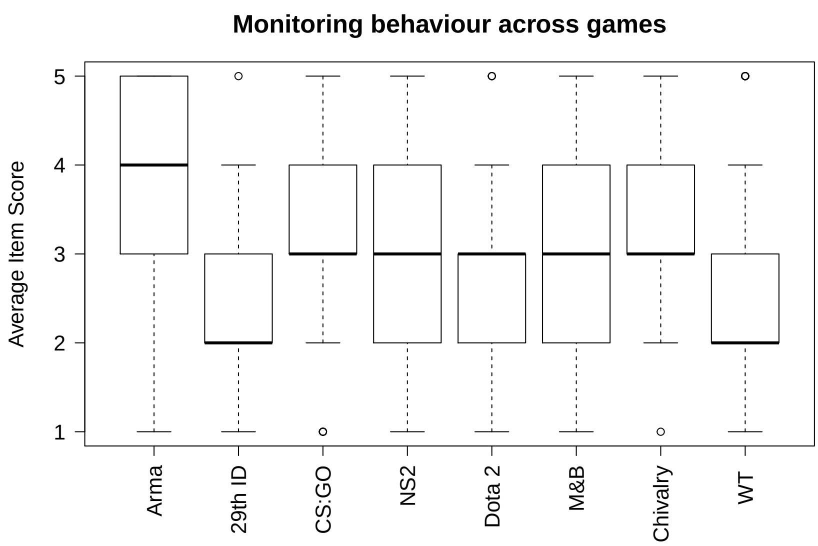

Figure 5.20: Monitoring Behaviour across Games

5.4.7 Comparative Analysis Summary

Trust and Cooperative Social Presence

The interplay between trust and cooperative social presence is fairly consistent across all games (Table 5.22). In terms of trust and overall cooperative social presence the correlation scores range from 0.92 (*CS:GO*) to 0.74 (*Natural Selection 2*), a small range of just 0.18 and all correlations could be considered as strong. The interplay between trust and Module 2.1 is almost identical to that of trust and overall cooperative social presence, with correlation scores ranging from 0.92 (*CS:GO*) to 0.77 (*Natural Selection 2*).

The interplay between trust and Module 2.2 is somewhat more varied with a range of correlation scores from 0.84 (*CS:GO*) to 0.42 (*Natural Selection 2*). However across overall cooperative social presence and both modules the comparative extent to which the concepts correlate remains consistent, for example *CS:GO* maintains the strongest correlation between trust and cooperative social presence, while *Natural Selection 2* shows the consistently weakest correlations.

These results show that the interplay between the trust scale and the overall cooperative social presence as measured by the CCPIG is fairly consistent, with only minor differences between games. The results also suggest that the interplay between trust and Module 2.1 (percieved team cohesion) is similarly consistent, while the interplay between trust and Module 2.2 (player involvement in their team) is more greatly affected by the game.

Performance

The majority of the games in this study followed the expectations that performance would affect cooperative social presence. However the great variety in the size of the effect of performance (Table 5.23) and the fact that cooperative social presence was unaffected by performance in two games suggests that performance is not a simplistic concept. While we can say that in general, in team-based digital games cooperative social presence in teams is reduced in the event of a loss, the extent of the effect differs from game to game. While speculations have been made in this study as to why the experience of some games is affected more greatly by performance than others, more focused research would be needed to establish more concrete arguments.

Team trust was by affected performance in a similar way to cooperative social presence, except in this case all the games showed at least a moderate effect size (Table 5.25). The results show that trust is more consistently affected by performance than cooperative social presence, however the great variety in effect size means there are still factors which influence the extent of any effect.

The majority of the games also followed the expectations in terms of overall competitive social presence, with only one game (*CS:GO*) showing an effect in overall competitive social presence (Table 5.26). Interestingly when the competitive modules were explored individually Module 1.1 showed an effect in all but two games, *Arma* and *War Thunder* (Table 5.27). These results mean that it could be argued that while competitive social presence is largely unaffected in team-based digital games, one element of competitive social presence is affected to varying degrees. The concept measured by Module 1.1 is generally referred to as 'awareness', but is more complex than simply being aware of another player, it also represents a person's Theory of Mind (Table 5.33).

Module 1.1 Awareness	Module 1.2 Engagement
I acted with my opponents in mind	My opponents were challenging
I reacted to my opponents' actions	The game was a battle of skill
I knew what my opponents were trying to achieve	The game was a battle of wits
I was aware that my opponents might work out my goals	I felt tense while playing my opponents
The actions of my opponents affected the way I played	My opponents created a sense of urgency
I felt I affected my opponents' actions	The presence of my opponents motivated me
	My opponents played a significant role in my experience of the game
	It seemed as though my opponents were acting with awareness of my actions

Table 5.33: Competitive social presence modules

Familiarity

Familiarity correlated with team trust across all the games, suggesting that familiarity consistently has a positive relationship with trust in team-based digital games. The Correlations between familiarity and cooperative social presence is less consistent, with five out of the eight games having correlations between overall cooperative social presence, Module 2.1 and familiarity, and only three of the eight games showing correlations between Module 2.2 and familiarity. This suggests that while familiarity seems to be a consistent factor in the feeling of trust in one's team, familiarity a less consistent factor in social presence. In other words familiarity is not always a key element of forming social connections through virtual environments, but it is a key element of forming trust. This suggests that cooperative social presence and team trust are related but separate concepts.

Challenge and Trust

The interplay between the overall challenge participants felt and other concepts in this study was fairly intermittent across games. Trust and overall challenge correlated in half of the eight games. Competitive social presence also correlated with team trust in four out of the eight games, though not the same games as showed the former correlations. The game data which showed correlations between team trust and overall challenge consisted of the *29th I.D.*, *Arma*, *Chivalry*, and *NS2* data sets. Correlations between team trust and competitive social presence appeared in the *29th I.D.*, *Chivalry*, *CS:GO*, and *Dota 2* data sets. In each case the four games have little in common and so establishing a common cause for these correlations would require further study.

Monitoring Behaviour

There is very little to say about monitoring behaviour in this study as it correlates with no other concept in all but one instance. The only correlation with monitoring behaviour in this study exists between monitoring behaviour and trust in the *29th I.D.* section of the data. While this result stands out, and is likely a feature of the highly organized and hierarchical nature of the *29th I.D.* gameplay, even this correlation is weak.

5.4.8 Analysis: Public vs Organised

In this study participants were asked a number of questions about the context of game play: their familiarity with other players, the size of their team (which incidentally correlated with no other concepts), and whether they were playing on a public server, or in an organized game. To reiterate, in this study 'pub play' is defined as any gaming session which took part on a server which is open to the public and/or which a player joined without specific pre-planning. The alternative to pub play in this study is organized play (org), which consists of gaming session which were pre-organized/pre-planned with a group of other players. For example data categorized as organized play in this study includes play in passworded servers, clan matches, clan practise sessions, participation in regular or pre-scheduled community events, and so on. Figure 5.21 suggests that there is a substantial difference, in cooperative social presence and trust at least, in the social experiences of public and organized play.

	Public	Organised
Respondents	819	168

Table 5.34: Participant Numbers Public vs Organised Data

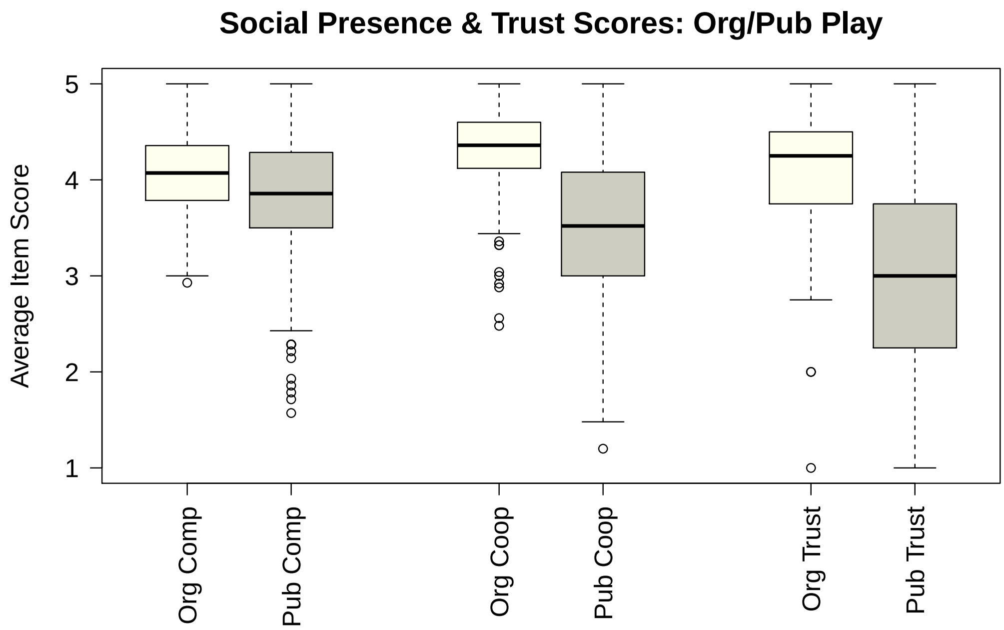

Figure 5.21: Organized and Public Competitive & Cooperative Social Presence and Trust.

The statistics below confirm this difference, with cooperative social presence and trust data producing very large effect sizes. Similar to the performance variable, competitive social presence, though different, has a small effect size and thus is clearly less affected by the differences between public and organized play.

Welch Two Sample t-test: **Competitive Social Presence Public/Organized Play**

$t = 4.2061$, $df = 246.187$, p-value $= < 0.001$

Cohen's D = 0.341

Welch Two Sample t-test: **Cooperative Social Presence Public/Organized Play**

$t = 15.8899$, $df = 336.443$, p-value $= < 0.001$

Cohen's D = 1.133

Welch Two Sample t-test: **Trust Public/Organized Play**

$t = 17.7106$, $df = 355.186$, p-value $= < 0.001$

Cohen's D = 1.262

Breaking down the CCPIG modules we can see that while Module 1.1 (awareness of one's opponents) is unaffected by the change in the context of play, Module 1.2 (competitive engagement) does see a change, though with a small effect size. Both cooperative modules show large effect sizes, though Module 2.1 (perceived team cohesion) has a far larger effect size than Module 2.2 (involvement).

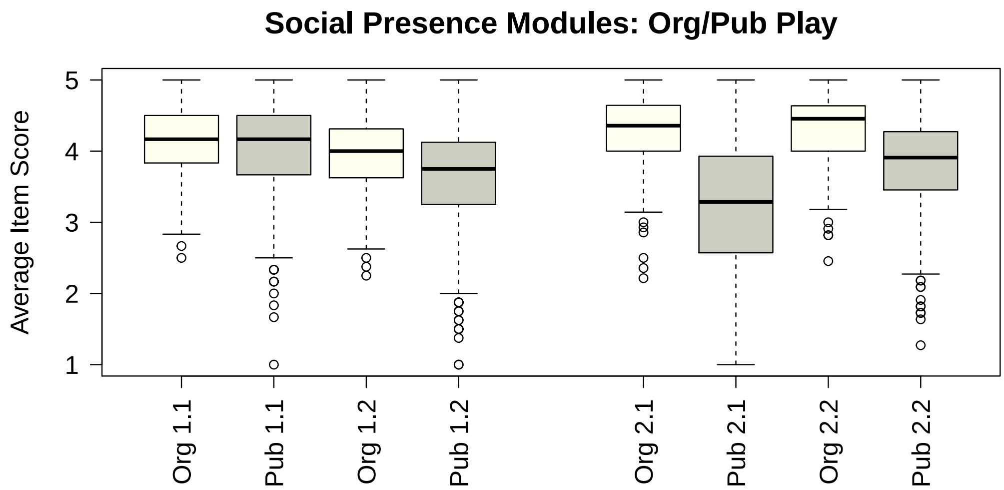

Figure 5.22: Competitive and Cooperative modules in Public and Organized play.

Welch Two Sample t-test: **Competitive Module 1.1 Public/Organized Play**

$t = 0.8383$, $df = 241.032$, p-value $= 0.4027$

Cohen's D $= 0.069$

Welch Two Sample t-test: **Competitive Module 1.2 Public/Organized Play**

$t = 5.5612$, $df = 249.335$, p-value $= < 0.001$

Cohen's D $= 0.447$

Welch Two Sample t-test: **Cooperative Module 2.1 Public/Organized Play**

$t = 18.4975$, $df = 395.66$, p-value $= < 0.001$

Cohen's D $= 1.238$

Welch Two Sample t-test: **Cooperative Module 2.2 Public/Organized Play**

$t = 10.1238$, $df = 309.733$, p-value $= < 0.001$

Cohen's D $= 0.762$

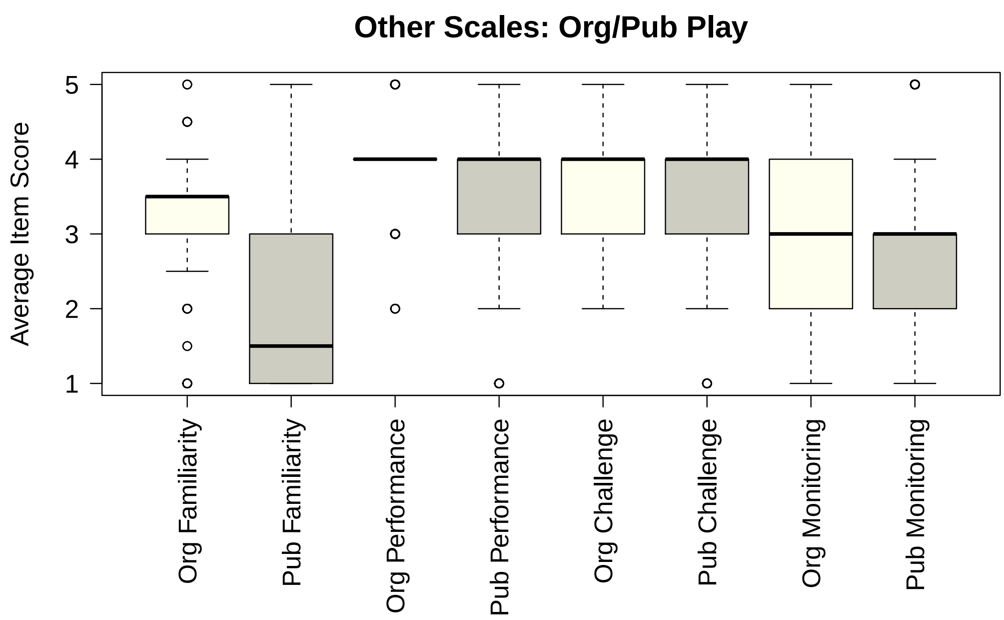

Figure 5.23: Mean familiarity, Perceived team performance, Overall game challenge, and Monitoring behaviour in Public and Organized play.

Figure 5.23 suggests that that only real difference between public and organized play is the level of familiarity between the players. While each scale had a significant difference between the public and organized play variables (T-Test P value of <0.05) the effect sizes of these differences varied greatly (Table 5.35). While it might be unsurprising that players would be more familiar with others in an organized context, there were other differences in the reported experiences of the respondents.

Table 5.35 shows that familiarity with others on the server is by far the biggest difference between public and organized play, however the Table also shows that respondents perceived their team's performance to be higher in organized play, and to a lesser extent perceived the overall challenge of the game to be different. As the overall data summary (Table 5.21) showed that familiarity does not correlate with perceived performance or challenge, familiarity cannot be the only factor at play in the differences between public and organized play. The difference between organized and public play could simply be due to the reasons one chooses to play in an organized rather than public setting. Across all the data sets there were many feedback comments from respondents which stated that there is a big difference in levels of trust, teamwork, skill level, and motivation between organized and public play. One chooses to play in an organized setting to help ensure a more controlled experience, and one is aware that the other players are likely there with the same motivation. Whether this motivation includes finding desirable levels of teamwork, maturity, skill level/challenge, familiarity with players, or a very specific gameplay experience such as the simulated command structures and set-piece battles found in the some clans, players in an organized setting might feel they have something in common with the other players in the server.

Scale	Cohen's D Org/Pub
Mean Familiarity	1.043
Perceived Team Performance	0.607
Game Challenge	0.422
Monitoring Behaviour	0.252

Table 5.35: Variables across Organised & Public Play

5.5 Discussion

This study set out to explore the potential conceptual cross-over between team trust and social presence, and to investigate how contextual gameplay elements affected these concepts. The study was also an opportunity to test the CCPIG questionnaire in a large scale study and has shown that the measure is fit for purpose. The results of this study have helped to clarify the relationship between team trust and social presence and highlight what contextual gameplay elements most affect the experience of team-based digital games. One of the most striking elements of the results of this study are the large effect sizes of some of the variables. As effect size is a measure of the strength of a phenomenon, the results suggest that concepts such as performance have a major effect on the perceptions of game play in most games.

Team Trust and Cooperative Social Presence

Due to the apparent conceptual crossover evident between the team trust literature and cooperative social presence it was expected that there would be a correlation between these two concepts in the data. Overall and in the individual game datasets team trust and cooperative social presence correlated strongly. In terms of individual cooperative modules, across all the data Module 2.1 (perceived team cohesion) consistently correlated more strongly than Module 2.2 (team involvement). This suggests that generally there is a greater interplay between the concept of team trust and team cohesion. The correlation between team trust and cooperative social presence is likely due to the fact that there are items within the CCPIG which address various topics which are stated as antecedents and evidence of trust in the team trust literature. The vast majority of literature regarding trust in teams is based around cooperative work environments, and the CCPIG is based around cooperative play, at their heart of both contexts is cooperation. While we may not think of trust as a primary concept of gaming, this study has shown that in team-based games it does appear to be a factor in a players experience of these environments. Team trust and cooperative social presence were shown to be strongly related but separate concepts in this study. While the two concepts correlated strongly and there were many statistical similarities throughout the data, a number of variables suggested differences between them. Performance produced similar statistical patterns in team trust and cooperative social presence across the individual game data-sets, however team trust was more consistently affected. Similarly the level of familiarity respondents reported with the other players in their game correlated consistently with team trust in every game data-set, yet familiarity and cooperative social presence showed correlation with only five of the eight data-sets.

Performance

The expectation based on the Wang [2013] study was that high performance would lead to high cooperative social presence but would not affect competitive social presence. As performance is claimed to be evidence of trust, these two concepts were also expected to correlate. As expected based on the [Wang, 2013] study, winning and losing had an effect on cooperative social presence, and only a small effect on overall competitive social presence. In line with expectations team trust was also affected by performance, with respondents from winning teams showing with high levels of team trust. It is interesting that while the overall results of this study were close to what was expected, there was a great variety in the effect size of performance from game to game. This shows that while performance can generally be expected to have an effect on a player's experience and perceptions of their team, the specific nature of this effect depends on the game. The results of this study also confirmed that competitive social presence is generally unaffected by performance, however there are some games, such as *CS:GO*, in which this is not the case.

Throughout this study it has been stated that performance has has an effect on concepts such as team trust and cooperative social presence, however the team trust literature argues that performance is evidence of trust. Therefore one might ask, is high performance the cause or the result of high trust, or high cooperative social presence. It is possible that the high trusting teams were more cohesive and this is why they won, however in this study the levels of trust and social presence were measured after the fact, and thus it is entirely possible that performance affected the respondent's perceptions of their team, rather than trust leading to the outcome of winning or losing. Alternatively the relationship might be more complex than being a unidirectional effect, however at this stage we can say for sure that there is a strong interplay between performance, team trust, and cooperative social presence.

Familiarity:

It was expected that familiarity would correlate with cooperative social presence as respondents in previous studies had stated that playing with friends and strangers offer very different gameplay experiences. Based on the literature it was expected that familiarity would correlate with team trust, as the teams in team-based digital games are often similar to swift starting action teams (STATs)[Wildman et al., 2012]. In these types of teams trust relies on quick judgements about others based on shallow cues and pre-existing relationships have a significant effect on trust across the whole team. Therefore it was expected that respondents playing with familiar players would feel generally higher levels of team trust. Throughout this study familiarity correlated with team trust, but only sporadically with cooperative social presence throughout the individual game datasets. The interplay between team trust and familiarity is likely due to the often unpredictable nature of teams in team-based games. When logging on to a server players often do not know who will be on their team and thus familiar players are likely to give players a greater sense of reassurance, predictability, and perhaps stronger initial trust towards their team.

In the overall dataset familiarity and cooperative social presence are shown to correlate to a modest degree, however the sporadic correlations between familiarity and cooperative social presence across the individual datasets suggest that the interplay between these two concepts is far more dependant on the game than with team trust. Therefore while the expectation that familiarity would correlate with cooperative social presence was found to be accurate in a general sense, from the results of this study we can only say that the two concepts are likely to correlate in most team-based games. However as stated previously, the correlations between familiarity and team trust (and cooperative social presence) were fairly weak across the majority of the data, suggesting that while familiarity has a positive interplay with team trust and cooperative social presence, it has only a moderate influence on this feeling. As stated in the results, it may be that familiarity is perhaps not an antecedent of team trust and cooperative social presence, but merely acts as social grease, allowing these concepts to be experienced more readily.

Danger/Challenge:

It was expected from arguments made in literature that the level of danger/challenge a participant experienced would correlate with the level of team trust. The relationships between team trust and perceived overall challenge, and team trust and competitive social presence, suggest that the gaming literature's prediction that challenge leads to trust is far from a universal truth. While the theory appears to hold to some degree in some of the game datasets in this study, half of the datasets show no relationship between the two concepts. Similarly sporadic are the correlations between team trust and competitive social presence, in which only half (but not the same half) of the games show moderate correlations. These results show that the interplay between challenge, ones opponents, and the concept of team trust is far from simple and highly dependant on individual games. The sporadic interplay between perceived overall challenge and competitive social presence also highlights the differences in which respondent's perceived their opponents in games in this study. Therefore it is difficult to draw any general conclusions about the effects of perceived challenge in team-based games.

Monitoring Behaviour in Games:

The team trust literature suggested that monitoring behaviour was evidence of distrust, while the social presence literature suggested monitoring behaviour in multi-player games would increase social presence. As team trust and cooperative social presence were expected, and indeed did, correlate both theories could not be true. The results of this study showed no interplay between monitoring behaviour and any other variable measured in this study. This suggests that monitoring the scores of fellow players, the measure for monitoring behaviour in this study, has little effect on the social experience of team-based virtual games, and is likely an egocentric action. It may be that the measure used in this study could not capture other types of monitoring behaviour in team-based games, however player scores was the most consistent type of monitoring behaviour available across all games in this study.

The CCPIG

In this study the CCPIG questionnaire was shown to be a suitable measure for social presence in team-based games. Factor analysis using the data from this study revealed a new perceptive on the cooperative section, and while it still appears to be one large factor, it can be separated into two modules based on very high factor loadings. While the section contained a large amount of cross-loading, as with previous studies, two new modules appeared thematically coherent and showed different statistical effects from variables.

Competitive Module 1.1 Awareness	**Competitive Module 1.2 Engagement**
I acted with my opponents in mind	My opponents were challenging
I reacted to my opponents' actions	The game was a battle of skill
I knew what my opponents were trying to achieve	The game was a battle of wits
I was aware that my opponents might work out my goals	I felt tense while playing my opponents
The actions of my opponents affected the way I played	My opponents created a sense of urgency
I felt I affected my opponents' actions	The presence of my opponents motivated me
	My opponents played a significant role in my experience of the game
	It seemed as though my opponents were acting with awareness of my actions

Cooperative Module 2.1 Cohesion	**Cooperative Module 2.2 Involvement**
I felt like I was part of a team	I was aware of my team
I felt a social connection to my	I acted with my team-mates in mind team-mates/camaraderie
I felt my team-mates were looking out for me	I considered my team-mates possible plans/thoughts
I felt the team helped me	I felt I contributed to the team
My team-mates played a significant role in my game experience	I felt my actions made a difference to my team-mates
My team communicated well	The actions of my team-mates affected my thoughts and actions
The team had a mutual understanding	My actions were determined by the objectives of the team
I put the performance of the team over my personal performance	I wanted my team to value me
Being part of a team motivated me	I felt responsible for achieving the objectives of the team
I felt my team was committed to working together	I made an effort to work with my team-mates
My team-mates were useful	I did not want my team to think I
I felt my team shared a common overall aim	had let them down
I felt my team shared common short term goals	
It was as much about the team as about my own game	

Table 5.36: CCPIG revised modules item list

5.5.1 Issues

The data in this study is entirely sourced from a self reported online questionnaire, it is likely to have a huge amount of self selection bias. This means that the respondents who took part in the study may present an unrepresentative sample causing skewed results, for example the low scores in the *War Thunder* data set might be due to participants taking part to express their displeasure at the game. However when tested the data was normally distributed, and the use of a prize draw to encourage participation is likely to have enticed respondents who might not normally have taken part. Respondents were sourced from community forums, with links to the call for participants also posted on the *reddit* website. This means that the respondents in this study are likley to have been made up of players that not only play the game, but actively frequent community discussions about the game. The table in the introduction/demographics section of the results section shows that respondent rates had very little to do with community size, and might be more representative of player participation in their community.

As all respondents were sourced from the internet it is also possible that all the data is fake and the result of an elaborate ruse, in which one person created 700+ email accounts and entered a 800+ responses in an attempt to win a number of video games, or perhaps a shadowy group of gamers wish to subvert the findings of any social gaming study for their own agenda. However I doubt anyone other than my self cares enough about the study to do such a thing. It is the opinion of this researcher that gaming communities are usually happy to share their gaming opinions and experiences due to their passion for their hobby, and while there may be a number of duplicated participants, or even fake responses, the data set is so large, and all flat lined and severely incomplete entries were removed, the statistics are probably robust enough to support the conclusions drawn.

As the central theme of my research is social presence this study used a fairly basic trust measure and did not explore notions such as 'task interdependence' or 'shared mental models'Maynard and Gilson [2013] which can affect team performance and trust. It may be that these concepts from organizational based studies of teams will have some interplay within team-based games, and may be a fruitful direction for future studies. However in terms of establishing a general view of the relationship between team trust and other concepts in team-based gaming the results of this study provide a strong foundation.

Suggestions from Respondents

There were a number of issues raised by multiple respondents, often from across different game communities, that will be discussed here.

A: Nature of the Questionnaire

Many respondents stated that the questionnaire included too many items and repetition of similar items, especially in Section 2 which included both the cooperative CCPIG items and the trust scale. While the Section 2 is longer than Section 1 the complaints of repetition may have been due to the inclusion of the trust scale, which are conceptually similar to many of the cooperative items. It should be considered in future studies that using the CCPIG with other scales may lead to an overly lengthy questionnaire, and it may even be prudent to attempts to streamline Section 2 in the future.

B: Squad and Team

In some games players not only have a team but are a member of a squad within their team. This creates a different social dynamic which is not explicitly covered in the CCPIG items. In studying games with a squad mechanic it might be useful to pose additional contextual questions in the preamble to the CCPIG to establish what the data is referring to, the connection to the squad, or overall team.

C: Situation

The CCPIG was designed to measure the experience of a specific game play session. However many respondents stated that their data would vary depending on their situation. A questionnaire asking players about an instance of gameplay may seem at odds with a study which aimed to produce general findings about team-based gameplay, however each instance of gameplay this study measured was based upon the contextual variables the study set out to investigate. Thus it is not detrimental to the study if a single respondent felt less engaged with their team than they usually would. This study did not aim to find 'which is the best social game' or 'where is the best team-work', but what affects the perceptions of team work, competition, and trust in team-based games.

D: Level of Play

One of the most common comments from respondents was that the 'level' of play be considered. Level of play does not necessarily refer to level of challenge, or specifically refer to organized play, but to the perceived experience level of the plays on a respondents team and of their opponents. Level of play seems to refer to the overall experience and understanding of the game the players on the server have. Respondents argue that the perceived level of play, and the balance of this level between the teams, strongly affects their experience of the game.

The idea of the 'level' of play affecting experience may be linked to the idea of 'group flow'[Kaye and Bryce, 2012]. "Collective competency, interdependence, collaboration, coordination, complementary participation and a shared task focus" and are likely to be more readily experience in high level game play with experienced team-mates. Just as the idea of concept of flow represents, in simple terms, the feeling of matching a games challenge with our own skill, two teams with at a similar 'level' of play will provide their opponents with a high yet not overwhelming level of challenge. Such a level of challenges which is more likely to lead to the concept of flow than far more or less skilled opponents, and Szentgyorgyi et al. [2008] found that players prefer games in which other players have skill levels which are relatively on par with their own.

E: Length of Play

Another common suggestion was to include and item in which players could state how long they have been playing the game for before they filled out the questionnaire. As the trust literature states that trust increases over time [Wilson et al., 2006, Webber, 2008, Curseu and Otoiu, 2013], this factor may be important in understanding social connections in team-based game play.

Chapter 6

Discussion & Conclusion

6.1 Discussion

This thesis explored the concept of social presence in team-based digital games, aiming to enlighten the core elements of social presence in this specific multi-user experience. Through a combination of quantitative and qualitative studies various insights into the nature of social presence have been made, the core elements of the concept, what contextual gameplay elements have an effect on the concept, and its interplay with related concepts such as team trust. The research in this thesis has been guided by both academic inquiry and industry guidance, to produce results which hopefully make contributions to both domains.

6.1.1 Answering the Research Questions

The main question which guided the research in this thesis was 'what is the nature of social presence in team-based digital games'? Chapters 3-5 of this thesis contribute to the answer of this question, the insights produced by the initial experiential vignettes, the development of the CCPIG questionnaire, and the results of the team trust and social presence study. The sub-questions gave specific focus on the journey towards answering the main research question, with the question of 'how social presence is affected by sharing a team-based virtual environment with human or computer controlled entities?' addressed in Chapter 3, and 'what other contextual elements encourage or reduce feelings of social presence?' the focus of Chapter 5. The team trust study has shown that user experience can differ greatly from game to game, however the answers to the research questions are based on studies which utilized a wide range of team-based games from a variety of genres, and thus represent the consolidation of a broad range of experiential evidence.

What is the nature of social presence in team-based digital games?
Social presence in team-based digital games can be split into two distinct concepts, competitive and cooperative social presence.

Competitive social presence is the social connection, the feeling of sharing a virtual place, with someone we are competing against. Competitive social presence can be split into two main factors, awareness and engagement. Competitive awareness is the awareness of opponents and the theory of mind one uses to simulate their minds, competitive engagement is the challenge presented by an opponent and the motivation besting them inspires.

Cooperative social presence is the social connection one makes with team-mates and, while the split is not as definitive as competitive social presence, this concept can also be split into two factors, perceived team cohesion, and team involvement. Perceived team cohesion is a product of joint task focus within a team, communication, and a sense of team identity. Team involvement refers to the cognitive and behavioural involvement a team-member commits to their team. Cooperative social presence is related to the concept of team trust in virtual environments. While the two concepts are separate, differing in their interplay with familiarity and performance, they strongly correlate.

Competitive and cooperative social presence each contain aspects of the core elements of social presence in team-based digital games which provided the foundation for the development of the CCPIG questionnaire. These elements include the awareness of other consciousness, Theory of Mind, an awareness of the social significance of one's actions, task focus, and social joint commitments. The conceptual split between competitive and cooperative social presence and the conceptual similarities between social presence and team trust are outcomes novel to this research.

How is social presence affected by sharing a team-based virtual environment with human or computer controlled entities?

Chapter 3 focused on answering this research question. While previous research had explored the difference human or bots make to the experience of a digital game [Lima and Reeves, 2010, Weibel et al., 2008, Merritt et al., 2011, Ravaja et al., 2006, Cairns et al., 2013], this thesis built upon these studies and took a novel approach by introducing ambiguity to push at the preconceptions of users. The results from Chapter 3 suggested that there is a substantial difference between the experience of sharing a virtual environment with a bot and with a human. The presence of humans change the way virtual environments are perceived and make them feel more 'alive'. The results of the *UT* study suggested that in tactical situations humans are regarded as far more challenging than bots and that ambiguity in these situations can cause players to change their focus from the task of the game to identifying the other human controlled entities. While humans and bots can offer disparate experiences in virtual environments, the results of Chapter 3 also suggested that in situations with low interactivity, humans are not able to differentiate between a human and a bot. In addition to this, in chaotic situations players are unconcerned with ambiguous agency. Therefore to answer the question of how social presence is affected by sharing a team-based virtual environment with human or computer controlled entities, it depends.

The importance of the agency, and a knowledge of the agency, of an entity within a virtual environment is highly dependent on context. In situations in which a human player deems the agency of an entity to be important then playing with/against a bot will invariably produce a lower degree of social presence. In situations in which the gameplay is unaffected by the agency of others and the player has little time to consider the agency of others then social presence will be unaffected. In situation where a players is unable to identify whether an entity is controlled by a human or a computer then their preconceptions will win out and their level of social presence will depend upon what they perceive the entity to be.

The results of Chapter 3 helped to guide the research and contributed to answering the main research question. The effects of agency and ambiguity were useful at pushing at the boundaries of social presence, however this is certainly not the last word on the matter. There is still much to reveal about the difference in experience produced by the presence of humans and bots in virtual environments.

What other contextual elements encourage or reduce feelings of social presence?

Chapter 5 documents a large scale user survey study which aimed to go some way to answering this research question. Following discussions with the industrial supervisor, the study documented in Chapter 5 also explored the notion of team trust and the conceptual similarities with cooperative social presence. Of course there is no way to account for all contextual elements which might affect social presence and team trust in team-based digital games, but it was decided to focus on those elements which were suggested by previous studies and the literature to be antecedents or evidence of both concepts. The contextual elements which served as the main variables for the team trust and social presence study were performance, interpersonal familiarity, perceived challenge, monitoring behaviour, and the games played by respondents. While the team trust literature shows that there has been work regarding the interplay between teams and variables such as performance and familiarity, the scope and detail of analysis of this interplay is novel in the context of digital games. The results of the study were complex and varied, with each game data-set containing intricacies and novel statistical patterns, however there were a number of generalizable results in terms of cooperative social presence. The results suggested that the contextual element with the most substantial effect on cooperative social presence was performance, with respondents on winning teams feeling far higher levels of cooperative social presence towards their team-mates. Familiarity also correlated to a moderate degree with cooperative social presence, with high familiarity appearing to contribute to cooperative social presence. Therefore it would seem that the levels of cooperative social presence felt towards team-mates is as much about the activities of a team than its constituents. This reflects the core elements of social presence in team-based digital games of social joint commitments and task and may go some way to explaining the statistical variety from game to game. Each game in the team trust study shared the common feature of being team-based, however each game contains different team tasks and provides different opportunities for interaction. For example in *CS:GO* teams have two main objectives, to either kill all the members of the opposing team, or bomb/protect an objective, in *Mount & Blade* the objective is usually to simply kill every opponent, and in *Natural Selection 2* the teams have varied team tasks in addition to fighting their opponents, such as building and protecting infrastructure, resources management and following commands. This variety of team task may be the cause of the variety in cooperative social presence in relation to performance.

6.1.2 Virtual Team Training: Implications for Design

The motivating technology behind this EngD thesis was socially complex virtual training environments. While virtual team training environments serve an entirely different purpose to team-based digital games, as discussed in the introduction the two technologies share a number of common elements such as co-operating and competing teams, direct and indirect interaction between users, groups and subgroups of users interacting, the potential presence of human and computer controlled entities, and the potential for a mixture of friends, acquaintances, and complete strangers interacting. In addition, serious games have been shown to be viable tools for training team-based capabilities [Hussain et al., 2008, Toups et al., 2011, Craighead, 2009]. Therefore the greater understanding of social presence in team-based digital games may be able to contribute in some way towards providing increased training effectiveness for team-based simulations. The following section presents the implication for design of team training scenarios.

1. The Awareness of other Humans

The awareness of other humans within a virtual environment changes user perceptions of that environment, making the environment seem more engaging and changing the way users perceive elements within that environment. Therefore including other human participants within a virtual training scenario could be used to make virtual environments with low interactivity or low fidelity become more engaging. Human team-mates are perceived as being more capable, human opponents are perceived as more challenging than their bot counterparts, and human opponents and team-mates can increase levels of motivation. For example, a virtual training scenario such as air-to-ground fast-jet mission could be made more engaging if the the ground defences were controlled by a human opponent and the trainee had a human team-mate.

Evidence: Chapter 3: Social Gaming Survey, Puji.

2. Limiting the Truth

People cannot always tell the difference between bots and humans in virtual environments. In an environment with limited interpersonal interaction or generally low communication bandwidth, people are less able to distinguish between computer and human controlled entities. This means that in these scenarios social presence is based as much on a users preconceptions of a virtual situation than any interaction taking place. Therefore people can be told that they are competing or collaborating with a human when they are in fact interacting with a bot. This means that a scenario can benefit from the increased engagement and perceived challenge from the awareness of other humans of deliverable 1. without the need for an actual human. However, deception can cause users to feel tricked, create distrust, and therefore lose interest in a scenario. In addition, if users suspect that an entity might be a bot rather than a human they may shift their focus away from the goals of the training scenarios to establishing the agency of an entity. To mitigate these risks deception should only be used in situations which have very limited interaction between entities and ideally no communication. For example, a fast-jet pilot in a virtual training scenario could be informed that computer controlled surface-to-air missile (SAM) sites are being controlled by a human to increase the perceived challenge they present.

Evidence: Chapter 3: Cooperative Tetris, Problem with Bots, Ambiguity in Unreal Tournament.

3. Team Trust & Learning

Team Performance (winning or losing) has an substantial effect on team trust, however familiarity may be able to reduce the effects. If a team wins then its members are more likely to feel increased team trust, while losing decreases levels of team trust. However losing is often valuable in training, learning what one did wrong and why one failed. This creates the situation in which team training and developing team trust are conceptually at odds. High levels of familiarity within teams can reduce or negate the effects of performance on team trust, therefore scenario design for building trust in teams should reflect the level of familiarity with the team. In the training pipeline of a team it may be advisable to develop training scenarios in which they can achieve high performance levels while developing familiarity. Once a team has reached a high level of familiarity then the training benefits of failure will have less effect on levels of team trust. However a risk with allowing teams to win scenarios is that they may develop a sense of complacency. Such risk could be reduced by allowing teams to achieve high performance rather than necessarily 'winning' a scenario. Teams could be put in impossible situations, in which there is no 'winning' but team performance could still be perceived as high.

Evidence: Chapter 5: Team Trust & Social Presence.

4. Tactical vs. Hectic

Chaotic or hectic environments reduce social awareness. In hectic or chaotic team-based scenarios people become more focused on their opponents and have a reduced awareness of their team. People also become less aware/concerned about agency, as a result performance has less effect on Cooperative Social Presence and Team Trust. In the domain of fast-jet pilots a hectic situation could be defined as the difference between requiring tactical competency versus dogfight competency. In hectic situations survival is based upon individual skill over team-work, in which a person is in direct and immediate danger from multiple entities. The effect of hectic situations has a number of implications for design. In training scenarios which wish to focus on team training capabilities it may be advisable to avoid hectic situations so that the trainees can focus on team. Alternatively the effect could be designed into a scenario which aims to train team members to remain calm and retain situational awareness of their team in hectic situations. For example, a training scenario could be designed for testing a squadron leader's ability to retain team awareness and command & control capabilities throughout a hectic situation. In terms of hardware rather than scenario design, interfaces could be designed to counteract the degraded social awareness caused by hectic situations.
Evidence: Chapter 3: Ambiguity in Unreal Tournament, Chapter 5: Team Trust & Social Presence.

5. Range of Engagement

The range at which a person must engage their opponents in a virtual environment changes their levels of Competitive Social Presence. Engaging an opponent at a great distance reduces Competitive Social Presence in team-based virtual environments, while engaging an opponent in close combat increases a person's awareness of challenge. Similar to deliverable 4, these effects could be designed in or out of a training scenario depending on the training requirements. To ensure a greater team focus opponents could be kept at a distance, while high levels of challenge and competitive focus could be stimulated by creating close encounters. For example, a virtual team training which aims to focus purely on procedures and high level strategy should maintain a significant distance between the trainees and their opponents.

Evidence: Chapter 5: Team Trust & Social Presence.

6. Team Size

In the team trust study small team sizes produced large statistical effects. Small team size seems to intensify social connections within virtual environments. Small teams create a stronger correlation between Cooperative Social Presence & Team Trust and team performance has a larger impact on Cooperative Social Presence and Team Trust. This means that team trust may develop more quickly in smaller teams, however failure will have a greater negative impact on the team trust. Therefore team trust may be considered as potentially more fragile within small teams. Designing training scenarios which allow small teams to feel part of a larger entity may alleviate this fragility. In an early stage of training small teams completing scenarios which create the perceptions of high performance could accelerate the development of team trust.

Evidence: Chapter 5: Team Trust & Social Presence.

7. Disparity

Disparity, differences in cognitive motivation, specialized knowledge and age, between team members can stunt the emergence of trust. Disparity can lead to a lower levels of team trust and increase the effects of performance on team trust. As low performance will produce a substantial negative impact on team trust within teams with high disparity, efforts must be made to either reduce team disparity or produce perceived high performance while team trust is fostered. For example, disparity may occur between junior and senior personnel and may be a factor in joint forces training.

Evidence: Chapter 5: Team Trust & Social Presence.

8. Perceived Team Cohesion

The perceived level of team cohesion is a central aspect of team trust. Perceived team cohesion is a component of the CCPIG Questionnaire used to measure Social Presence. The level of cohesion a team member perceives to be present within their team correlates strongly with team trust. The more a team member perceived their team to be a cohesive unit, the greater the level of trust that member will have in their team. In addition perceived team cohesion is generally highly sensitive to performance, with members of losing teams perceiving their team to be cohesive. Therefore when aiming to build team trust training systems should be designed to encourage team cohesion, promote an awareness of team cohesion, and where possible explicitly present the team as cohesive. For example, an information system which not only promoted an awareness of the location of their team-mates but tasks they were completing to work towards the joint objectives of the team may increase the perception of team cohesion and thus increase team trust. However perceived team cohesion is generally highly sensitive to performance, with members of losing a team perceiving their team to be less cohesive.

Evidence: Chapter 5: Team Trust & Social Presence.

6.2 Conclusion

6.2.1 Concluding Thoughts

The work in this thesis was inspired by socially complex virtual environments, training simulators used to improve team capabilities. While academic, the nature of the work here is client focused, and regular meetings with the industrial supervisor guided research the and helped to contextualize the results. Team-based digital games provided a research tool with high availability and a large base of expert users. The method used for gathering the majority of the user data in this thesis, the online community survey method, has inherent risk yet provided a high level of ecological validity to the data. The data was based upon expert users experiencing games they were familiar with in a naturalistic way, before completing the CCPIG questionnaire. The core academic contributions made by the research in this thesis are a greater understanding of social presence and team trust in team-based digital games, and a measure for social presence in this environment. The CCPIG questionnaire provides the first measure for social presence that is specifically tailored to team-based digital games, accounting for how social presence is experienced differently between team-mates and opponents.

6.2.2 Limitations & Further Work

While the research in this thesis has provided insights it has also raised numerous question to inspire further work. The work in Chapter 3 provided insights into the how bots and humans created different virtual experiences, the effects of ambiguous agency, and situations in which agency is not a concern. In relation to virtual team training a useful next stage in this line of inquiry would have been to investigate the notion of bots as learning partners. Could a bot learning partner provide equal training transfer as a human, and what effect would ambiguity have on learning. While human perception of bots is that they are of lesser challenge and use than other humans it would be interesting to discover if these perceptions would affect learning. Studies could be designed to test training transfer across human, bot, and ambiguous conditions, perhaps in simplistic dyadic teams at first to reduce variables and isolate the relationship.

One of the limitations of this study is that the theories presented here have yet to be tested in a more realistic simulation environment. Further work should include studies or trials to establish if the the CCPIG questionnaire, the theories about the core elements of social presence, and the effects of contextual variables, have similar relevance to the experience of virtual team training environments. In this way the outcomes of this thesis could be evaluated in terms of their applicability to virtual team-based team training environments.

Some of the core elements of social presence in team-based digital games are team task and joint social commitments, these concepts may relate to an underlying notion of 'shared mental models'[Jonker et al., 2011]. Shared mental model is a concept which refers to a shared understanding of a task that is to be performed and the team work involved [Jonker et al., 2011], however this concept is predominantly discussed in management/organizational studies in relation to workplace teams and therefore it is unknown if this concept would map to the domain of team-based digital games. To explore this concept initial user data based research could establish if there is an analogous concept within gaming communities, a study would then investigate if teams with a shared mental model show higher levels of cooperative social presence, or if a strong shared mental model reduced the effect of performance on cooperative social presence. The challenge here is how one would reliably measure a shared mental model in an instance of gameplay.

Group flow [Kaye and Bryce, 2012] is another concept which is of relevance to team-based digital games and understanding the relationship of this interpersonal variation on the concept of flow with social presence would be useful. A related concept which could add insight to a study on group flow and social presence was raised by respondents of the team-trust study, the concept of player ability levels and the effect this has on gameplay experience. Group flow is said to occur in situations in which whole teams are met with appropriate challenge and therefore one may expect group flow to be a product of cooperating teams competing against teams with equal ability. As group flow may be the balance between competitive and cooperative interaction it would be useful to gain an understanding of the relationship between group flow and competitive and cooperative social presence.

The research in this thesis has predominantly focused on team relationships, however within teams there might be numerous smaller groups acting more independently. Such groups are often refereed to as squads in team-based digital games, particularly military themed FPS games. Understanding the differences in social presence between squad members and the larger team may help to better understand social dynamics with teams. A study could be designed to measure social presence between participants with some reporting the social presence within their squad, and others within the whole team. The CCPIG could be easily adapted for this purpose by simply changing the wording of the cooperative items from team-mates to squad-mates.

Chapter 7

Appendix 1

7.1 Experiential Vignettes

7.1.1 Social Gaming Questionnaire

Name

Age

Sex

Favourite Online Multiplayer game?

What game have you been playing on most lately?

How often do you play computer games (past / present)?

Would you describe yourself as a 'Gamer'?

Are you a member of a 'Clan'?

Why do you play team/squad based online team games?

Do you pay closer attention to your opponents or your squad members?

When part of a squad, where do you feel your attention is focused?

What sort of role do you like to take in a squad?

Does being in a squad affect how much effort you put into playing the game?

To what extent do you conform to your 'role' in the squad?

Does being part of a squad make the game for immersive?

When in a squad what is most important to you?

Does being in a squad make the game environment feel more interactive?

Do you feel the need to take revenge on someone who kills someone in your squad?

In what circumstances can being in a squad be annoying?

Is squad play more challenging than being a lone wolf style player?

Do you often leave your squad or team? If so why?

Do you feel more motivated when part of a squad or close-knit team?

How important is being able to communicate with your squad verbally or using text?

How does the mood of your squad members affect you?

If you lose the game but your squad worked together well, how would you feel?

Does squad play increase emotional attachment to the game?

Any other thoughts on the social aspect of team/squad play?

Do you often leave your squad? If so why?

Do you feel more motivated when part of a squad?

How important is being able to verbally communicate with your squad?

How does the mood of your squad members affect you?

If you lose the game but your squad worked together well, how would you feel?

Does squad play increase emotional attachment to the game?

Any other thoughts on the social aspect of team/squad play?

7.1.2 Tetris Questionnaire

Immersion and Social Presence Questionnaire used in Pilot Experiment adapted from [Jennett et al., 2008], and [Martin, 2010].

Your Experience of the Game.

Please fill in parts 1 and 2 of the following questionnaire relating to your gaming experience as accurately and honestly as possible.

Part 1

Please answer the following questions by circling the relevant number.

1. In particular, remember that these questions are asking you about how you felt at the end of the game.

To what extent did the game hold your attention?

Not at all 1 2 3 4 5 A lot

2. To what extent did you feel you were focused on the game?

Not at all 1 2 3 4 5 A lot

3. How much effort did you put into playing the game?

Very little 1 2 3 4 5 A lot

4. Did you feel that you were trying you best?

Not at all 1 2 3 4 5 Very Much So

5. To what extent did you lose track of time?

Not at all 1 2 3 4 5 A lot

6. To what extent did you feel consciously aware of being in the real world whilst playing?

Not at all 1 2 3 4 5 Very Much So

7. To what extent did you forget about your everyday concerns?

Not at all 1 2 3 4 5 A lot

8. To what extent were you aware of yourself in your surroundings?

Not at all 1 2 3 4 5 Very Much So

9. To what extent did you notice events taking place around you?

Not at all 1 2 3 4 5 A lot

10. Did you feel the urge at any point to stop playing and see what was happening around you?

Not at all 1 2 3 4 5 Very Much So

11. To what extent did you feel that you were interacting with the game environment?

Not at all 1 2 3 4 5 Very Much So

12. To what extent did you feel as though you were separated from your real-world environment?

Not at all 1 2 3 4 5 Very Much So

13. To what extent did you feel that the game was something you were experiencing, rather than something you were just doing?

Not at all 1 2 3 4 5 Very Much So

14. At any point did you find yourself become so involved that you were unaware you were even using controls?

Not at all 1 2 3 4 5 Very Much So

15. To what extent did you feel as though you controlling the game according to you own will?

Not at all 1 2 3 4 5 Very Much So

16. To what extent did you find the game challenging?

Not at all 1 2 3 4 5 Very Much So

17. Were there any times during the game in which you just wanted to give up?

Not at all 1 2 3 4 5 A lot

18. To what extent did you feel motivated while playing?

Not at all 1 2 3 4 5 A lot

19. To what extent did you find the game easy?

Not at all 1 2 3 4 5 Very Much So

20. To what extent did you feel like you were making progress towards the end of the game?

Not at all 1 2 3 4 5 A lot

21. How well do you think you performed in the game?

Very Poor 1 2 3 4 5 Very Well

22. To what extent did you feel emotionally attached to the game?

Not at all 1 2 3 4 5 Very Much So

23. To what extent were you interested in seeing how the game would progress?

Not at all 1 2 3 4 5 A lot

24. How much did you want to "win"the game?

Not at all 1 2 3 4 5 Very Much So

25. Were you in suspense about how well you would do at the game?

Not at all 1 2 3 4 5 Very Much So

26. How much would you say you enjoyed playing the game?

Not at all 1 2 3 4 5 A lot

27. When interrupted, were you disappointed that the game was over?

Not at all 1 2 3 4 5 Very Much So

28. Would you like to play the game again?

Definitely not 1 2 3 4 5 Definitely Yes

Part 2

Please indicate how you felt while playing the game for each of the items, on the following scale:

29. I empathized with my opponent.

Not at all 1 2 3 4 5 A lot

30. My actions depended on my teammate's actions.

Not at all 1 2 3 4 5 A lot

31. My teammate's actions were dependent on my actions.

Not at all 1 2 3 4 5 A lot

32. I felt connected to my teammate.

Not at all 1 2 3 4 5 A lot

33. My teammate paid close attention to me.

Not at all 1 2 3 4 5 A lot

34. I paid close attention to my teammate.

Not at all 1 2 3 4 5 A lot

35. I felt jealous of my teammate.

Not at all 1 2 3 4 5 A lot

36. I found it enjoyable to play/be with my teammate.

Not at all 1 2 3 4 5 A lot

37. I made an effort to work with my teammate.

Not at all 1 2 3 4 5 A lot

38. My teammate made an effort to work with me.

Not at all 1 2 3 4 5 A lot

39. My teammate worked harder than me.

Not at all 1 2 3 4 5 A lot

40. I made most tactical choices during the game.

Not at all 1 2 3 4 5 A lot

41. My teammate made most tactical choices during the game.

Not at all 1 2 3 4 5 A lot

42. I felt me and my teammate communicated throughout the game.

Not at all 1 2 3 4 5 A lot

43. Sometimes my teammate's actions were annoying.

Not at all 1 2 3 4 5 A lot

44. I felt my teammate was communicating intent through the game.

Not at all 1 2 3 4 5 A lot

45. I felt my teammate understood my aims.

Not at all 1 2 3 4 5 A lot

46. I admired my teammate.

Not at all 1 2 3 4 5 A lot

47. What my teammate did affected what I did.

Not at all 1 2 3 4 5 A lot

48. I felt me and my teammate shared a common overall aim.

Not at all 1 2 3 4 5 A lot

49. I felt me and my teammate shared a common short term goals.

Not at all 1 2 3 4 5 A lot

50. What I did affected what my teammate did.

Not at all 1 2 3 4 5 A lot

51. I felt revengeful.

Not at all 1 2 3 4 5 A lot

Post-Experiment Interview

52. Age
53. Gender
54. How often do you play video/computer games?
55. What type of games do you usually enjoy playing?
56. What are your main motivations for playing digital games?
57. Would you call yourself a ‘Gamer‘?
58. In general do you prefer playing against people or the computer?
59. Do you ever play games online against strangers? (over the internet on PC or games consoles)?
60. Do you ever play online against your friends (over the internet on PC or games consoles)?
61. Have you played cooperative Tetris before?
62. Have you played competitive Tetris before?
63. What did you think of the game in this study?
64. Do you prefer playing against your friend or the computer?
65. During the game, did you feel you were communicating with your teammates in a non-verbal way?
66. Is there anything you would change about the game?
67. Would you play differently if you were playing a bot/human?

7.1.3 Tetris Results

Condition	Participant	Immersion	Social Presence
Base	Ba	89	66
Base	Bb	94	67
Base	Bc	104	41
Base	Bd	73	64
Base	Be	109	78
Base	Bf	103	72
Base	Bg	88	81
Base	Bh	101	76
R2R	Ra	92	62
R2R	Rb	106	84
R2R	Rc	112	83
R2R	Rd	81	64
R2R	Re	82	55
R2R	Rf	100	66
R2R	Rg	93	75
R2R	Rh	93	70
Bot	Ta	102	59
Bot	Tb	95	59
Bot	Tc	91	58
Bot	Td	79	60
Bot	Te	98	66
Bot	Tf	99	53
Bot	Tg	85	44
Bot	Th	101	53
Bot	Ti	97	55

Table 7.1: Immersion and Social Presence Results

7.1.4 UT Ambiguity Questionnaire

Immersion and Social Presence Questionnaire used in the Experiment adapted from [Jennett et al., 2008], and [Martin, 2010]. Your Experience of the Game. Please fill in parts 1 and 2 of the following questionnaire relating to your gaming experience as accurately and honestly as possible. In this questionnaire all the word *player* refers to both human and bot players in the server.

Part 1

Please answer the following questions by circling the relevant number.
In particular, remember that these questions are asking you about how you felt at the end of the game.

To what extent did the game hold your attention?

Not at all 1 2 3 4 5 A lot

To what extent did you feel you were focused on the game?

Not at all 1 2 3 4 5 A lot

How much effort did you put into playing the game?

Very little 1 2 3 4 5 A lot

Did you feel that you were trying you best?

Not at all 1 2 3 4 5 Very Much So

To what extent did you lose track of time?

Not at all 1 2 3 4 5 A lot

To what extent did you feel consciously aware of being in the real world whilst playing?

Not at all 1 2 3 4 5 Very Much So

To what extent did you forget about your everyday concerns?

Not at all 1 2 3 4 5 A lot

To what extent were you aware of yourself in your surroundings?

Not at all 1 2 3 4 5 Very Much So

To what extent did you notice events taking place around you?

Not at all 1 2 3 4 5 A lot

Did you feel the urge at any point to stop playing and see what was happening around you?

Not at all 1 2 3 4 5 Very Much So

To what extent did you feel that you were interacting with the game environment?

Not at all 1 2 3 4 5 Very Much So

To what extent did you feel as though you were separated from your real-world environment?

Not at all 1 2 3 4 5 Very Much So

To what extent did you feel that the game was something you were experiencing, rather than something you were just doing?

Not at all 1 2 3 4 5 Very Much So

To what extent was your sense of being in the game environment stronger than your sense of being in the real world?

Not at all 1 2 3 4 5 Very Much So

At any point did you find yourself become so involved that you were unaware you were even using controls?

Not at all 1 2 3 4 5 Very Much So

To what extent did you feel as though you controlling the game according to you own will?

Not at all 1 2 3 4 5 Very Much So

To what extent did you find the game challenging?

Not at all 1 2 3 4 5 Very Much So

Were there any times during the game in which you just wanted to give up?

Not at all 1 2 3 4 5 A lot

To what extent did you feel motivated while playing?

Not at all 1 2 3 4 5 A lot

To what extent did you find the game easy?

Not at all 1 2 3 4 5 Very Much So

To what extent did you feel like you were making progress towards the end of the game?

Not at all 1 2 3 4 5 A lot

How well do you think you performed in the game?

Very Poor 1 2 3 4 5 Very Well

To what extent did you feel emotionally attached to the game?

Not at all 1 2 3 4 5 Very Much So

To what extent were you interested in seeing how the game would progress?

Not at all 1 2 3 4 5 A lot

How much did you want to “win”the game?

Not at all 1 2 3 4 5 Very Much So

Were you in suspense about how well you would do at the game?

Not at all 1 2 3 4 5 Very Much So

To what extent did you enjoy the graphics and the imagery?

Not at all 1 2 3 4 5 A lot

How much would you say you enjoyed playing the game?

Not at all 1 2 3 4 5 A lot

When interrupted, were you disappointed that the game was over?

Not at all 1 2 3 4 5 Very Much So

Would you like to play the game again?

Definitely not 1 2 3 4 5 Definitely Yes

Part 2

Please indicate how you felt while playing the game for each of the items, on the following scale:

I empathized with the other players.

Not at all 1 2 3 4 5 A lot

My actions depended on the actions of the other players.

Not at all 1 2 3 4 5 A lot

The actions of the other players were dependent on my actions.

Not at all 1 2 3 4 5 A lot

I felt connected to the other players.

Not at all 1 2 3 4 5 A lot

I feel the other players paid close attention to me.

Not at all 1 2 3 4 5 A lot

I paid close attention to the other players.

Not at all 1 2 3 4 5 A lot

I felt jealous of the other players.

Not at all 1 2 3 4 5 A lot

I found it enjoyable to play/be with the other players.

Not at all 1 2 3 4 5 A lot

The other players worked harder than me.

Not at all 1 2 3 4 5 A lot

I made most tactical choices during the game.

Not at all 1 2 3 4 5 A lot

The other players made most tactical choices during the game.

Not at all 1 2 3 4 5 A lot

I felt me and the other players communicated throughout the game.

Not at all 1 2 3 4 5 A lot

Sometimes the other players' actions were annoying.

Not at all 1 2 3 4 5 A lot

I felt the other players were communicating intent through the game.

Not at all 1 2 3 4 5 A lot

I felt the other players understood my aims.

Not at all 1 2 3 4 5 A lot

When the other players were happy, I was happy.

Not at all 1 2 3 4 5 A lot

I influenced the mood of the other players.

Not at all 1 2 3 4 5 A lot

I was influenced by my opponents moods.

Not at all 1 2 3 4 5 A lot

I admired the other players.

Not at all 1 2 3 4 5 A lot

What the other players did affected what I did.

Not at all 1 2 3 4 5 A lot

I felt me and the other players shared a common overall aim.

Not at all 1 2 3 4 5 A lot

I felt me and the other players shared a common short term goals.

Not at all 1 2 3 4 5 A lot

What I did affected what the other players did.

Not at all 1 2 3 4 5 A lot

I felt revengeful.

Not at all 1 2 3 4 5 A lot

I felt schadenfreude (malicious delight).

Not at all 1 2 3 4 5 A lot

Post-Experiment Interview

Age:

Gender:

Have you played UT before?:

How often do you play video/computer games?:

Would you call yourself a 'Gamer'?

What did you think of the game in this study?

During the game, did you feel you were communicating with your teammates in a non-verbal way?

Is there anything you would change about the game?

Teammates vs Opponents

Did you feel as though you were sharing a virtual place?

Who most affected your enjoyment of the game, opponents or team mates?

Who most affected your immersion in the game, opponents or team mates?

Who most affected any social feelings you had within the game, opponents or team mates?

Bots vs Humans

Did you try to figure out who the were the *bots* and who were the humans?

Do you think you could specify any player as defiantly *bot* or defiantly human?

Did you care?

Did you feel the opposing team had more/less bots?

Did you feel the game was more/less immersive than normal?

Did the knowledge that some of the other players were *bots* make you feel more/less socially connected to the other players?

Teamwork

Does being in a team affect how much effort you put into playing the game?

Does being part of a team make the game for immersive?

Does being in a team make the game environment feel more interactive?

In what circumstances can being in a team be annoying?

Do you feel more motivated when part of a team?

7.2 Questionnaire Development

7.2.1 Questionnaire Development R Codes

The correlations were calculated using the following R code:

```
cor(Data, use="pairwise.complete.obs")
```

The Cronbach's α's were calculated using the following R code:

```
cronbach.alpha(Data, standardized = FALSE, CI = TRUE,
probs = c(0.025, 0.975), B = 1000, na.rm = TRUE )
```

The KMO and MSA scores were calculated using the following R code [Nakazawa, 2007].

```
kmo <- function(x)
{
x <- subset(x, complete.cases(x))  # Omit missing values
r <- cor(x)  # Correlation matrix
r2 <- r^2  # Squared correlation coefficients
i <- solve(r)  # Inverse matrix of correlation matrix
d <- diag(i)  # Diagonal elements of inverse matrix
p2 <- (-i/sqrt(outer(d, d)))^2  # Squared partial correlation coefficients
diag(r2) <- diag(p2) <- 0  # Delete diagonal elements
KMO <- sum(r2)/(sum(r2)+sum(p2))
MSA <- colSums(r2)/(colSums(r2)+colSums(p2))
return(list(KMO=KMO, MSA=MSA))
}
```

7.2.2 CCPIGv0.1

Section 1: General Social Presence

The game was challenging

The game was engaging

I felt my actions in the game were significant to others

I felt my actions in the game affected others

The actions of others affected me

The actions of others were significant to me

I was aware of the presence of other players

The awareness of other players affected the way I played

I wanted to play because other people were playing

Section 2: Task

The objectives in the game required teamwork

The objectives in the game were more easily achieved using teamwork

The game was more fun when using team-work

Competitive Social Presence Section 3.1:

I was aware of my opponents

I acted with my opponent in mind

I was thoughtful about my opponents' possible plans/thoughts

I reacted to my opponents actions

I considered my opponents possible plans/thoughts

It seemed as though my opponent was acting with awareness of my actions

It was satisfying when I felt I got the upper hand

My opponents were challenging

The game was a battle of skill

The game was a battle of wits

It was fun to play against my opponents

I felt the sensation of being hunted

I felt tense/ on edge while playing my opponents

I felt a sense of urgency during the game

The presence of my opponents influenced my plans and actions during the game

I tried to imagine what my opponents were thinking

I tried to second guess my opponent

I tried to outwit my opponent

I think my opponents were trying to outwit me

My opponents were dangerous

I knew what my opponent was trying to achieve

I was aware that my opponent might work out my goals

I could easily have lost

I needed to win out against the other players

Competitive Social Presence Section 3.2

My opponents affected my actions

The actions of my opponents affected the way I played

The actions of my opponents affected my thoughts and plans

My opponents played a significant role in my experience of the game

My opponents played a significant role in the challenge of the game

My opponents affected my performance

I felt I affected my opponents' actions

Cooperative Social Presence Section 4.1

I was aware of my team-mates

I acted with my team-mates in mind

I was thoughtful about my team-mates' possible plans/thoughts

I considered my team-mates' possible plans/thoughts

I reacted to my team-mates' actions

I felt my team-mates were looking out for me

I had my team-mates' support

I felt I took more risks in game when

I had my team-mates with me I felt part of a team

I made an effort to work with my team-mates

My team-mates seemed to make an effort to work with me

I felt my team shared a common overall aim

It was as much about the team as about my own game

I felt my team shared common short term goals

I felt I contributed to the team

I felt the team helped me

The performance of the team was important to me

My personal performance was important to me

My actions were determined by the objectives of the team

I put my own survival above the immediate team goals

I felt I had played my role in the team

Cooperative Social Presence Section 4.2

I felt camaraderie with my team

I felt a social connection to my team-mates

I felt that being part of my team increased my desire to keep playing

I wanted to appear capable to my team-mates

The desire to be better than my team-mates motivated me

I cared what my team-mates thought of my performance

Being part of a team motivated me

I did not want to let my team down

I felt bad (guilty) when I let my team down

I felt responsible for achieving the teams objectives

I felt the team shared a commitment to a shared goal

I wanted my team to value me

I didnt want my team to think Id let them down

Cooperative Social Presence Section 4.3

I felt I affected my team-mates' actions

I felt my actions made a difference to my team-mates

My actions contributed to the teams performance

My actions contributed to the performance of other players

I felt my team was committed to working together

My team-mates and I were working towards the same goal

My team shared an objective

I felt obliged to help my team

My team were focused on one goal

I wanted to help my team

My team-mates were focused on the same task as me

My team-mates were working to complete the same task as me

My team-mates were focused on the same overall objective as me

My team-mates actions affected my actions

The actions of my team-mates affected the way I played

The actions of my team-mates affected my thoughts and plans

My team mates played a significant role in my experience of the game

My team mates played a significant role in my enjoyment of the game

My team contributed to my performance

My team-mates were useful

My team-mates helped me achieve my objectives

My team-mates contributed to the success of the team

My team communicated well

I communicated with my team-mates

My team-mates communicated with me

I read the actions of my team

The team had a mutual understanding

I felt I could communicate effectively with my team in the game

The task at hand determined my actions and plans

My team mates determined my actions and plans

My opponents determined my actions and plans

Motivation Section 5:

The desire to beat my opponents motivated me

I wanted to appear capable to my opponents

The presence of the my opponents motivated me

The desire to help my team beat the opposition motivated me

Losing made me want to try harder

I didnt mind dying if it meant my team would win

I was happy to take a boring role if it meant the team would win

I felt I was playing my part in fighting the enemy

7.2.3 CCPIGv0.5

General Social Presence

The game was challenging

The game was engaging

I felt my actions in game were significant to others

The actions of others were significant to me

I was aware of the presence of other players

The awareness of other players affected the way I played

Cooperative Confirmation

The objectives in the game required teamwork

The objectives in the game were more easily achieved using teamwork

The game was more fun when using team-work

Competitive Social Presence: Behavioural & Cognitive Involvement

I was aware of my opponents

I acted with my opponents in mind

I reacted to my opponents actions

It seemed as though my opponents were acting with awareness of my actions

I knew what my opponents was trying to achieve

I was aware that my opponents might work out my goals

The actions of my opponents affected the way I played

My opponents played a significant role in my experience of the game

I felt I affected my opponents actions

Competitive Social Presence: Competitive Engagement

It was satisfying when I felt I got the upper hand

My opponents were challenging

The game was a battle of skill

The game was a battle of wits

It was fun to play against my opponents

I could easily have lost

I felt the need to beat my opponents

I tried to outwit my opponents

I think my opponents were trying to outwit me

Competitive Social Presence: Competitive Sensation

I felt the sensation of being hunted

I felt tense/on edge while playing my opponents

My opponents created a sense of urgency

The presence of my opponents influenced my plans and actions during the game

Competitive Social Presence: Competitive Motivation

The desire to beat the enemy motivated me

I wanted to appear capable to my enemies

Losing made me want to try harder

Cooperative Social Presence: Team Identification

I was aware of my team

I acted with my teammates in mind

I considered my team-mates possible plans/thoughts

I felt like I was part of a team

I felt a social connection to my team-mates (camaraderie)

Cooperative Social Presence: Team Security

I felt my team-mates were looking out for me

I felt I took more risks in game when I had my team-mates with me

I felt I contributed to the team

I felt the team helped me

I felt I had played my role in the team

Cooperative Social Presence: Cooperative Motivation

The performance of the team was most important to me

My personal performance was most important to me

My actions were determined by the objectives of the team

I put my own survival above the immediate team goals

I wanted to appear capable to my team-mates

I didnt want my team to think Id let them down

Being part of a team motivated me

I felt responsible for achieving the teams objectives

I wanted my team to value me

I did not want to let my team down

I felt that being part of my team increased my desire to keep playing

Cooperative Social Presence: Social Action

I felt my actions affected my team-mates actions

I felt my actions made a difference to my team-mates

My team-mates actions affected my actions

The actions of my team-mates affected my thoughts and plans

My team-mates played a significant role in my experience of the game

My team-mates played a significant role in my enjoyment of the game

Cooperative Social Presence: Social Commitments

I felt my team was committed to working together

I made an effort to work with my team mates

I felt my team shared a common overall aim

I felt my team shared common short term goals

It was as much about the team as about my own game

I felt obliged to help my team

I wanted to help my team

Cooperative Social Presence: Team-mate Value

My team-mates were useful

My team-mates helped me achieve my objectives

My team-mates contributed to the success of the team

My team communicated well

I read the actions of my team

The team had a mutual understanding

I felt I could communicate effectively with my team in the game

Team Based Confirmation

The desire to help my team beat the opposition motivated me

I didnt mind dying if it meant my team would win

I was happy to take a boring role if it meant the team would win

I felt I was playing my part in fighting the enemy

The presence of the other team motivated me

7.2.4 Chivalry Study Data: Module Items Correlation

General SP

Item	Score
The.game.was.challenging	
The.game.was.challenging	1.00000000
The.game.was.engaging	0.20327504
I.felt.my.actions.in.game.were.significant.to.others	-0.01241969
The.actions.of.others.were.significant.to.me	0.06186358
I.was.aware.of.the.presence.of.other.players	0.04734606
The.awareness.of.other.players.affected.the.way.I.played	-0.11772629
The.game.was.engaging	
The.game.was.challenging	0.20327504
The.game.was.engaging	1.00000000
I.felt.my.actions.in.game.were.significant.to.others	0.64879766
The.actions.of.others.were.significant.to.me	0.21514713
I.was.aware.of.the.presence.of.other.players	0.09258906
The.awareness.of.other.players.affected.the.way.I.played	-0.13968606
I.felt.my.actions.in.game.were.significant.to.others	
The.game.was.challenging	-0.012419686
The.game.was.engaging	0.648797664
I.felt.my.actions.in.game.were.significant.to.others	1.000000000
The.actions.of.others.were.significant.to.me	0.420269537
I.was.aware.of.the.presence.of.other.players	0.376641380
The.awareness.of.other.players.affected.the.way.I.played	-0.006049982
The.actions.of.others.were.significant.to.me	
The.game.was.challenging	0.06186358
The.game.was.engaging	0.21514713
I.felt.my.actions.in.game.were.significant.to.others	0.42026954
The.actions.of.others.were.significant.to.me	1.00000000
I.was.aware.of.the.presence.of.other.players	0.17101150
The.awareness.of.other.players.affected.the.way.I.played	0.06523281
I.was.aware.of.the.presence.of.other.players	
The.game.was.challenging	0.04734606
The.game.was.engaging	0.09258906
I.felt.my.actions.in.game.were.significant.to.others	0.37664138
The.actions.of.others.were.significant.to.me	0.17101150
I.was.aware.of.the.presence.of.other.players	1.00000000
The.awareness.of.other.players.affected.the.way.I.played	0.19661675
The.awareness.of.other.players.affected.the.way.I.played	
The.game.was.challenging	-0.117726294
The.game.was.engaging	-0.139686059
I.felt.my.actions.in.game.were.significant.to.others	-0.006049982

Team Task

Item	Score
The.objectives.in.the.game.required.teamwork	
The.objectives.in.the.game.required.teamwork	1.0000000
The.objectives.in.the.game.were.more.easily.achieved.using.teamwork	0.2216991
The.game.was.more.fun.when.using.team.work	0.2503152
The.objectives.in.the.game.were.more.easily.achieved.using.teamwork	
The.objectives.in.the.game.required.teamwork	0.2216991
The.objectives.in.the.game.were.more.easily.achieved.using.teamwork	1.0000000
The.game.was.more.fun.when.using.team.work	0.2236068
The.game.was.more.fun.when.using.team.work	
The.objectives.in.the.game.required.teamwork	0.2503152
The.objectives.in.the.game.were.more.easily.achieved.using.teamwork	0.2236068
The.game.was.more.fun.when.using.team.work	1.0000000

Table 7.3: Team Task Item Correlations

Team vs Team

Item	Score
The.desire.to.help.my.team.beat.the.opposition.motivated.me	
The.desire.to.help.my.team.beat.the.opposition.motivated.me	1.0000000
I.didnt.mind.dying.if.it.meant.my.team.would.win	0.2432156
I.was.happy.to.take.a.boring.role.if.it.meant.the.team.would.win	0.3358902
I.felt.I.was.playing.my.part.in.fighting.the.enemy	0.1516795
The.presence.of.the.other.team.motivated.me	0.5591964
I.didnt.mind.dying.if.it.meant.my.team.would.win	
The.desire.to.help.my.team.beat.the.opposition.motivated.me	0.24321557
I.didnt.mind.dying.if.it.meant.my.team.would.win	1.00000000
I.was.happy.to.take.a.boring.role.if.it.meant.the.team.would.win	0.45611158
I.felt.I.was.playing.my.part.in.fighting.the.enemy	0.38728301
The.presence.of.the.other.team.motivated.me	-0.04238399
I.was.happy.to.take.a.boring.role.if.it.meant.the.team.would.win	
The.desire.to.help.my.team.beat.the.opposition.motivated.me	0.3358902
I.didnt.mind.dying.if.it.meant.my.team.would.win	0.4561116
I.was.happy.to.take.a.boring.role.if.it.meant.the.team.would.win	1.0000000
I.felt.I.was.playing.my.part.in.fighting.the.enemy	0.2784203
The.presence.of.the.other.team.motivated.me	0.2180987

Table 7.4: Team vs Team Item Correlations

Item	Score
I.felt.I.was.playing.my.part.in.fighting.the.enemy	
The.desire.to.help.my.team.beat.the.opposition.motivated.me	0.1516795
I.didnt.mind.dying.if.it.meant.my.team.would.win	0.3872830
I.was.happy.to.take.a.boring.role.if.it.meant.the.team.would.win	0.2784203
I.felt.I.was.playing.my.part.in.fighting.the.enemy	1.0000000
The.presence.of.the.other.team.motivated.me	0.1163510
The.presence.of.the.other.team.motivated.me	
The.desire.to.help.my.team.beat.the.opposition.motivated.me	0.55919642
I.didnt.mind.dying.if.it.meant.my.team.would.win	-0.04238399
I.was.happy.to.take.a.boring.role.if.it.meant.the.team.would.win	0.21809870
I.felt.I.was.playing.my.part.in.fighting.the.enemy	0.11635099
The.presence.of.the.other.team.motivated.me	1.00000000

Table 7.5: Team vs Team Item Correlations

Competitive Social Presence: Behavioural & Cognitive Involvement

Item	Score
I.was.aware.of.my.opponents	
I.was.aware.of.my.opponents	1.00000000
I.acted.with.my.opponents.in.mind	0.41670004
I.reacted.to.my.opponents.actions	0.17097391
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.17512368
I.knew.what.my.opponents.was.trying.to.achieve	0.09657133
I.was.aware.that.my.opponents.might.work.out.my.goals	0.10889948
The.actions.of.my.opponents.affected.the.way.I.played	0.12305057
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.26370321
I.felt.I.affected.my.opponents.actions	-0.02324426
I.acted.with.my.opponents.in.mind	
I.was.aware.of.my.opponents	0.41670004
I.acted.with.my.opponents.in.mind	1.00000000
I.reacted.to.my.opponents.actions	0.42662639
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.08951307
I.knew.what.my.opponents.was.trying.to.achieve	0.02668329
I.was.aware.that.my.opponents.might.work.out.my.goals	0.17076264
The.actions.of.my.opponents.affected.the.way.I.played	0.33163512
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.12533023
I.felt.I.affected.my.opponents.actions	0.10925598
I.reacted.to.my.opponents.actions	
I.was.aware.of.my.opponents	0.170973906
I.acted.with.my.opponents.in.mind	0.426626395
I.reacted.to.my.opponents.actions	1.000000000
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.001649797
I.knew.what.my.opponents.was.trying.to.achieve	0.053324526
I.was.aware.that.my.opponents.might.work.out.my.goals	0.121570916
The.actions.of.my.opponents.affected.the.way.I.played	0.382545514
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.013652752
I.felt.I.affected.my.opponents.actions	0.186997100

Table 7.6: Behavioural & Cognitive Involvement Item Correlations

Item	Score
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	
I.was.aware.of.my.opponents	0.175123684
I.acted.with.my.opponents.in.mind	0.089513071
I.reacted.to.my.opponents.actions	0.001649797
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	1.000000000
I.knew.what.my.opponents.was.trying.to.achieve	0.408175490
I.was.aware.that.my.opponents.might.work.out.my.goals	0.363231825
The.actions.of.my.opponents.affected.the.way.I.played	0.132225863
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.231335459
I.felt.I.affected.my.opponents.actions	0.507036330
I.knew.what.my.opponents.was.trying.to.achieve	
I.was.aware.of.my.opponents	0.09657133
I.acted.with.my.opponents.in.mind	0.02668329
I.reacted.to.my.opponents.actions	0.05332453
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.40817549
I.knew.what.my.opponents.was.trying.to.achieve	1.00000000
I.was.aware.that.my.opponents.might.work.out.my.goals	0.59691889
The.actions.of.my.opponents.affected.the.way.I.played	0.18132855
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.14801096
I.felt.I.affected.my.opponents.actions	0.31831360

Table 7.7: Behavioural & Cognitive Involvement Item Correlations

Item	Score
I.was.aware.that.my.opponents.might.work.out.my.goals	
I.was.aware.of.my.opponents	0.1088995
I.acted.with.my.opponents.in.mind	0.1707626
I.reacted.to.my.opponents.actions	0.1215709
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.3632318
I.knew.what.my.opponents.was.trying.to.achieve	0.5969189
I.was.aware.that.my.opponents.might.work.out.my.goals	1.0000000
The.actions.of.my.opponents.affected.the.way.I.played	0.5501974
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.2556242
I.felt.I.affected.my.opponents.actions	0.3657108
The.actions.of.my.opponents.affected.the.way.I.played	
I.was.aware.of.my.opponents	0.1230506
I.acted.with.my.opponents.in.mind	0.3316351
I.reacted.to.my.opponents.actions	0.3825455
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.1322259
I.knew.what.my.opponents.was.trying.to.achieve	0.1813285
I.was.aware.that.my.opponents.might.work.out.my.goals	0.5501974
The.actions.of.my.opponents.affected.the.way.I.played	1.0000000
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.5352182
I.felt.I.affected.my.opponents.actions	0.2813152
My.opponents.played.a.significant.role.in.my.experience.of.the.game	
I.was.aware.of.my.opponents	0.26370321
I.acted.with.my.opponents.in.mind	0.12533023
I.reacted.to.my.opponents.actions	0.01365275
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.23133546
I.knew.what.my.opponents.was.trying.to.achieve	0.14801096
I.was.aware.that.my.opponents.might.work.out.my.goals	0.25562418
The.actions.of.my.opponents.affected.the.way.I.played	0.53521819
My.opponents.played.a.significant.role.in.my.experience.of.the.game	1.00000000
I.felt.I.affected.my.opponents.actions	0.22350778
I.felt.I.affected.my.opponents.actions	
I.was.aware.of.my.opponents	-0.02324426
I.acted.with.my.opponents.in.mind	0.10925598
I.reacted.to.my.opponents.actions	0.18699710
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.50703633
I.knew.what.my.opponents.was.trying.to.achieve	0.31831360
I.was.aware.that.my.opponents.might.work.out.my.goals	0.36571078
The.actions.of.my.opponents.affected.the.way.I.played	0.28131523
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.22350778
I.felt.I.affected.my.opponents.actions	1.00000000

Table 7.8: Behavioural & Cognitive Involvement Item Correlations

Competitive Social Presence: Competitive Engagement

Item	Score
It.was.satisfying.when.I.felt.I.got.the.upper.hand	
It.was.satisfying.when.I.felt.I.got.the.upper.hand	1.000000000
My.opponents.were.challenging	0.206508138
The.game.was.a.battle.of.skill	0.005571485
The.game.was.a.battle.of.wits	-0.085472473
It.was.fun.to.play.against.my.opponents	-0.025954859
I.could.easily.have.lost	0.405672126
I.felt.the.need.to.beat.my.opponents	0.516601607
I.tried.to.outwit.my.opponents	0.047675297
I.think.my.opponents.were.trying.to.outwit.me	0.202395295
My.opponents.were.challenging	
It.was.satisfying.when.I.felt.I.got.the.upper.hand	0.20650814
My.opponents.were.challenging	1.00000000
The.game.was.a.battle.of.skill	0.17020898
The.game.was.a.battle.of.wits	0.06572092
It.was.fun.to.play.against.my.opponents	0.15160505
I.could.easily.have.lost	0.34846667
I.felt.the.need.to.beat.my.opponents	-0.04600789
I.tried.to.outwit.my.opponents	-0.17591731
I.think.my.opponents.were.trying.to.outwit.me	0.36015939
The.game.was.a.battle.of.skill	
It.was.satisfying.when.I.felt.I.got.the.upper.hand	0.005571485
My.opponents.were.challenging	0.170208982
The.game.was.a.battle.of.skill	1.000000000
The.game.was.a.battle.of.wits	0.396681734
It.was.fun.to.play.against.my.opponents	0.562955429
I.could.easily.have.lost	-0.022704696
I.felt.the.need.to.beat.my.opponents	0.103505862
I.tried.to.outwit.my.opponents	-0.080377271
I.think.my.opponents.were.trying.to.outwit.me	0.192826827

Table 7.9: Engagement Item Correlations

Item	Score
The.game.was.a.battle.of.wits	
It.was.satisfying.when.I.felt.I.got.the.upper.hand	-0.08547247
My.opponents.were.challenging	0.06572092
The.game.was.a.battle.of.skill	0.39668173
The.game.was.a.battle.of.wits	1.00000000
It.was.fun.to.play.against.my.opponents	0.57457233
I.could.easily.have.lost	-0.21907537
I.felt.the.need.to.beat.my.opponents	0.08321560
I.tried.to.outwit.my.opponents	0.31376926
I.think.my.opponents.were.trying.to.outwit.me	0.17604507
It.was.fun.to.play.against.my.opponents	
It.was.satisfying.when.I.felt.I.got.the.upper.hand	-0.025954859
My.opponents.were.challenging	0.151605048
The.game.was.a.battle.of.skill	0.562955429
The.game.was.a.battle.of.wits	0.574572332
It.was.fun.to.play.against.my.opponents	1.000000000
I.could.easily.have.lost	-0.265239185
I.felt.the.need.to.beat.my.opponents	0.001753396
I.tried.to.outwit.my.opponents	0.182591571
I.think.my.opponents.were.trying.to.outwit.me	0.257403927

Table 7.10: Engagement Item Correlations

Item	Score
I.could.easily.have.lost	
It.was.satisfying.when.I.felt.I.got.the.upper.hand	0.4056721
My.opponents.were.challenging	0.3484667
The.game.was.a.battle.of.skill	-0.0227047
The.game.was.a.battle.of.wits	-0.2190754
It.was.fun.to.play.against.my.opponents	-0.2652392
I.could.easily.have.lost	1.0000000
I.felt.the.need.to.beat.my.opponents	0.3051967
I.tried.to.outwit.my.opponents	-0.1225487
I.think.my.opponents.were.trying.to.outwit.me	0.3396208
I.felt.the.need.to.beat.my.opponents	
It.was.satisfying.when.I.felt.I.got.the.upper.hand	0.516601607
My.opponents.were.challenging	-0.046007892
The.game.was.a.battle.of.skill	0.103505862
The.game.was.a.battle.of.wits	0.083215601
It.was.fun.to.play.against.my.opponents	0.001753396
I.could.easily.have.lost	0.305196743
I.felt.the.need.to.beat.my.opponents	1.000000000
I.tried.to.outwit.my.opponents	0.267320840
I.think.my.opponents.were.trying.to.outwit.me	0.076407575
I.tried.to.outwit.my.opponents	
It.was.satisfying.when.I.felt.I.got.the.upper.hand	0.04767530
My.opponents.were.challenging	-0.17591731
The.game.was.a.battle.of.skill	-0.08037727
The.game.was.a.battle.of.wits	0.31376926
It.was.fun.to.play.against.my.opponents	0.18259157
I.could.easily.have.lost	-0.12254869
I.felt.the.need.to.beat.my.opponents	0.26732084
I.tried.to.outwit.my.opponents	1.00000000
I.think.my.opponents.were.trying.to.outwit.me	0.05210598
I.think.my.opponents.were.trying.to.outwit.me	
It.was.satisfying.when.I.felt.I.got.the.upper.hand	0.20239529
My.opponents.were.challenging	0.36015939
The.game.was.a.battle.of.skill	0.19282683
The.game.was.a.battle.of.wits	0.17604507
It.was.fun.to.play.against.my.opponents	0.25740393
I.could.easily.have.lost	0.33962081
I.felt.the.need.to.beat.my.opponents	0.07640758
I.tried.to.outwit.my.opponents	0.05210598
I.think.my.opponents.were.trying.to.outwit.me	1.00000000

Table 7.11: Engagement Item Correlations

Competitive Social Presence: Competitive Sensation

Item	Score
I.felt.the.sensation.of.being.hunted	
I.felt.the.sensation.of.being.hunted	1.00000000
I.felt.tense.on.edge.while.playing.my.opponents	0.36032783
My.opponents.created.a.sense.of.urgency	0.23382050
The.presence.of.my.opponents.influenced.my.plans.and.actions.during.the.game	0.08860799
I.felt.tense.on.edge.while.playing.my.opponents	
I.felt.the.sensation.of.being.hunted	0.36032783
I.felt.tense.on.edge.while.playing.my.opponents	1.00000000
My.opponents.created.a.sense.of.urgency	0.61958041
The.presence.of.my.opponents.influenced.my.plans.and.actions.during.the.game	0.05146491
My.opponents.created.a.sense.of.urgency	
I.felt.the.sensation.of.being.hunted	0.2338205
I.felt.tense.on.edge.while.playing.my.opponents	0.6195804
My.opponents.created.a.sense.of.urgency	1.0000000
The.presence.of.my.opponents.influenced.my.plans.and.actions.during.the.game	0.2520594
The.presence.of.my.opponents.influenced.my.plans.and.actions.during.the.game	
I.felt.the.sensation.of.being.hunted	0.08860799
I.felt.tense.on.edge.while.playing.my.opponents	0.05146491
My.opponents.created.a.sense.of.urgency	0.25205937
The.presence.of.my.opponents.influenced.my.plans.and.actions.during.the.game	1.00000000

Table 7.12: Sensation Item Correlations

Competitive Social Presence: Competitive Motivation

Item	Score
The.desire.to.beat.the.enemy.motivated.me	
The.desire.to.beat.the.enemy.motivated.me	1.0000000
I.wanted.to.appear.capable.to.my.enemies	0.3067047
Losing.made.me.want.to.try.harder	0.4871629
I.wanted.to.appear.capable.to.my.enemies	
The.desire.to.beat.the.enemy.motivated.me	0.3067047
I.wanted.to.appear.capable.to.my.enemies	1.0000000
Losing.made.me.want.to.try.harder	0.2283293
Losing.made.me.want.to.try.harder	
The.desire.to.beat.the.enemy.motivated.me	0.4871629
I.wanted.to.appear.capable.to.my.enemies	0.2283293
Losing.made.me.want.to.try.harder	1.0000000

Table 7.13: Motivation Item Correlations

Cooperative Social Presence: Team Identification

Item	Score
I.was.aware.of.my.team	
I.was.aware.of.my.team	1.0000000
I.acted.with.my.teammates.in.mind	0.1449918
I.considered.my.team.mates.possible.plans.thoughts	0.4116518
I.felt.like.I.was.part.of.a.team	0.2606071
I.felt.a.social.connection.to.my.team.mates..camaraderie.	0.3915508
I.acted.with.my.teammates.in.mind	
I.was.aware.of.my.team	0.1449918
I.acted.with.my.teammates.in.mind	1.0000000
I.considered.my.team.mates.possible.plans.thoughts	0.1305070
I.felt.like.I.was.part.of.a.team	0.2183242
I.felt.a.social.connection.to.my.team.mates..camaraderie.	0.3019329
I.considered.my.team.mates.possible.plans.thoughts	
I.was.aware.of.my.team	0.4116518
I.acted.with.my.teammates.in.mind	0.1305070
I.considered.my.team.mates.possible.plans.thoughts	1.0000000
I.felt.like.I.was.part.of.a.team	0.4182193
I.felt.a.social.connection.to.my.team.mates..camaraderie.	0.2673470
I.felt.like.I.was.part.of.a.team	
I.was.aware.of.my.team	0.2606071
I.acted.with.my.teammates.in.mind	0.2183242
I.considered.my.team.mates.possible.plans.thoughts	0.4182193
I.felt.like.I.was.part.of.a.team	1.0000000
I.felt.a.social.connection.to.my.team.mates..camaraderie.	0.6253790
I.felt.a.social.connection.to.my.team.mates..camaraderie.	
I.was.aware.of.my.team	0.3915508
I.acted.with.my.teammates.in.mind	0.3019329
I.considered.my.team.mates.possible.plans.thoughts	0.2673470
I.felt.like.I.was.part.of.a.team	0.6253790
I.felt.a.social.connection.to.my.team.mates..camaraderie.	1.0000000

Table 7.14: Team Identification Item Correlations

Cooperative Social Presence: Team Security

Item	Score
I.felt.my.team.mates.were.looking.out.for.me	
I.felt.my.team.mates.were.looking.out.for.me	1.0000000
I.felt.I.took.more.risks.in.game.when.I.had.my.team.mates.with.me	0.3425909
I.felt.I.contributed.to.the.team	0.2640781
I.felt.the.team.helped.me	0.6544261
I.felt.I.had.played.my.role.in.the.team	0.2824064
I.felt.I.took.more.risks.in.game.when.I.had.my.team.mates.with.me	
I.felt.my.team.mates.were.looking.out.for.me	0.3425909
I.felt.I.took.more.risks.in.game.when.I.had.my.team.mates.with.me	1.0000000
I.felt.I.contributed.to.the.team	0.2097698
I.felt.the.team.helped.me	0.5410149
I.felt.I.had.played.my.role.in.the.team	0.1575051
I.felt.I.contributed.to.the.team	
I.felt.my.team.mates.were.looking.out.for.me	0.2640781
I.felt.I.took.more.risks.in.game.when.I.had.my.team.mates.with.me	0.2097698
I.felt.I.contributed.to.the.team	1.0000000
I.felt.the.team.helped.me	0.2128627
I.felt.I.had.played.my.role.in.the.team	0.4419740
I.felt.the.team.helped.me	
I.felt.my.team.mates.were.looking.out.for.me	0.65442612
I.felt.I.took.more.risks.in.game.when.I.had.my.team.mates.with.me	0.54101488
I.felt.I.contributed.to.the.team	0.21286274
I.felt.the.team.helped.me	1.00000000
I.felt.I.had.played.my.role.in.the.team	0.01494482
I.felt.I.had.played.my.role.in.the.team	
I.felt.my.team.mates.were.looking.out.for.me	0.28240645
I.felt.I.took.more.risks.in.game.when.I.had.my.team.mates.with.me	0.15750510
I.felt.I.contributed.to.the.team	0.44197397
I.felt.the.team.helped.me	0.01494482
I.felt.I.had.played.my.role.in.the.team	1.00000000

Table 7.15: Team Security Item Correlations

Cooperative Social Presence: Cooperative Motivation

Item	Score
The.performance.of.the.team.was.most.important.to.me	
The.performance.of.the.team.was.most.important.to.me	1.00000000
My.personal.performance.was.most.important.to.me	-0.35785389
My.actions.were.determined.by.the.objectives.of.the.team	0.39883323
I.put.my.own.survival.above.the.immediate.team.goals	-0.25768969
I.wanted.to.appear.capable.to.my.team.mates	0.03311331
I.didnt.want.my.team.to.think.Id.let.them.down	0.34058402
Being.part.of.a.team.motivated.me	0.35697373
I.felt.responsible.for.achieving.the.teams.objectives	0.26398668
I.wanted.my.team.to.value.me	0.22440910
I.did.not.want.to.let.my.team.down	0.29215554
I.felt.that.being.part.of.my.team.increased.my.desire.to.keep.playing	0.28359598
My.personal.performance.was.most.important.to.me	
The.performance.of.the.team.was.most.important.to.me	-0.35785389
My.personal.performance.was.most.important.to.me	1.00000000
My.actions.were.determined.by.the.objectives.of.the.team	0.03317536
I.put.my.own.survival.above.the.immediate.team.goals	0.31809870
I.wanted.to.appear.capable.to.my.team.mates	0.17352624
I.didnt.want.my.team.to.think.Id.let.them.down	-0.12145141
Being.part.of.a.team.motivated.me	-0.29716641
I.felt.responsible.for.achieving.the.teams.objectives	-0.15926034
I.wanted.my.team.to.value.me	0.10105256
I.did.not.want.to.let.my.team.down	0.03376786
I.felt.that.being.part.of.my.team.increased.my.desire.to.keep.playing	-0.07808765
My.actions.were.determined.by.the.objectives.of.the.team	
The.performance.of.the.team.was.most.important.to.me	0.39883323
My.personal.performance.was.most.important.to.me	0.03317536
My.actions.were.determined.by.the.objectives.of.the.team	1.00000000
I.put.my.own.survival.above.the.immediate.team.goals	-0.32352768
I.wanted.to.appear.capable.to.my.team.mates	0.09996162
I.didnt.want.my.team.to.think.Id.let.them.down	0.17798176
Being.part.of.a.team.motivated.me	0.13162557
I.felt.responsible.for.achieving.the.teams.objectives	0.18889755
I.wanted.my.team.to.value.me	0.10229517
I.did.not.want.to.let.my.team.down	0.23118252
I.felt.that.being.part.of.my.team.increased.my.desire.to.keep.playing	0.12512034

Table 7.16: Motivation Item Correlations

Item	Score
I.put.my.own.survival.above.the.immediate.team.goals	
The.performance.of.the.team.was.most.important.to.me	-0.25768969
My.personal.performance.was.most.important.to.me	0.31809870
My.actions.were.determined.by.the.objectives.of.the.team	-0.32352768
I.put.my.own.survival.above.the.immediate.team.goals	1.00000000
I.wanted.to.appear.capable.to.my.team.mates	0.08374731
I.didnt.want.my.team.to.think.Id.let.them.down	-0.22564861
Being.part.of.a.team.motivated.me	-0.09550363
I.felt.responsible.for.achieving.the.teams.objectives	-0.13226903
I.wanted.my.team.to.value.me	0.08395800
I.did.not.want.to.let.my.team.down	-0.12085259
I.felt.that.being.part.of.my.team.increased.my.desire.to.keep.playing	0.18090200

Table 7.17: Motivation Item Correlations

Item	Score
I.wanted.to.appear.capable.to.my.team.mates	
The.performance.of.the.team.was.most.important.to.me	0.03311331
My.personal.performance.was.most.important.to.me	0.17352624
My.actions.were.determined.by.the.objectives.of.the.team	0.09996162
I.put.my.own.survival.above.the.immediate.team.goals	0.08374731
I.wanted.to.appear.capable.to.my.team.mates	1.00000000
I.didnt.want.my.team.to.think.Id.let.them.down	0.48861166
Being.part.of.a.team.motivated.me	0.19757927
I.felt.responsible.for.achieving.the.teams.objectives	0.23077487
I.wanted.my.team.to.value.me	0.68693212
I.did.not.want.to.let.my.team.down	0.56814154
I.felt.that.being.part.of.my.team.increased.my.desire.to.keep.playing	0.19301345
I.didnt.want.my.team.to.think.Id.let.them.down	
The.performance.of.the.team.was.most.important.to.me	0.34058402
My.personal.performance.was.most.important.to.me	-0.12145141
My.actions.were.determined.by.the.objectives.of.the.team	0.17798176
I.put.my.own.survival.above.the.immediate.team.goals	-0.22564861
I.wanted.to.appear.capable.to.my.team.mates	0.48861166
I.didnt.want.my.team.to.think.Id.let.them.down	1.00000000
Being.part.of.a.team.motivated.me	0.41482347
I.felt.responsible.for.achieving.the.teams.objectives	0.02428133
I.wanted.my.team.to.value.me	0.48773373
I.did.not.want.to.let.my.team.down	0.55903266
I.felt.that.being.part.of.my.team.increased.my.desire.to.keep.playing	0.21143167
Being.part.of.a.team.motivated.me	
The.performance.of.the.team.was.most.important.to.me	0.35697373
My.personal.performance.was.most.important.to.me	-0.29716641
My.actions.were.determined.by.the.objectives.of.the.team	0.13162557
I.put.my.own.survival.above.the.immediate.team.goals	-0.09550363
I.wanted.to.appear.capable.to.my.team.mates	0.19757927
I.didnt.want.my.team.to.think.Id.let.them.down	0.41482347
Being.part.of.a.team.motivated.me	1.00000000
I.felt.responsible.for.achieving.the.teams.objectives	-0.10857195
I.wanted.my.team.to.value.me	0.27545248
I.did.not.want.to.let.my.team.down	0.35044968
I.felt.that.being.part.of.my.team.increased.my.desire.to.keep.playing	0.57170276

Table 7.18: Motivation Item Correlations

Item	Score
I.felt.responsible.for.achieving.the.teams.objectives	
The.performance.of.the.team.was.most.important.to.me	0.26398668
My.personal.performance.was.most.important.to.me	-0.15926034
My.actions.were.determined.by.the.objectives.of.the.team	0.18889755
I.put.my.own.survival.above.the.immediate.team.goals	-0.13226903
I.wanted.to.appear.capable.to.my.team.mates	0.23077487
I.didnt.want.my.team.to.think.Id.let.them.down	0.02428133
Being.part.of.a.team.motivated.me	-0.10857195
I.felt.responsible.for.achieving.the.teams.objectives	1.00000000
I.wanted.my.team.to.value.me	0.38643369
I.did.not.want.to.let.my.team.down	0.16079430
I.felt.that.being.part.of.my.team.increased.my.desire.to.keep.playing	0.01657401

Table 7.19: Motivation Item Correlations

Item	Score
I.wanted.my.team.to.value.me	
The.performance.of.the.team.was.most.important.to.me	0.2244091
My.personal.performance.was.most.important.to.me	0.1010526
My.actions.were.determined.by.the.objectives.of.the.team	0.1022952
I.put.my.own.survival.above.the.immediate.team.goals	0.0839580
I.wanted.to.appear.capable.to.my.team.mates	0.6869321
I.didnt.want.my.team.to.think.Id.let.them.down	0.4877337
Being.part.of.a.team.motivated.me	0.2754525
I.felt.responsible.for.achieving.the.teams.objectives	0.3864337
I.wanted.my.team.to.value.me	1.0000000
I.did.not.want.to.let.my.team.down	0.4489837
I.felt.that.being.part.of.my.team.increased.my.desire.to.keep.playing	0.3264283
I.did.not.want.to.let.my.team.down	
The.performance.of.the.team.was.most.important.to.me	0.29215554
My.personal.performance.was.most.important.to.me	0.03376786
My.actions.were.determined.by.the.objectives.of.the.team	0.23118252
I.put.my.own.survival.above.the.immediate.team.goals	-0.12085259
I.wanted.to.appear.capable.to.my.team.mates	0.56814154
I.didnt.want.my.team.to.think.Id.let.them.down	0.55903266
Being.part.of.a.team.motivated.me	0.35044968
I.felt.responsible.for.achieving.the.teams.objectives	0.16079430
I.wanted.my.team.to.value.me	0.44898374
I.did.not.want.to.let.my.team.down	1.00000000
I.felt.that.being.part.of.my.team.increased.my.desire.to.keep.playing	0.14581191
I.felt.that.being.part.of.my.team.increased.my.desire.to.keep.playing	
The.performance.of.the.team.was.most.important.to.me	0.28359598
My.personal.performance.was.most.important.to.me	-0.07808765
My.actions.were.determined.by.the.objectives.of.the.team	0.12512034
I.put.my.own.survival.above.the.immediate.team.goals	0.18090200
I.wanted.to.appear.capable.to.my.team.mates	0.19301345
I.didnt.want.my.team.to.think.Id.let.them.down	0.21143167
Being.part.of.a.team.motivated.me	0.57170276
I.felt.responsible.for.achieving.the.teams.objectives	0.01657401
I.wanted.my.team.to.value.me	0.32642834
I.did.not.want.to.let.my.team.down	0.14581191
I.felt.that.being.part.of.my.team.increased.my.desire.to.keep.playing	1.00000000

Table 7.20: Motivation Item Correlations

Cooperative Social Presence: Social Action

Item	Score
I.felt.my.actions.affected.my.team.mates.actions	
I.felt.my.actions.affected.my.team.mates.actions	1.0000000
I.felt.my.actions.made.a.difference.to.my.team.mates	0.5873227
My.team.mates.actions.affected.my.actions	0.2624037
The.actions.of.my.team.mates.affected.my.thoughts.and.plans	0.2057166
My.team.mates.played.a.significant.role.in.my.experience.of.the.game	0.2828596
My.team.mates.played.a.significant.role.in.my.enjoyment.of.the.game	0.2598009
I.felt.my.actions.made.a.difference.to.my.team.mates	
I.felt.my.actions.affected.my.team.mates.actions	0.58732270
I.felt.my.actions.made.a.difference.to.my.team.mates	1.00000000
My.team.mates.actions.affected.my.actions	0.27686936
The.actions.of.my.team.mates.affected.my.thoughts.and.plans	0.13317673
My.team.mates.played.a.significant.role.in.my.experience.of.the.game	0.06726521
My.team.mates.played.a.significant.role.in.my.enjoyment.of.the.game	0.09763667
My.team.mates.actions.affected.my.actions	
I.felt.my.actions.affected.my.team.mates.actions	0.2624037
I.felt.my.actions.made.a.difference.to.my.team.mates	0.2768694
My.team.mates.actions.affected.my.actions	1.0000000
The.actions.of.my.team.mates.affected.my.thoughts.and.plans	0.7005132
My.team.mates.played.a.significant.role.in.my.experience.of.the.game	0.3646985
My.team.mates.played.a.significant.role.in.my.enjoyment.of.the.game	0.3197556

Table 7.21: Social Action Item Correlations

Item	Score
The.actions.of.my.team.mates.affected.my.thoughts.and.plans	
I.felt.my.actions.affected.my.team.mates.actions	0.2057166
I.felt.my.actions.made.a.difference.to.my.team.mates	0.1331767
My.team.mates.actions.affected.my.actions	0.7005132
The.actions.of.my.team.mates.affected.my.thoughts.and.plans	1.0000000
My.team.mates.played.a.significant.role.in.my.experience.of.the.game	0.4459924
My.team.mates.played.a.significant.role.in.my.enjoyment.of.the.game	0.3148952
My.team.mates.played.a.significant.role.in.my.experience.of.the.game	
I.felt.my.actions.affected.my.team.mates.actions	0.28285964
I.felt.my.actions.made.a.difference.to.my.team.mates	0.06726521
My.team.mates.actions.affected.my.actions	0.36469854
The.actions.of.my.team.mates.affected.my.thoughts.and.plans	0.44599237
My.team.mates.played.a.significant.role.in.my.experience.of.the.game	1.00000000
My.team.mates.played.a.significant.role.in.my.enjoyment.of.the.game	0.64910043
My.team.mates.played.a.significant.role.in.my.enjoyment.of.the.game	
I.felt.my.actions.affected.my.team.mates.actions	0.25980092
I.felt.my.actions.made.a.difference.to.my.team.mates	0.09763667
My.team.mates.actions.affected.my.actions	0.31975565
The.actions.of.my.team.mates.affected.my.thoughts.and.plans	0.31489524
My.team.mates.played.a.significant.role.in.my.experience.of.the.game	0.64910043
My.team.mates.played.a.significant.role.in.my.enjoyment.of.the.game	1.00000000

Table 7.22: Social Action Item Correlations

Cooperative Social Presence: Social Commitments

Item	Score
I.felt.my.team.was.committed.to.working.together	
I.felt.my.team.was.committed.to.working.together	1.0000000
I.made.an.effort.to.work.with.my.team.mates	0.5679918
I.felt.my.team.shared.a.common.overall.aim	0.3372888
I.felt.my.team.shared.common.short.term.goals	0.3479903
It.was.as.much.about.the.team.as.about.my.own.game	0.4541267
I.felt.obliged.to.help.my.team	0.2869885
I.wanted.to.help.my.team	0.3250418
I.made.an.effort.to.work.with.my.team.mates	
I.felt.my.team.was.committed.to.working.together	0.5679918
I.made.an.effort.to.work.with.my.team.mates	1.0000000
I.felt.my.team.shared.a.common.overall.aim	0.3171935
I.felt.my.team.shared.common.short.term.goals	0.1664126
It.was.as.much.about.the.team.as.about.my.own.game	0.6005948
I.felt.obliged.to.help.my.team	0.4842424
I.wanted.to.help.my.team	0.6034965
I.felt.my.team.shared.a.common.overall.aim	
I.felt.my.team.was.committed.to.working.together	0.337288757
I.made.an.effort.to.work.with.my.team.mates	0.317193538
I.felt.my.team.shared.a.common.overall.aim	1.000000000
I.felt.my.team.shared.common.short.term.goals	0.482459505
It.was.as.much.about.the.team.as.about.my.own.game	0.394123962
I.felt.obliged.to.help.my.team	-0.008695956
I.wanted.to.help.my.team	0.137399616

Table 7.23: Social Commitments Item Correlations

Item	Score
I.felt.my.team.shared.common.short.term.goals	
I.felt.my.team.was.committed.to.working.together	0.3479903
I.made.an.effort.to.work.with.my.team.mates	0.1664126
I.felt.my.team.shared.a.common.overall.aim	0.4824595
I.felt.my.team.shared.common.short.term.goals	1.0000000
It.was.as.much.about.the.team.as.about.my.own.game	0.3727268
I.felt.obliged.to.help.my.team	0.2841902
I.wanted.to.help.my.team	0.1982348
It.was.as.much.about.the.team.as.about.my.own.game	
I.felt.my.team.was.committed.to.working.together	0.4541267
I.made.an.effort.to.work.with.my.team.mates	0.6005948
I.felt.my.team.shared.a.common.overall.aim	0.3941240
I.felt.my.team.shared.common.short.term.goals	0.3727268
It.was.as.much.about.the.team.as.about.my.own.game	1.0000000
I.felt.obliged.to.help.my.team	0.4105255
I.wanted.to.help.my.team	0.4979605
I.felt.obliged.to.help.my.team	
I.felt.my.team.was.committed.to.working.together	0.286988465
I.made.an.effort.to.work.with.my.team.mates	0.484242391
I.felt.my.team.shared.a.common.overall.aim	-0.008695956
I.felt.my.team.shared.common.short.term.goals	0.284190176
It.was.as.much.about.the.team.as.about.my.own.game	0.410525479
I.felt.obliged.to.help.my.team	1.000000000
I.wanted.to.help.my.team	0.705414436

Table 7.24: Social Commitments Item Correlations

Cooperative Social Presence: Team-mate Value

Item	Score
My.team.mates.were.useful	
My.team.mates.were.useful	1.0000000
My.team.mates.helped.me.achieve.my.objectives	0.7153718
My.team.mates.contributed.to.the.success.of.the.team	0.7266348
My.team.mates.helped.me.achieve.my.objectives	
My.team.mates.were.useful	0.7153718
My.team.mates.helped.me.achieve.my.objectives	1.0000000
My.team.mates.contributed.to.the.success.of.the.team	0.8783429
My.team.mates.contributed.to.the.success.of.the.team	
My.team.mates.were.useful	0.7266348
My.team.mates.helped.me.achieve.my.objectives	0.8783429
My.team.mates.contributed.to.the.success.of.the.team	1.0000000

Table 7.25: Team-mate Value Item Correlations

Cooperative Social Presence: Communication

Item	Score
My.team.communicated.well	
My.team.communicated.well	1.00000000
I.read.the.actions.of.my.team	0.01091288
The.team.had.a.mutual.understanding	0.48240189
I.felt.I.could.communicate.effectively.with.my.team.in.the.game	0.67246081
I.read.the.actions.of.my.team	
My.team.communicated.well	0.01091288
I.read.the.actions.of.my.team	1.00000000
The.team.had.a.mutual.understanding	0.18995682
I.felt.I.could.communicate.effectively.with.my.team.in.the.game	0.15795111
The.team.had.a.mutual.understanding	
My.team.communicated.well	0.4824019
I.read.the.actions.of.my.team	0.1899568
The.team.had.a.mutual.understanding	1.0000000
I.felt.I.could.communicate.effectively.with.my.team.in.the.game	0.6185216
I.felt.I.could.communicate.effectively.with.my.team.in.the.game	
My.team.communicated.well	0.6724608
I.read.the.actions.of.my.team	0.1579511
The.team.had.a.mutual.understanding	0.6185216
I.felt.I.could.communicate.effectively.with.my.team.in.the.game	1.0000000

Table 7.26: Communication Item Correlations

7.2.5 CCPIGv0.6

Section 1: Competitive Social Presence

1.1 Behavioral Involvement:

I acted with my opponent in mind.

I reacted to my opponents actions.

My opponents played a significant role in my experience of the game.

1.2 Mind Theory

It seemed as though my opponent was acting with awareness of my actions.

I knew what my opponent was trying to achieve

I was aware that my opponent might work out my goals

The actions of my opponents affected the way I played

I felt I affected my opponents actions.

1.3 Competitive Engagement (Perceived Human Opponents)

My opponent was challenging.

The game was a battle of skill.

The game was a battle of wits.

1.4 Sensation & Ego

I felt tense while playing my opponent.

My opponent created a sense of urgency.

I wanted my enemies to think I was capable.

The presence of my opponent motivated me.

Section 2: Cooperative Social Presence

2.1 Team Identification

I was aware of my team.

I acted with my teammates in mind.

I considered my team-mates possible plans/thoughts.

I felt like I was part of a team.

I felt a social connection to my team-mate (camaraderie).

2.2 Team Security

I felt my team-mate was looking out for me.

I felt I took more risks in game when I had my team-mate with me.

I felt I contributed to the team.

I felt the team helped me.

2.3 Cooperative Motivation

I put the performance of the team over my personal performance

My actions were determined by the objectives of the team.

I wanted my team to value me.

Being part of a team motivated me.

I felt responsible for achieving the teams objectives.

I did not want my team to think I had let them down.

2.4 Social Action & Communication

I felt my actions made a difference to my team-mates.

The actions of my team-mate affected my thoughts and actions.

My team mates played a significant role in my experience of the game.

My team communicated well.

The team had a mutual understanding.

2.5 Social Commitments & Team-mate Value

I felt my team was committed to working together.

I made an effort to work with my team mates.

I felt my team shared a common overall aim.

I felt my team shared common short term goals.

It was as much about the team as about my own game

My team-mates were useful.

I was happy to take a boring role if it meant the team would win.

7.2.6 Natural Selection 2 Study Data: Module Analysis

Competitive Section

Item	MSA Scores			
I.acted.with.my.opponents.in.mind	0.71	.78	0.79	0.78
I.reacted.to.my.opponents.actions	0.79	0.81	0.80	0.83
My.opponents.played.a.significant. role.in.my.experience.of.the.game	0.73	0.75	0.76	0.73
It.seemed.as.though.my.opponents.were. acting.with.awareness.of.my.actions	0.82	0.82	0.80	0.81
I.knew.what.my.opponents.were.trying.to.achieve	0.82	0.94	0.95	0.94
I.was.aware.that.my.opponents.might.work.out.my.goals	0.72	0.81	0.82	0.88
The.actions.of.my.opponents.affected.the.way.I.played	0.75	0.84	0.83	0.85
I.felt.I.affected.my.opponents.actions	0.65		0.726	0.84
My.opponents.were.challenging	0.85	0.84	0.84	0.83
The.game.was.a.battle.of.skill	0.71	0.82	0.74	
The.game.was.a.battle.of.wits	0.69			
I.felt.tense.while.playing.against.my.opponents	0.80	0.8	0.83	0.83
My.opponents.created.a.sense.of.urgency	0.78	0.82	0.79	0.86
I.wanted.my.opponents.to.think.I.was.capable	0.76	0.81	0.83	0.81
The.presence.of.my.opponents.motivated.me	0.78	0.81	0.79	0.78
KMO	0.76	0.82	0.81	0.83

Table 7.27: Competitive Section MSA

Item		MSA Score	
I.acted.with.my.opponents.in.mind	0.54	0.82	
I.reacted.to.my.opponents.actions	0.52	0.82	
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.56	0.81	
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions		0.80	0.76
I.knew.what.my.opponents.were.trying.to.achieve		0.90	0.68
I.was.aware.that.my.opponents.might.work.out.my.goals		0.88	0.79
The.actions.of.my.opponents.affected.the.way.I.played		0.79	0.71
I.felt.I.affected.my.opponents.actions		0.89	0.80
KMO	0.54	0.83	0.73

Table 7.28: Modules 1+2 MSA

Cooperative Section

Item	MSA Score
I.was.aware.of.my.team	0.83
I.acted.with.my.teammates.in.mind	0.90
I.considered.my.team.mates.possible.plans.thoughts	0.75
I.felt.like.I.was.part.of.a.team	0.82
I.felt.a.social.connection.to.my.team.mates..camaraderie.	0.71
I.felt.my.team.mates.were.looking.out.for.me	0.81
I.felt.I.took.more.risks.in.game.when.I.had.my.team.mates.with.me	0.59
I.felt.I.contributed.to.the.team	0.79
I.felt.the.team.helped.me	0.864
I.put.the.performance.of.the.team.over.my.personal.performance	0.89
My.actions.were.determined.by.the.objectives.of.the.team	0.77
I.wanted.my.team.to.value.me	0.71
Being.part.of.a.team.motivated.me	0.90
I.felt.responsible.for.achieving.the.team.s.objectives	0.660
I.did.not.want.my.team.to.think.I.had.let.them.down	0.85
I.felt.my.actions.made.a.difference.to.my.team.mates	0.67
The.actions.of.my.team.mates.affected.my.thoughts.and.actions	0.91
My.team.mates.played.a.significant.role.in.my.experience.of.the.game	0.83
The.team.communicated.well	0.74
The.team.had.a.mutual.understanding	0.91
I.felt.the.team.was.committed.to.working.together	0.80
I.made.an.effort.to.work.with.my.team.mates	0.87
I.felt.my.team.shared.a.common.overall.aim	0.81
I.felt.my.team.shared.common.short.term.goals	0.88
It.was.as.much.about.the.team.as.about.my.own.game	0.80
My.team.mates.were.useful	0.77
I.was.happy.to.take.a.boring.role.if.it.meant.the.team.would.win	0.80
KMO	0.81

Table 7.29: Cooperative Section MSA

7.2.7 NS2 Study Data: Module Item Correlation

Item	Score
I.acted.with.my.opponents.in.mind	
I.acted.with.my.opponents.in.mind	1.0000000
I.reacted.to.my.opponents.actions	0.5795777
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.2151794
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.3527788
I.knew.what.my.opponents.were.trying.to.achieve	0.4921860
I.was.aware.that.my.opponents.might.work.out.my.goals	0.4506001
The.actions.of.my.opponents.affected.the.way.I.played	0.5853263
I.felt.I.affected.my.opponents.actions	0.3130429
I.reacted.to.my.opponents.actions	
I.acted.with.my.opponents.in.mind	0.5795777
I.reacted.to.my.opponents.actions	1.0000000
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.5042407
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.2133879
I.knew.what.my.opponents.were.trying.to.achieve	0.6211246
I.was.aware.that.my.opponents.might.work.out.my.goals	0.3939642
The.actions.of.my.opponents.affected.the.way.I.played	0.7901236
I.felt.I.affected.my.opponents.actions	0.3842440
My.opponents.played.a.significant.role.in.my.experience.of.the.game	
I.acted.with.my.opponents.in.mind	0.2151794
I.reacted.to.my.opponents.actions	0.5042407
My.opponents.played.a.significant.role.in.my.experience.of.the.game	1.0000000
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.2151722
I.knew.what.my.opponents.were.trying.to.achieve	0.3661382
I.was.aware.that.my.opponents.might.work.out.my.goals	0.2207937
The.actions.of.my.opponents.affected.the.way.I.played	0.5355043
I.felt.I.affected.my.opponents.actions	0.3061278

Table 7.30: Competitive Module 1 Item Correlations

Item	Score
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	
I.acted.with.my.opponents.in.mind	0.3527788
I.reacted.to.my.opponents.actions	0.2133879
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.2151722
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	1.0000000
I.knew.what.my.opponents.were.trying.to.achieve	0.1874364
I.was.aware.that.my.opponents.might.work.out.my.goals	0.2864654
The.actions.of.my.opponents.affected.the.way.I.played	0.2317075
I.felt.I.affected.my.opponents.actions	0.1778663
I.knew.what.my.opponents.were.trying.to.achieve	
I.acted.with.my.opponents.in.mind	0.4921860
I.reacted.to.my.opponents.actions	0.6211246
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.3661382
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.1874364
I.knew.what.my.opponents.were.trying.to.achieve	1.0000000
I.was.aware.that.my.opponents.might.work.out.my.goals	0.3681642
The.actions.of.my.opponents.affected.the.way.I.played	0.5451172
I.felt.I.affected.my.opponents.actions	0.4066895
I.was.aware.that.my.opponents.might.work.out.my.goals	
I.acted.with.my.opponents.in.mind	0.4506001
I.reacted.to.my.opponents.actions	0.3939642
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.2207937
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.2864654
I.knew.what.my.opponents.were.trying.to.achieve	0.3681642
I.was.aware.that.my.opponents.might.work.out.my.goals	1.0000000
The.actions.of.my.opponents.affected.the.way.I.played	0.3188533
I.felt.I.affected.my.opponents.actions	0.2742016

Table 7.31: Competitive Module 1 Item Correlations

Item	Score
The.actions.of.my.opponents.affected.the.way.I.played	
I.acted.with.my.opponents.in.mind	0.5853263
I.reacted.to.my.opponents.actions	0.7901236
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.5355043
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.2317075
I.knew.what.my.opponents.were.trying.to.achieve	0.5451172
I.was.aware.that.my.opponents.might.work.out.my.goals	0.3188533
The.actions.of.my.opponents.affected.the.way.I.played	1.0000000
I.felt.I.affected.my.opponents.actions	0.3090272
I.felt.I.affected.my.opponents.actions	
I.acted.with.my.opponents.in.mind	0.3130429
I.reacted.to.my.opponents.actions	0.3842440
My.opponents.played.a.significant.role.in.my.experience.of.the.game	0.3061278
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.1778663
I.knew.what.my.opponents.were.trying.to.achieve	0.4066895
I.was.aware.that.my.opponents.might.work.out.my.goals	0.2742016
The.actions.of.my.opponents.affected.the.way.I.played	0.3090272
I.felt.I.affected.my.opponents.actions	1.0000000

Table 7.32: Competitive Module 1 Item Correlations

Item	Score
My.opponents.were.challenging	
My.opponents.were.challenging	1.0000000
The.game.was.a.battle.of.skill	0.2945228
The.game.was.a.battle.of.wits	0.5884834
I.felt.tense.while.playing.against.my.opponents	0.5823873
My.opponents.created.a.sense.of.urgency	0.6311383
The.presence.of.my.opponents.motivated.me	0.4045741
The.game.was.a.battle.of.skill	
My.opponents.were.challenging	0.2945228
The.game.was.a.battle.of.skill	1.0000000
The.game.was.a.battle.of.wits	0.3783050
I.felt.tense.while.playing.against.my.opponents	0.1459535
My.opponents.created.a.sense.of.urgency	0.4492391
The.presence.of.my.opponents.motivated.me	0.4445020
The.game.was.a.battle.of.wits	
My.opponents.were.challenging	0.5884834
The.game.was.a.battle.of.skill	0.3783050
The.game.was.a.battle.of.wits	1.0000000
I.felt.tense.while.playing.against.my.opponents	0.5242123
My.opponents.created.a.sense.of.urgency	0.4306879
The.presence.of.my.opponents.motivated.me	0.3297948

Table 7.33: Competitive Module 2 Item Correlations

Item	Score
I.felt.tense.while.playing.against.my.opponents	
My.opponents.were.challenging	0.5823873
The.game.was.a.battle.of.skill	0.1459535
The.game.was.a.battle.of.wits	0.5242123
I.felt.tense.while.playing.against.my.opponents	1.0000000
My.opponents.created.a.sense.of.urgency	0.5101648
The.presence.of.my.opponents.motivated.me	0.2621916
My.opponents.created.a.sense.of.urgency	
My.opponents.were.challenging	0.6311383
The.game.was.a.battle.of.skill	0.4492391
The.game.was.a.battle.of.wits	0.4306879
I.felt.tense.while.playing.against.my.opponents	0.5101648
My.opponents.created.a.sense.of.urgency	1.0000000
The.presence.of.my.opponents.motivated.me	0.3883857
The.presence.of.my.opponents.motivated.me	
My.opponents.were.challenging	0.4045741
The.game.was.a.battle.of.skill	0.4445020
The.game.was.a.battle.of.wits	0.3297948
I.felt.tense.while.playing.against.my.opponents	0.2621916
My.opponents.created.a.sense.of.urgency	0.3883857
The.presence.of.my.opponents.motivated.me	1.0000000

Table 7.34: Competitive Module 2 Item Correlations

Competitive Merged Module Correlation

7.2.8 Natural Selection 2: Additional Data

Competitive: Mind Theory

Item	1	2	3	4	5
1. It.seemed.as.though.my.opponents.were. acting.with.awareness.of.my.actions	1.0	0.19	0.29	0.23	0.18
2. I.knew.what.my.opponents.were.trying.to.achieve	0.19	1.0	0.37	0.55	0.41
3. I.was.aware.that.my.opponents.might.work.out.my.goals	0.29	0.37	1.0	0.32	0.27
4. The.actions.of.my.opponents.affected.the.way.I.played	0.23	0.55	0.32	1.0	0.31
5. I.felt.I.affected.my.opponents.actions	0.18	0.41	0.27	0.31	1.0

Table 7.35: Mind Theory Item Correlations

Item	MSA Score
It.seemed.as.though.my.opponents.were.acting.with.awareness.of.my.actions	0.76
I.knew.what.my.opponents.were.trying.to.achieve	0.68
I.was.aware.that.my.opponents.might.work.out.my.goals	0.79
The.actions.of.my.opponents.affected.the.way.I.played	0.71
I.felt.I.affected.my.opponents.actions	0.80
KMO	0.73

Table 7.36: Mind Theory MSA

Competitive: Engagement

Cronbach's α for the 'Engagement' data-set

Items: 3

Sample units: 56

α: 0.649

Figure 7.1: Engagement Cronbach's Alpha

Item	1	2	3
1. My.opponents.were.challenging	1.0	0.29	0.59
2. The.game.was.a.battle.of.skill	0.29	1.0	0.38
3. The.game.was.a.battle.of.wits	0.59	0.38	1.0

Table 7.37: Engagement Correlations

Item	MSA Score
My.opponents.were.challenging	0.59
The.game.was.a.battle.of.skill	0.74
The.game.was.a.battle.of.wits	0.58
KMO	0.61

Table 7.38: Engagement MSA

Competitive: Sensation & Ego

Cronbach's α for the 'Sensation & Ego' data-set

Items: 4

Sample units: 56

α: 0.678

Figure 7.2: Sensation & Ego Cronbach's Alpha

Item	1	2	3	4
1. I.felt.tense.while.playing.against.my.opponents	1.0	0.54	0.31	0.27
2. My.opponents.created.a.sense.of.urgency	0.54	1.0	0.16	0.39
3. I.wanted.my.opponents.to.think.I.was.capable	0.31	0.16	1.0	0.46
4. The.presence.of.my.opponents.motivated.me	0.27	0.39	0.46	1.0

Table 7.39: Sensation & Ego Item Correlations

Item	MSA Score
I.felt.tense.while.playing.against.my.opponents	0.58
My.opponents.created.a.sense.of.urgency	0.54
I.wanted.my.opponents.to.think.I.was.capable	0.54
The.presence.of.my.opponents.motivated.me	0.59
KMO	0.56

Table 7.40: Sensation & Ego MSA

Cooperative: Motivation

Cronbach's α for the 'Motivation' data-set
Items: 6
Sample units: 56
α: 0.813

Figure 7.3: Motivation Cronbach's Alpha

Item	1	2	3	4	5	6
1. I.put.the.performance.of.the.team over.my.personal.performance	1.0	0.50	0.30	0.66	0.18	0.37
2. My.actions.were.determined.by the.objectives.of.the.team	0.50	1.0	0.31	0.47	0.21	0.16
3. I.wanted.my.team.to.value.me	0.30	0.31	1.0	0.42	0.70	0.68
4. Being.part.of.a.team.motivated.me	0.66	0.47	0.42	1.0	0.32	0.43
5. I.felt.responsible.for.achieving the.team.s.objectives	0.18	0.21	0.70	0.32	1.0	0.57
6. I.did.not.want.my.team.to.think I.had.let.them.down	0.37	0.16	0.68	0.43	0.57	1.0

Table 7.41: Motivation Item Correlations

Item	MSA Score
I.put.the.performance.of.the.team.over.my.personal.performance	0.70
My.actions.were.determined.by.the.objectives.of.the.team	0.74
I.wanted.my.team.to.value.me	0.73
Being.part.of.a.team.motivated.me	0.78
I.felt.responsible.for.achieving.the.team.s.objectives	0.77
I.did.not.want.my.team.to.think.I.had.let.them.down	0.77
KMO	0.75

Table 7.42: Motivation MSA

Cooperative: Team Security

Cronbach's α for the 'Team Security' data-set

Items: 4

Sample units: 56

α: 0.601

Figure 7.4: Team Security Cronbach's Alpha

Item	1	2	3	4
1. I.felt.my.team.mates.were.looking.out.for.me	1.0	0.13	0.34	0.70
2. I.felt.I.took.more.risks.in.game.when. I.had.my.team.mates.with.me	0.13	1.0	0.06	0.14
3. I.felt.I.contributed.to.the.team	0.34	0.06	1.0	0.14
4. I.felt.the.team.helped.me	0.70	0.14	0.44	1.0

Table 7.43: Team Security Item Correlations

Item	MSA Score
I.felt.my.team.mates.were.looking.out.for.me	0.59
I.felt.I.took.more.risks.in.game.when.I.had.my.team.mates.with.me	0.85
I.felt.I.contributed.to.the.team	0.77
I.felt.the.team.helped.me	0.58
KMO	0.62

Table 7.44: Team Security MSA

Cooperative: Social Action & Communication

Cronbach's α for the 'Social Action & Communication' data-set

Items: 5

Sample units: 56

α: 0.777

Figure 7.5: Social Action & Communication Cronbach's Alpha

Item	1	2	3	4	5
1. I.felt.my.actions.made.a.difference to.my.team.mates	1.0	0.53	0.60	0.20	0.35
2. The.actions.of.my.team.mates.affected my.thoughts.and.actions	0.53	1.0	0.75	0.21	0.41
3. My.team.mates.played.a.significant.role in.my.experience.of.the.game	0.60	0.75	1.0	0.03	0.29
4. The.team.communicated.well	0.20	0.21	0.03	1.0	0.62
5. The.team.had.a.mutual.understanding	0.35	0.40	0.29	0.61	1.0

Table 7.45: Social Action & Communication Item Correlations

Item	MSA Score
I.felt.my.actions.made.a.difference.to.my.team.mates	0.83
The.actions.of.my.team.mates.affected.my.thoughts.and.actions	0.70
My.team.mates.played.a.significant.role.in.my.experience.of.the.game	0.61
The.team.communicated.well	0.51
The.team.had.a.mutual.understanding	0.66
KMO	0.66

Table 7.46: Social Action & Communication MSA

7.2.9 CCPIGv1

Section 1: Competitive Social Presence

1.1 Behavioural & Cognitive Involvement:

I acted with my opponent in mind.

I reacted to my opponents actions.

My opponents played a significant role in my experience of the game.

It seemed as though my opponent was acting with awareness of my actions.

I knew what my opponent was trying to achieve

I was aware that my opponent might work out my goals

The actions of my opponents affected the way I played

I felt I affected my opponents actions.

1.2 Competitive Engagement (Perceived Human Opponents)

My opponent was challenging.

The game was a battle of skill.

The game was a battle of wits.

I felt tense while playing my opponent.

My opponent created a sense of urgency.

The presence of my opponent motivated me.

Section 2: Cooperative Social Presence

2.1 Team Identification

I was aware of my team.

I acted with my teammates in mind.

I considered my team-mates possible plans/thoughts.

I felt like I was part of a team.

I felt a social connection to my team-mate (camaraderie).

2.2 Social Action

I felt my team-mate was looking out for me.

I felt I took more risks in game when I had my team-mate with me.

I felt I contributed to the team.

I felt the team helped me.

I felt my actions made a difference to my team-mates.

The actions of my team-mate affected my thoughts and actions.

My team mates played a significant role in my experience of the game.

My team communicated well.

The team had a mutual understanding.

2.3 Cooperative Motivation

I put the performance of the team over my personal performance

My actions were determined by the objectives of the team.

I wanted my team to value me.

Being part of a team motivated me.

I felt responsible for achieving the teams objectives.

I did not want my team to think I had let them down.

2.4 ocial Commitments & Team-mate Value

I felt my team was committed to working together.

I made an effort to work with my team mates.

I felt my team shared a common overall aim.

I felt my team shared common short term goals.

It was as much about the team as about my own game

My team-mates were useful.

7.2.10 PCA Study Data: Coop/Comp Factors

Section	Item	Factor 1	Factor 2
1	Iactedwithmyopponentinmind	0.183	0.703
1	Ireactedtomyopponentsactions	0.327	0.651
1	Myopponentsplayedasignificantroleinmyexperienceofthegame	0.145	0.368
1	Itseemedasthoughmyopponentwasactingwithawarenessofmy	0.42	0.441
1	Iknewwhatmyopponentwastryingtoachieve	0.184	0.561
1	Iwasawarethatmyopponentmightworkoutmygoals	0.36	0.535
1	TheactionsofmyopponentsaffectedthewayIplayed	0.314	0.46
1	IfeltIaffectedmyopponentsactions	0.165	0.401
1	Myopponentwaschallenging	0.559	0.236
1	Thegamewasabattleofskill	0.489	0.296
1	Thegamewasabattleofwits	0.418	0.387
1	Ifelttensewhileplayingmyopponent	0.38	0.405
1	Myopponentcreatedasenseofurgency	0.442	0.311
1	Thepresenceofmyopponentmotivatedme	0.411	0.54

Table 7.47: Principal Component Analysis, 2 Factor split

Section	Item	Factor 1	Factor 2
2	Iwasawareofmyteam	0.525	0.542
2	Iactedwithmyteammatesinmind	0.587	0.487
2	Iconsideredmyteammatespossibleplansthoughts	0.593	0.4
2	IfeltlikeIwaspartofateam	0.808	0.422
2	Ifeltasocialconnectiontomyteammatescamaraderie	0.784	0.211
2	Ifeltmyteammateswerelookingoutforme	0.77	0.272
2	IfeltItookmorerisksingamewhenIhadmyteammateswithm	0.189	0.175
2	IfeltIcontributedtotheteam	0.137	0.48
2	Ifelttheteamhelpedme	.705	0.276
2	Ifeltmyactionsmadeadifferencetomyteammates	0.329	0.611
2	Theactionsofmyteammatesaffectedmythoughtsandactions	0.657	0.47
2	Myteammatesplayedasignificantroleinmyexperienceofthe	0.69	0.447
2	Myteamcommunicatedwell	0.744	0.165
2	Theteamhadamutualunderstanding	0.735	0.227
2	Iputtheperformanceoftheteamovermypersonalperformance	0.591	0.265
2	Myactionsweredeterminedbytheobjectivesoftheteam	0.665	0.426
2	Iwantedmyteamtovalueme	0.497	0.484
2	Beingpartofateammotivatedme	0.803	0.375
2	Ifeltresponsibleforachievingtheteamsobjectives	0.456	0.569
2	IdidnotwantmyteamtothinkIhadletthemdown	0.538	0.424
2	Ifeltmyteamwascommittedtoworkingtogether	0.833	0.186
2	Imadeanefforttoworkwithmyteammates	0.684	0.346
2	Ifeltmyteamsharedacommonoverallaim	0.676	0.317
2	Ifeltmyteamsharedcommonshorttermgoals	0.721	0.466
2	Itwasasmuchabouttheteamasaboutmyowngame	0.728	0.321
2	Myteammateswereuseful	0.799	0.241

Table 7.48: Principal Component Analysis, 2 Factor split

7.2.11 CCPIGv1.1

Section 1: Competitive Social Presence

1.1 Awareness

I acted with my opponents in mind

I reacted to my opponents actions

I knew what my opponents were trying to achieve

I was aware that my opponents might work out my goals

The actions of my opponents affected the way I played

I felt I affected my opponents actions

1.2 Engagement

My opponents were challenging

The game was a battle of skill

The game was a battle of wits

I felt tense while playing my opponents

My opponents created a sense of urgency

The presence of my opponents motivated me

My opponents played a significant role in my experience of the game

It seemed as though my opponents were acting with awareness of my actions

Section 2: Cooperative Social Presence

2.1 Team Identification

I was aware of my team

I acted with my team-mates in mind

I considered my team-mates possible plans/thoughts

I felt like I was part of a team

I felt a social connection to my team-mates (camaraderie)

2.2 Social Action

I felt my team-mates were looking out for me

I felt I contributed to the team

I felt the team helped me

I felt my actions made a difference to my team-mates

The actions of my team-mates affected my thoughts and actions

My team-mates played a significant role in my experience of the game

My team communicated well

The team had a mutual understanding

2.3 Motivation

I put the performance of the team over my personal performance

My actions were determined by the objectives of the team

I wanted my team to value me

Being part of a team motivated me

I felt responsible for achieving the objectives of the team

I did not want my team to think I had let them down

2.4 Team Value

I felt my team was committed to working together

I made an effort to work with my team-mates

I felt my team shared a common overall aim

I felt my team shared common short term goals

It was as much about the team as about my own game

My team-mates were useful

7.2.12 Chivalry Study Validity Probe

Introduction

During the development an early validity probe was conducted to assess the CCPIG progress. This study analysed user data from the *Chivalry: Medieval Warfare* community forums and compared it to the (unvalidated) CCPIGv0.5 results of Trial 1. This study was part of the development of the CCPIG and aimed to test the ability of the evolving questionnaire to measure social presence in a team based online multiplayer game. To help establish the validity of the questionnaire at this stage of the development the quantitative item analysis was accompanied by a qualitative analysis of relevant user generated content. To this end a content analysis on found user data and user feedback data was conducted, the findings of which support the social presence results of the questionnaire. While the questionnaire was not yet validated at this point, this support suggests that the questionnaire was already sensitive to issues within the game.

The report of this validity probe contains two main sections, a summary of the social presence results, read as if one were analysing the user scores to establish the levels of social presence experienced by players of *Chivalry*, and content analysis of the user data/feedback. Content analysis is a method of analysing communication data, and was originally developed to analyse magazines, hymns and posters [Satu and Helvi, 2008]. Content analysis can be used to find the presence of certain concepts within a text and it is commonly used in the study of media, and it is now also used to analyse the communication on online virtual communities and user generated content[Cairns and Blythe, 2009, Kim and J.Kuljis, 2010].

Aims

The aim of this study was to compare the attitudes of users, primarily in the form of found user data, to the data gathered by the as yet unvalidated CCPIGv0.5 in Trial 1. It was hoped that this data would contribute to the improvement of the questionnaire by either showing a correlation between the found user data and the CCPIGv0.5 results, or highlighting any gaps/weaknesses in the CCPIG that needed to be addressed.

Trial 1 Social Presence Results

Trial 1 used the CCPIGv0.5, to clarify the sections below is a model of the questionnaire's structure.

Section 1: General Social Engagement (9 Items)
Section 2: Competitive social presence
- Module 2.1: Behavioural and Cognitive Involvement (9 Items)
- Module 2.2: Competitive Engagement (9 Items)
- Module 2.3: Competitive Sensation (4 Items)
- Module 2.4: Competitive Motivation (3 Items)

Section 3: Cooperative social presence
- Module 3.1: Team Identification (5 Items)
- Module 3.2: Team Security (5 Items)
- Module 3.3: Cooperative Motivation (11 Items)
- Module 3.4: Social Action (6 Items)
- Module 3.5: Social Commitments (7 Items)
- Module 3.6: Team-mate Value (3 Items)

Section 4: Team Based Confirmation (5 Items)

Section 5: Task (3 Items)

The 'Team Based Confirmation' and 'Task' modules were not part of the CCPIG but served to gather additional data to help establish how important various aspects of the game were to players, this helped contextualize the analysis of core CCPIG data. The 'Task' section contained questions which were used to establish whether the respondents viewed the game as requiring, or being improved by, being part of a team. The questions in this small section included '*The objectives in the game required teamwork*', '*The objectives in the game were more easily achieved using teamwork*', and '*The game was more fun when using team-work*'. These questions were designed to establish the importance of the 'Cooperative Social Presence' section of the questionnaire. In this user study the 'Task' score was fairly high with an average score of 4.6. This confirms that the respondents considered that teams were an important part of their *Chivalry* experience, that the tasks within the game are team based tasks, and therefore we can assume that cooperative social presence was a significant part of the game play experience.

The 'Team Based Confirmation' section of the questionnaire aimed to measure how much the competition between the two teams affected the respondents, how much it motivated them, and how much the team competition changed the way that the respondents played the game. This section too gained a high average score from respondents (4.2), suggesting that being part of a team in competition with an opposition is a significant part of the game play experience.

Generally there was a high level of social presence measured by the questionnaire, with both the total average scores (4), and the individual social presence sections scoring well. The 'General Social Engagement' received a reasonably high score of 4.3, supporting the overall high social presence experienced by the respondents. However the 'Competitive Social Presence' section gained proportionately higher scores that the 'Cooperative Social Presence'section, suggesting that while teamplay is a core element to *Chivalry*, respondents felt a higher level of engagement with their enemies than with their allies. A Mann-Whitney U Test confirms the statistical significance of the difference between the competitive (4.2) and cooperative (3.7) social presence scores, with a $p2$ value of 0.0004.

Competitive Play

The 'Competitive Social Presence' section gained an average score of 4.2. To provide a more detailed breakdown of the user experience the section contains four separate modules which can be seen in the structure above. A summary of the results of the main social presence sections can be seen in Tables 7.49 & 7.50.

The 'competitive behavioural and cognitive involvement' was designed to measure how aware respondents were of the presence of their opponents, and how much they felt their actions affected the actions of their opponents (and vice versa). This module also aimed to measure the extent to which respondents attempted to simulated the minds of their competition, in an attempt to second guess their plans and actions. The 'competitive engagement' module aimed to measure how actively engaged the respondents were in the the competitive play, to what extent they were considering the competitive play, and the level of challenge it was providing. The 'competitive motivation' module was a short module which was designed to measure how competitive the respondents were, measuring ego focused issues such as extent to which they desired to appear capable and beat other players. The 'competitive sensation'module was designed to measure to what extent the competitive game play affected the way the respondents felt while playing the game. The previous studies in social presence which inspired this questionnaire suggested that the awareness of enemy human players within a virtual environment creates a sense of trepidation. This module gained the lowest proportionate score of the consisted of 'competitive social presence' modules. The question which reduced the overall score of the module was 'I felt the sensation of being hunted'. While this question may be relevant to other FPS games it does not appear that a sense of hunting/being hunted is a core part of the *Chivalry* experience, which appears to be more focused on face to face combat.

Module	Average Score
Competitive Behavioural and Cognitive Involvement	4.4
Competitive Engagement	4.2
Competitive Sensation	3.8
Competitive Motivation	4.1

Table 7.49: Competitive Social Presence Modules

Cooperative Play

As noted the average scores for questions in the 'Cooperative Social Presence' section were significantly lower than for the competitive section. Like the previous section the 'Cooperative Social Presence' section was split into a number of modules to allow for a more fine grain analysis of the cooperative gameplay experience. These modules consisted of 'Team Awareness'(how aware the respondents were of their team and team-mates), 'Team Security'(the extent to which the presence of team-mates made respondents feel more safe and secure), 'Cooperative Motivation'(how much being part of a team motivated the respondents), 'social action'(the extent to which respondents felt the team affected each other's plans and actions), 'Social Commitments'(how committed respondents felt they and their team-mates were to their team), 'Team-mate Value'(the extent to which respondents felt their team-mates were of value to them and the team), and 'Communication'(the level of explicit and implicit communication experienced in game).

The results in Table 7.50 show that respondents felt the presence of their team-mates, that their team-mates played a significant role in their experience of the game, and that being part of a team was a strong motivator. Lower scores were gained for the 'Team Security' and 'Social Commitment' modules, suggesting that respondents did not feel their team was committed to working together, and therefore did not provide them with an advantage when playing in a group. The lowest scores were given to the 'Team-mate Value' and 'Communication' modules, further suggesting that respondents felt there was a lack of coordination and mutual understanding among their team-mates.

Module	Average Score
Team Awareness and	3.9
Team Security	3.7
Cooperative Motivation	3.9
Social Action	4.0
Social Commitments	3.8
Team-mate Value	3.5
Communication	2.9

Table 7.50: Cooperative Social Presence Modules

The higher level of engagement with enemies than allies may simply be part of the game mechanic, as players of *Chivalry* usually fight their enemies in close brutal combat, and perhaps no amount of teamwork could outweigh the experience of an enemy swinging an axe at your face. However in team based scenarios like the TO mode, respondents feel there is clearly some issue with team coordination and teamplay/teamwork in general.

While some results of this questionnaire may seem obvious (team games equals team experience, etc.) this study qualitatively summarises the user experience of 48 *Chivalry* players, suggesting where the strengths and weaknesses of those experiences lay. The results of this survey show that *Chivalry* inspired strong competitive social presence and a substantial yet reduced cooperative social presence. Respondents have shown that while competitive play seems to provide a more substantial share of the game experience, their team-mates are a significant factor in the way they experience the game, while the specific module results of the questionnaire suggest that the communication and coordination are the largest factors in the reduced feeling of cooperative social presence.

Content Analysis

As the cooperative element of the CCPIGv0.5 achieved proportionately lower scores than the competitive element, the focus of the content analysis was directed to user data from the *Chivalry* community regarding teamwork & teamplay to explore why this might be.

Data

The data was made up of around nine thousand words of text from the *Chivalry* community forums, and a further thousand words of user feedback from the comments section of the questionnaire. The forum data was found in one of two ways, firstly the forums were searched through to find threads which had explicitly teamwork/teamplay based topics based on their titles and opening posts. These explicit threads were analysed in their entirety and consisted of the majority of the forum data. The second way in which data was acquired was via a forum search, the terms teamplay and teamwork were searched for and individual posts containing these terms were analysed if they had not already appeared in a previously analysed thread, these posts made up around five hundred words worth of data. Data from the forum was acquired from posts made before the call for participants in Trial 1.

Coding Method

Generally the forum threads which made up the majority of the data for this study consisted of exchanges of opinion about the 'Team Objective' game mode, a mode which all but one questionnaire respondent reported playing prior to taking part. In the threads some people were stating teamwork does exist, and others stating that teamwork was not encouraged, and discussing potential solutions to this. The coding for this study was emergent, with only one code being decided upon 'a priori', while the data found was relevant to teamplay/teamwork there were few presupposed topics that would occur. The one code that was established 'a priori' was *Comms* (communication), which reflected the first impressions which were gleamed from the questionnaire results. Each post was coded using the emergent coding method and to simplify the way in which forums are used, any user who posted '+1' referring to a quote would add +1 to the coding instances, and users repeating their own points in the same thread would not be counted. As a member of the forum the researcher did not use any thread in which they had posted.

Coding Scheme

A total of 14 codes were developed. The codes were split into three main topics which refer to internal and external influences on a user's experience of the game. The internal influences are the topics of Player Incentives within the game and general Game Mechanics, while the external influence on user experience of a game like *Chivalry* are the other Players.

Player Incentives

Code: *Objective Rewards*

This code refers to posts which state that *Chivalry* does not promote teamwork because players are not sufficiently incentivised by the game's reward system. Posts state a variety of issues, from insignificant rewards for objective based play, to over-incentivising of selfish play, but all ultimately state that teamwork is not incentivised.

Code: *Weapons*

Much like the previous code, this code refers to users feeling that incentives do not promote teamwork. However these posts specifically refer to the 'weapon unlock' system within the game, in which new weapons are unlocked after a player has killed a specific number of other players. Post state that this encourages 'grind'behaviour and actively discourages teamplay.

Code: *Award Awareness*

This code represents posts which state that players are unaware when they are getting points for teamwork, and that a lack of awareness make them feel that teamwork is not explicitly rewarding.

Code: *Teamplay Rewards*

This code refers to posts which state that it is not rewards for objective based teamwork which is required, but more general rewards for teamplay in all circumstances. Users argue for rewarding kill assists, players sticking together, etc.

Code: *Remove K/D*

This code refers to posts which state that the 'kill to death ratio' (K/D ratio) on the scoreboard discourages teamwork/teamplay, and that its removal would increase the teamwork in objective based game modes.

Game Mechanics

Code: *Comms*

This code refers to posts which state that more effective ways of communication in game would increase teamplay/teamwork, or that teamplay is not present due to a lack of effective communication.

Code: *Vagueness*

This code refers to posts which argue that the players of *Chivalry* are unclear about how to achieve the objectives in the game due to vague instructions given by the game. Users argue this decreases the ability to play as an effective team.

Code: *Spawn*

This code refers to posts which argue that the way player's avatars spawn into a level (at specific spawn points) spoils the balance of the game and makes teamplay/teamwork difficult.

Code: *Squad*

This code refers to post which request/suggest the addition of a squad mechanic to the game, including commander roles, squad structures, squad spawning, and the encouragement of formation use.

Code: *Game Modes*

This code is used to denote posts which argue that the game modes in *Chivalry* should offer a greater degree of difference in experience, allowing players to feel that they are playing for different reasons in different game modes. Posts argue that this would encourage players who wanted to use teamwork would play game modes that require it, and players that don't would not.

Code: *Team I.D.*

Team Identification. This code refers to posts which argue that teamplay would be increased if players could more easily identify their friends when in game.

Code: *Realism*

This code refers to posts which state that the game should have a more realistic setting option to increase the complexity of the experience and encourage teamplay.

Other Players

Code: *Players*

This code refers to posts which relate to a lack of teamwork in the game being due to other players. These posts state that players are the problem, and that they and not the game, need to change to encourage teamwork/teamplay.

Code: *Go Clan*

This code refers to posts which state that *Chivalry* is not the type of game that should encourage teamwork. These posts argue that players wishing to experience teamplay/teamwork should join a clan or arrange playing sessions with groups of friends.

Content Analysis Results

The results of the content analysis can be seen in Table 7.51.

Code	Instances
Players	15
Objective Rewards	14
Award Awareness	12
Weapons	9
Teamplay Rewards	8
Remove K/D	8
Comms	8
Vagueness	7
Spawn	4
Squad	4
Game Modes	4
Go Clan	3
Team I.D.	2
Realism	1
Total	99

Table 7.51: Results: Coding Instances

Inter-coder Reliability

To validate the coding scheme a forum thread consisting of 14 posts and around two thousand words, were coded by a second coder to establish inter-coder reliability. The second coder was an *outside* coder, they did not help to develop the original coding scheme, but were instructed to suggest any codes they thought were needed but missing from the original coding scheme. However while they were an *outside* coder they had a depth of domain knowledge.

Results of the coding are shown in Table 7.53. The total number of code cases was 34, with agreement on 22 of these cases, giving a simple inter-coder agreement of 64.7% (22/34 = 0.647). However, there is a possibility that coders will agree by chance and so *Cohen's Kappa*[Cohen, 1960], which takes this into consideration, was used to calculate the inter-coder reliability.

Cohen's Kappa = (Pa - Pc)/(1-Pc)

Probability of agreeing by chance (Pc) = 1/14 = 0.07

Probability of actual agreement (Pa) = 22/34 = 0.647

(0.647-0.07)/(1-0.07) = 0.62

Based on the Landis and Koch [1977] (Table 7.52) benchmark for interpreting Cohen's Kappa score we can see that the inter-coder reliability was *Substantial*.

Kappa Statistic	Strength of Agreement
less than 0.00	Poor
0.00 - 0.20	Slight
0.21 - 0.40	Fair
0.41 - 0.60	Moderate
0.61- 0.80	Substantial
0.81- 1.00	Almost Perfect

Table 7.52: Landis & Koch Kappa Benchmarks

Post	Coder A	Coder B	Codes	Agreed
1	Players Spawn Weapons	Players Teamplay Weapons	6	4
2	-	Spawn	1	0
3	Spawn Comms Players Weapons Squad	Spawn Comms Players Weapons	9	8
4	-	-	0	0
5	Players Squad	Squad	3	2
6	Players	-	1	0
7	Players	Spawn	2	0
8	Spawn	Spawn	2	2
9	-	-	0	0
10	-	-	0	0
11	-	-	0	0
12	Spawn	-	1	0
13	-	-	0	0
14	Players	Players	2	2
15	-	-	0	0
16	Spawn Awareness	Awareness	3	2
17	Players Awareness Teamplay	Awareness	4	2
18	-	-	0	0
Total	-	-	34	22

Table 7.53: Inter-coder Coding Instances

Discussion: Players

The most frequent code found within the data was that of players being the cause of a lack of teamplay. Users stated that while some players may wish to work with their team-mates the vast majority of players focus only on their opponents. Many games now profess, 'game experience may change during online play', and this is due to most online FPS style games being examples of "co-creative media" [Morris, 2003]. This means that the experience of the game is not created solely by the developers, but is co-constructed by both the developed product and the players present within the virtual environment. Therefore while a game may encourage teamplay and an awareness of one's team-mates, cooperative social presence will be largely dependant on the players of any game which is an example of co-creative media. In the case of

Chivalry, if users of the forums are experiencing a lack of teamwork in their games, due to the dependency of the game experience on other players, this would likely lead to low levels of cooperative social presence.

Discussion: Player Incentives

Other codes which occurred frequently were those relating to the incentives that users of the forum felt did not encourage teamwork/teamplay. The highest occurring of these codes were Objective Rewards, Weapons, and Award Awareness. This suggests that a proportion of users feel that the way the game rewards players does not encourage players to participate in teamwork when teamwork is needed in game. Weapon unlocks are one of the main reward systems of the game and users feel that the system does not encourage teamplay. This is because there are no points gained for helping a team-mate kill an enemy, and the points gained for helping one's team win an objective based scenario do not unlock any in-game items. There was also a high frequency of codes regarding users feeling that they are unaware whether they, or members of their team, were receiving points for teamwork in the form of objective based play. Unlike kills which are explicit and tally on the game's scoreboard and appear on the 'killfeed', rewards for objectives are only rewarded in a passive accumulation of points.

The two main views which are apparent within the community data, that 'players are to blame' and 'players need better incentives', are in interesting opposition. One side of the argument suggests that players should not need encouragement to play in a way which benefits their team, the other argues that players will only take part in teamplay if it is encouraged. While these arguments are opposed they are both examples of the co-created nature of this game, that any discussion about it refers to the balance between the game and the players.

In the case of *Chivalry* the two main views perhaps boil down to the two main reasons why the players are playing in the first place. If a players is intent on teamplay then they need no dangling carrot to encourage them, if they are playing a game for explicit rewards then they will only play in a way that gets them those rewards.

Concluding Thoughts

The content analysis suggested the social presence questionnaire had some validity in this *Chivalry* user study, as the results of the content analysis seem to support the low cooperative social presence scores of the questionnaire study. In the questionnaire cooperative social presence scored lower than competitive, while the content analysis found that most community discussion of teamwork/teamplay referred to various problems inherent in the game and/or its players. As this game is an example of co-created media, the complaints that the game does not promote teamwork and the lack of social involvement of players would likely lead to low social presence. One way in which the content analysis did not reflect the questionnaire results was the issue of communication between team members. The results from the questionnaire showed that respondents had very low levels of communication with their team-mates, with the communication component of the questionnaire receiving the lowest average scores. However the issue of communication (code: *Comms*) was only found to be of medium importance in discussions of teamwork/teamplay throughout the community forums, although it was the highest frequency Game Mechanics code.

Limitations

While the content analysis suggested that the development of the questionnaire was heading in the right direction, the questionnaire was yet to be validated and so the data gathered could not be considered a anything more than suggestive of user experience. However the comparison of the analysis of the user feedback and found user data with the CCPIGv0.5 data is not considered to have any meaningful academic implications, but was carried out to explore if the development was producing a measure sensitive to elements inherent to the game experience.

7.2.13 User Feedback Analysis

Introduction

A benefit of the online community survey methodology used throughout the development of the CCPIG is the rich additional user data which occurs on the community forums and can be collected by simply adding an 'additional comments' section to the end of the questionnaire. The additional comments section at the end of the questionnaire allows participants to comment on the questionnaire, but more often allows them to 'blow off steam' about the game or gaming session used as a basis for their CCPIG scores. This section provided around 4500 words of data from across the studies of this chapter. This comment data adds context and richness to the purely numerical CCPIG data and allows for a more pragmatic interpretation of the results.

To explore the user feedback of the questionnaire throughout the process of development further content analysis [Satu and Helvi, 2008, Cairns and Blythe, 2009, Kim and J.Kuljis, 2010] was conducted on comments made on the 'call for participants' forum threads and comments made in the feedback section of the online questionnaires. These two sets of data contain similar concepts and, it is likely, that they are constructed by some of the same members of the communities. It is not unreasonable to assume some participants that commented on the questionnaire also commented on the forum threads within their communities. However the two data sets are different in that one was collected from a public forum, viewable to the entire internet, while the questionnaire data was explicitly confidential & anonymous. Thus the public forum data would be linked to a user's online handle, subject to public scrutiny, and could be made without completing the questionnaire. The private questionnaire data was submitted anonymously, away from the eyes of the community, and was from confirmed participants in the questionnaire study.

The aim of this analysis was twofold, initially the data was subject to content analysis to establish if the majority of the comments refer to teamwork, team-play or social engagement in some way. This would provide evidence to suggest that the CCPIG had good face validity. In other words, if the participants were commenting on social issues, it was clear to them that this is what is being measured. In addition to establishing the the level of social themes in the user comments, the content analysis also reviewed other issues that users felt pertinent to the survey, their game communities, and the games they play. The community forums provide useful data in the form of comments made on the 'call for participants' forum threads. This source provided around 2000 words of data, consisting mostly of short acknowledgements, but also providing user feedback on the questionnaire, teamwork in the specific communities, and elements which users felt should be considered when exploring teamwork in games.

The Data

The forum data consisted of the seven 'call for participant'forum threads used to engage with respondents throughout the development chapter. The questionnaire data consisted of the anonymous user feedback given once the participants had completed the online user experience questionnaire. While the data is similar it has been analysed separately due to the different method of data collection (public versus private).

Coding Method

In this study the coding was almost wholly emergent. While the content analysis was to focus on comments regarding team play, other issues raised that might give insights into how the users viewed the questionnaire and their experiences of the games were not to be ignored. Due to the familiarity with the data the *Done* code was decided upon 'a priori'. In addition to this code the *Team Comment* code was developed 'a priori'as this was to be an important concept in establishing if the CCPIG had good face validity. While the public and private data sets were analysed separately it was found that there was a large amount of crossover in terms of coding themes, thus one coding scheme is used for both data sets.

Coding Scheme

Code: *Done*

This code refers to instances where users post that they have completed the survey on the 'call for participants' forum thread. These posts ranged from simply posting 'done', 'participated', or posting a commitment to take part in the survey.

Code: *Positive*

This code refers to comments of a general positive nature which do not refer to anything too specific, comments such as "Goodluck with the rest of your studies and research".

Code: *Pub vs*

This code refers to comments which state that the answers to the CCPIG they would give are likely to be different depending on weather they were playing in a pub server, in a clan match, with friends, etc. as the users claim these elements alter their experience of the game. For example, user comments coded as *Pub vs* include: "Wouldn't there be a massive difference between pub play and clan matches?", and "I answered all the questions in terms of a pub environment. I would say you'd probably see a difference if you question people who are in teams and play in leagues". This code is based upon user speculation/perception of social engagement in their games.

Code: *Role*

This code is used to denote comments which state that the role a player takes in game (for example a player can chose to be a Scout, Soldier, Pyro, Demoman, Heavy, Engineer, Medic, Sniper, or Spy in TF2) changes their level of social engagement. For example user comments coded as *Role* include: "I felt I was putting a lot of "5"s just because I happened to have been playing medic tonight. Had I been jumper-cabering snipers on orange like I sometimes do, my answers would have been radically different", and "Acting as Team Leader in my last drill so this may skew my perceptions of teamwork a little". This code is also based upon user speculation/perception of social engagement in their games.

Code: *Looking Out*

This code refers to comments made about the questionnaire item 'I felt my team-mates were looking out for me', which usually consisted of statements about how this was not the case.

Code: *Bland*

This code refers to comments which refer to the items in the CCPIG as being bland, boring, or vague. These comments were generally made in the context that the questions were not game specific, at the time that the questionnaire was posted participants were not told that the CCPIG was being designed to be used across multiple games. Thus while these comments may have implied the participants thought badly of this genericness, it is in fact intended.

Code: *Teamplay*

This code is used when a user comment states that teamwork is essential for victory.

Code: *No Negative*

This code refers to comments which complain that the CCPIG has no negatively phrased questions. For example that instead of 'I was aware of my team' 'I was *not* aware of my team'.

Code: *Results*

This code is used to refer to user comment which request to see the results of the user experience survey once the study had been completed.

Code: *Think About*

This code is used for comments which state that participating in the survey made the users think about/evaluate the game play. For example "was good answering these, helped to actually evaluate myself and the team", "I had fun filling out the questionnaire, made me think about the game I was just playing a lot more than I usually think about it".

Code: *Support*

This code refers to comments which in some way offer support or encouragement for the study. For example comments such as "My respect goes out to you for actually taking the time to get to know gaming communities before drawing conclusions. it gets frustrating when every day politicians make assumptions about us while never asking for our side of it.". These comments suggest an acceptance from the game communities and may suggest a higher level of user buy-in.

Code: *Community*

This code refers to comments which suggest that the game community affects the level of engagement a user has with a game. For example this code refers to comments such as "I think the game itself is amazing, but there's no way I'd still be playing this game if not for the community and the people I play with. I think that goes for allot of games", and "The social experience will differ a lot depending on a players view of the community of the game, which will change when the player is familiar with the game and its community".

Code: *Match*

This code refers to user comments which argue that the scores they gave would alter to a greater or lesser degree from match to match and are not blanket scores that always apply to the game. In other words in these socially complex virtual environments we are measuring instances of user experience in a particular scenario, not a blanket social presence score for a game.

Code: *How To*

This code is used when a user comment is used to ask for instructions on how to complete the survey, for example asking how long they should play the game, asking about game modes, etc.

Code: *No TW*

This code refers to comments which argue that there was not enough team work in the game which they played before filling out the questionnaire.

Code: *Too Long*

This code refers to user comments which suggest the CCPIG is too long.

Code: *Team comment*
This code refers to any non-specific statements about teamwork, team play, and team tasks. This includes anything from non-specific (i.e. not covered by other codes) teamwork statements such as "Teams are often not coordinated well", and "Attaining my personal goals as part of the team in the games led to a much stronger sense of achievement and enjoyment", to long rambling anecdotes about teamwork. These comments are coded together to measure the level of general team based comments, which would suggest that participants knew that this was the theme of the CCPIG and thus suggest good face validity.

Code: *Comms*
This code is used to denote comments which argue that a lack of communication in game leads to the failure of a team.

Code: *Metagame*
This code refers to comments which make statements about the underlying game mechanics and how this affects teamwork and gameplay.

Code: *Tricky*
This code refers to comments in which users state they had trouble with the CCPIG or specific items within it. For example the comments "Slightly difficult to answer section 2 considering my friends and I formed a small team inside the bigger team in a public match" and "The goals of each team is very clear in a typical 29th ID scrim, so the opponent always knows your goals, if not the way you attempt to accomplish them. If interpreted so, some of them become a matter of fact" were coded as *Tricky*.

Code: *Items Similar*
This code refers to comments which state some of the CCPIG items are too similar.

Code: *Team Killing*
This code refers to comments which argue Team killing reduces social engagement and/or should be avoided in team games.

Code: *XP affects SP*
This code is used to refer to comments which suggest that the amount of experience a person has in a game would affect their level of social engagement and the level of social engagement of those around them. For example an inexperienced player may cause other players to become frustrated if they do not know how to best help the team, thus lowering their social presence.

Public Feedback
Table 7.54 shows that the data from the community forums centred around comments about the study and the interplay between the users, the survey and the game community. The most frequently occurring codes were *Done*, *Support*, *Think About*, *Looking Out*, and *Results*. The *Done* code appeared most frequently and as the code description states, consisted of simple posts such as 'done', 'participated', 'done, good luck', etc. While these simple comments could be seen as of little consequence, their appearance is not without significance. The users could have just as easily participated and not commented, however the action of posting these simple messages is a public communication within the game community. It seems

that the *Done* posts are more a statement of involvement to the community, letting the community know that that member has taken the time to participate in a study about the game around which the community revolves. It could alternatively be seen as an encouragement for others to participate, as commenting would not only show that the study was active and engaging the community, but also posting would move the forum thread back to the top of the thread lists and thus enhance the viability of the study. It is interesting that the highest numbers of these codes appear in the communities which could be argued to be the most involved in the study (highest Response/View Rates).

The second most frequent among the public data is the *Looking Out* code. Comments coded in this way were predominately humorous in nature, such as "I felt like my teammates were looking out for me. This needs a Zero option. Ever had people behind ya mysteriously disappear?" "I felt my team-mates were looking out for me :/" "My team-mates never look out for me though! (Because I am in the most stupid positions most of the time.)".

Code	Total	TF2	MnB	NS2	Chiv	KAG	29th
Done	48	8	16	7	2	1	14
Looking Out	6		3	3			
Support	5		5				
Think About	4		2	1		1	
Results	4	1			2	1	
Pub vs	3	2	1				
Role	3	2				1	
Bland	2	1		1			
Community	1		1				
Match	1			1			
How to	1					1	
No Negative	1	1					
No TW	1					1	
Teamplay	1	1					
Too Long	1	1					
Total	82	17	28	13	4	6	14

Table 7.54: Public Feedback: Coding Instances

Private Feedback

While the public data seemed to focus on the study its self, the private data from the questionnaire comments were more team based. The *team comment* code was the most abundant among the data suggesting that the participants were aware of some of the issues the questionnaire was measuring. Other prevalent codes such as *Pub vs*, *Role*, *Community*, *Match*, and *Teamplay*, also suggest participants were keen to communicate their views on team work, and social experiences in games. This suggests that the questionnaire has good face validity, but the data from the user feedback also correlates with the questionnaire data to provide content validity.

Code	Total	TF2	MnB	NS2	Chiv	KAG	29th	PS2
Team comment	25	1	8	3	10		3	
Pub vs	19	5	8	3	2	1		
Positive	18		5	3	1	3	6	
Community	10		3	1	3	2	1	
Comms	9	2	2		5			
Match	8	1	3	2	1		1	
Teamplay	8			3	2	2	1	
XP affects SP	6	1	2	1	1	1		
No TW	6				5			1
Role	5	2		2			1	
Bland	4	2	1				1	
Items Similar	3	2	1					
Metagame	3				2			1
Team Killing	2				2			
Think About	2		1			1		
Tricky	2		1				1	
Too long	1				1			
Total	131	16	35	18	35	10	15	2

Table 7.55: Private Feedback: Coding Instances

One of the most comment codes throughout the data is *Pub vs*, an issue which not only occurs in the data gathered for this study, but also in the initial Social Gaming study in Chapter 1. This means that the respondents believe that playing online team games with friends and clanmates changes the way one experiences the game compared to sharing the virtual environment with only strangers.

In the preamble questions of the online CCPIG, respondents were asked for their age, gender, etc. In addition they were asked about their relationship with the other players in their game, whether they were playing with only strangers or with friends and/or clanmates. It is therefore possible to use the data to investigate whether, in the particular games used in this study, if playing with friends/clanmates does indeed change the experience. Data, consisting of 92 responses, from two of the game communities which provided some of the largest response rates, *Team Fortress 2* (TF2) and *Mount and Blade* (MnB) was analysed. While no likert scale items in the CCPIG directly refer to friends, strangers, or clanmates, Table 7.56 and Figure 7.2.13 clearly show that the social presence scores are different depending on the familiarity of the players. A Mann-Whitney test confirms the significance of the difference in social presence between familiar (friends and clan-mates) and unfamiliar players, with both the competitive and cooperative value achieving significance with $P < 0.001$.

The *Pub vs* code along with evidence from the Social Gaming study correlate with the scores from the survey and suggest that playing team-based online games with friends/clanmates does change the experience, increasing social presence, particularly cooperative social presence. Not only do these results suggest the CCPIG has content validity, it also suggests that the competitive and cooperative sections of the questionnaire are indeed measuring different concepts and are sensitive enough to show differences between games and other variables, in this case player relationships.

	Mean Competitive	Mean Cooperative	MnB Competitive	MnB Cooperative	TF2 Competitive	TF2 Cooperative
Clanmates/ Friends	4.06	4.03	4.16	4.10	3.86	3.89
Strangers	3.43	3.14	3.83	3.36	3.34	3.10

Table 7.56: Social Presence Scores and relationship to other players

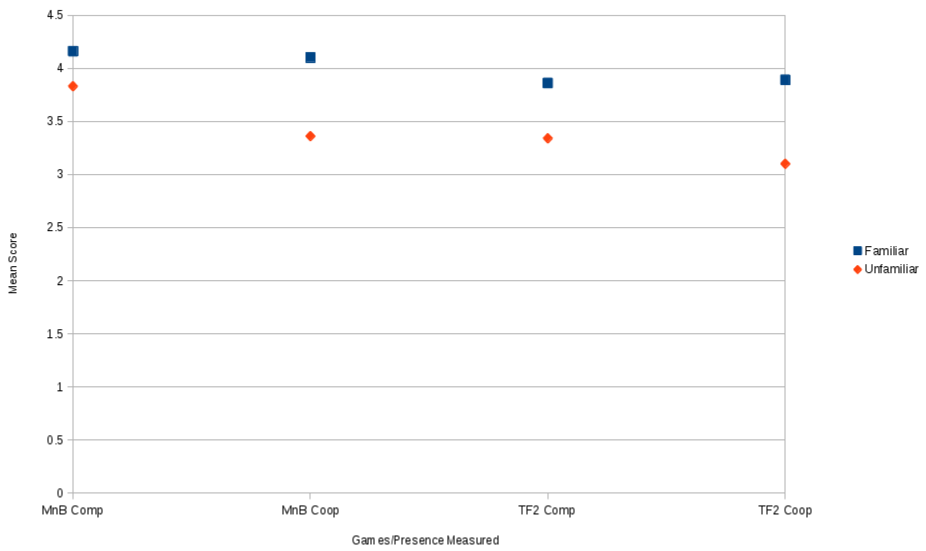

Figure 7.6: Familiarity vs Competitive and Cooperative Social Presence Scores

Inter-coder Reliability

To validate the coding scheme a total of 30 user generated comments, consisting of one thousand words, were coded by a second coder to establish inter-coder reliability. The second coder was an *outside* coder, they did not help to develop the original coding scheme, but were instructed to suggest any codes they thought were needed but missing from the original coding scheme. However while they were an *outside* coder they had a depth of domain knowledge, and had played a number of the games used in this chapter.

Results of the coding are shown in Table 7.58. The total number of code cases was , with agreement on of these cases, giving a simple inter-coder agreement of 65.38% (34/52 = 0.6538). However, there is a possibility that coders will agree by chance and so *Cohen's Kappa*[Cohen, 1960], which takes this into consideration, was used to calculate the inter-coder reliability.

Cohen's Kappa = (Pa - Pc)/(1-Pc)

(Pc) Probability of agreeing by chance - 1/number of codes = 1/23 = 0.0434

(Pa) Probability of actual agreement = 0.6538

(0.6538-0.0434)/(1-0.0434) = 0.6380

Based on Landis & Koch's [Landis and Koch, 1977] (Table 7.57) benchmarks for interpreting Cohen's Kappa score we can see that the inter-coder reliability was *Substantial*.

Kappa Statistic	Strength of Agreement
less than 0.00	Poor
0.00 - 0.20	Slight
0.21 - 0.40	Fair
0.41 - 0.60	Moderate
0.61- 0.80	Substantial
0.81- 1.00	Almost Perfect

Table 7.57: Landis & Koch Kappa Benchmarks

Comment	Coder A	Coder B	Codes	Agreed
1	Positive	Positive Support	3	2
2	Tricky	Tricky	2	2
3	Positive	Positive Support	3	2
4			0	0
5		Think About	1	0
6	Positive	Positive	2	2
7		Support	1	0
8	Bland Similar	Tricky Similar	4	2
9	Think About	Think About Positive	3	2
10	Pub vs	Pub vs	2	2
11	Pub vs Comms Team Comment	Pub vs Comms Tricky	6	4
12	Community	Community	2	2
13		Tricky	1	0
14	Team Comment	Team Comment	2	2
15	Positive	Positive	2	2
16	Positive	Positive	2	2
17			0	0
18	Team Comment	Teamplay	2	0
19		Community	1	0
20	TK	TK XP	3	2
21		Positive	1	0
22		Metagame	1	0
23			0	0
24	Pub vs	Pub vs	2	2
25			0	0
26	Community Team Comment	Community	3	2
27			0	0
28			0	0
29	Community	Community	2	2
30		Team Comment	1	0
Total	-	-	52	34

Table 7.58: Inter-coder Coding Instances

7.3 Social Presence & Team Trust

The Jarvenpaa et al. [1998] Trust Survey Measure

Trust

If I had my way, I would not let the other team members have any influence over issues that are important to the project. (reversed)

I would be comfortable giving the other team members complete responsibility for the completion of this project.

I really wish I had a good way to oversee the work of the other team members on the project. (reversed)

I would be comfortable giving the other team members a task or problem that was critical to the project, even if I could not monitor them.

Ability

I feel very confident about the other team members skills.

The other team members have much knowledge about the work that needs to be done.

The other team members have specialized capabilities that can increase our performance.

The other team members are well qualified.

The other team members are very capable of performing their tasks.

The other team members seem to be successful in the activities they undertake.

Benevolence

The other team members are very concerned about the ability of the team to get along.

The outcomes of this project are very important to the other team members.

The other team members would not knowingly do anything to disrupt or slow down the project.

The other team members are concerned about what is important to the team.

The other team members will do everything in their capacity to help the team perform.

Integrity

The other team members try hard to be fair in dealing with one another.

The other team members have a strong sense of commitment.

I never am doubtful about whether the other team members will do what they promised.

I like the work values of the members on this team.

The other team members do not behave in a consistent manner I am never sure if they are going to do what they promise or not.(reversed)

The other team members display a solid work ethic.

Propensity of Trust

One should be very cautious when working with students. (reversed) dropped

Most students tell the truth about the limits of their knowledge.

Most students can be counted on to do what they say they will do.

Most students are honest in describing their experiences and abilities.

The McAllister [1995] Questionnaire

1. Behavioral Response and Interpersonal Trust Measures

1.1 Affect-based trust

We have a sharing relationship. We can both freely share our ideas, feelings, and hopes.

I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.

We would both feel a sense of loss if one of us was transferred and we could no longer work together.

If I shared my problems with this person, I know (s)he would respond constructively and caringly.

I would have to say that we have both made considerable emotional investments in our working relationship.

1.2 Cognition-based trust

This person approaches his/her job with professionalism and dedication.

Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.

I can rely on this person not to make my job more difficult by careless work.

Most people, even those who aren't close friends of this individual, trust and respect him/her as a coworker.

Other work associates of mine who must interact with this individual consider him/her to be trustworthy.

If people knew more about this individual and his/her background, they would be more concerned and monitor his/her performance more closely?

1.3 Need-based monitoring

Even when others think everything is fine, I know when (s)he is having difficulties.

This person doesn't have to tell me in order for me to know how things are going for him/her at work.

1.4 Affiliative citizenship behavior

I take time to listen to this person's problems and worries.

I have taken a personal interest in this individual.

I frequently do extra things I know I won't be rewarded for, but which make my cooperative efforts with this person more productive.

I pass on new information that might be useful to this person.

I willingly help this individual, even at some cost to personal productivity.

When making decisions at work that affect this individual, I try to take his/her needs and feelings into account.

I try not to make things more difficult for this person by my careless actions.

1.5 Assistance-oriented citizenship behavior

I help this person with difficult assignments, even when assistance is not directly requested.

I assist this person with heavy work loads, even though it is not part of my job.

I help this person when (s)he has been absent.

1.6 Monitoring and defensive behavior

I find that this person is not the sort of coworker I need to monitor closely.

The quality of the work I receive from this individual is only maintained by my diligent monitoring.

I have sometimes found it necessary to work around this individual in order to get things done the way that I would like them to be done.

I keep close track of my interactions with this individual, taking note of instances where (s)he does not keep up her/his end of the bargain.

I have found it necessary to make inquiries before responding to this person's requests for assistance. This ensures that my interests are protected.

Rather than just depending on this individual to come through when I need assistance, I try to have a backup plan ready.

2 Exogenous Measures

2.1 Interaction frequency

How frequently does this individual initiate work-related interaction with you?

How frequently do you initiate work-related interaction with this person?

How frequently do you interact with this person at work?

How frequently do you interact with this person informally or socially at work?

2.2 Peer affiliative citizenship behavior

I take time to listen to this person's problems and worries.

I willingly help this individual, even at some cost to personal productivity.

I have taken a personal interest in this individual.

I pass on new information that might be useful to this person.

I frequently do extra things I know I won't be rewarded for, but which make my cooperative efforts with this person more productive.

When making decisions at work that affect this individual, I try to take his/her needs and feelings into account.

I try not to make things more difficult for this person by my careless actions.

2.3 Peer assistance-oriented citizenship behavior

I help this person when (s)he has been absent.

I help this person with difficult assignments, even when assistance is not directly requested.

I assist this person with heavy work loads, even though it is not part of my job.

2.4 Peer reliable role performance

This person adequately completes assigned duties.

This person performs all tasks that are expected of him/her.

This person fulfills responsibilities specified in job description.

This person meets formal performance requirements of the job.

3 Performance Measures

3.1 Assessor rating of focal manager's performance

Overall, to what extent do you feel that this person is performing his/her total job the way you would like it to be performed?

To what extent has this person met all of your expectations in his/her roles and responsibilities?

To what extent are you satisfied with the total contribution made by this person?

If you had your way, to what extent would you change the manner in which this person is doing his/her job?

3.2 Assessor rating of peer performance Overall, to what extent do you feel that this person is performing his/her total job the way you would like it to be performed?

To what extent has this person met all of your expectations in his/her roles and responsibilities?

To what extent are you satisfied with the total contribution made by this person?

If you had your way, to what extent would you change the manner in which this person does his/her job?

The Webber [2008] Questionnaire

Familiarity

How well do you know the academic reputation of this team member?

How well do you know this team member personally?

How well do you know the strengths and weaknesses of this team member?

How familiar are you with the way this team member works?

Citizenship behavior

My team members have taken a personal interest in the team.

My team members willingly help each other, even at some cost to personal productivity.

When making decisions in class that affect the team, my team members try to take each others needs and feelings into account.

My team members frequently do extra things they know they will not be rewarded for, but which makes our work with the team more productive.

My team members take time to listen to each others problems and worries.

My team members try not to make things more difficult for each other by their careless actions.

My team members pass on new information that is useful to the team.

Reliable performance

My team fulfills responsibilities specified in the project description.

My team performs all tasks that are expected of them.

My team meets formal performance requirements of the project.

Interaction frequency

How frequently do you initiate team-related interaction with members of your team?

How frequently do members of your team initiate team-related interaction with you?

How frequently does your team interact for project purposes?

Monitoring

I have sometimes found it necessary to work around team members to get things done the way that I would like them done.

I keep a close track of my interactions with team members, keeping track of instances when they do keep track of their end of the bargain.

The quality of work I receive from members of this team is only maintained by my diligent monitoring of members.

Rather than just depending on some team members to come through, I try to have a backup plan ready.

The Kanawattanachai and Yoo [2002] Questionnaire

Cognition-based Trust

Most of my teammates approach his/her job with professionalism and dedication.

I see no reason to doubt my teammates' competence and preparation for the job.

I can rely on other teammates not to make my job more difficult by careless work.

Most of my teammates can be relied upon to do as they say they will do.

Affect-based Trust

I can talk freely to my team about difficulties I am having at work and know that my team will want to listen.

I would feel a sense of loss if one of us was transferred and we could no longer work together.

If I shared my problems with my team. I know (s)he would respond constructively and caringly.

I would have to say that we (my team) have made considerable emotional investments in our working relationship.

Disposition to Trust

Most people tell the truth about the limits of their knowledge.

Most people can be counted on to do what they say they will do.

Most people are honest in describing their experience and abilities.

Most people answer personal questions honestly.

The Langfred [2004] Questionnaire

Individual Autonomy

[Breaugh, 1989]

1. In the team, I decide how to do my own work.
2. On team projects, I control the scheduling of my work.
3. Once the team decides what to do, I decide how to do my part.

Trust

[Simons and Peterson, 2000]

1. We trust each other a lot in my team.
2. I know I can count on the other team members.
3. The other team members know they can count on me.
4. I trust all of the other team members.

Monitoring

[Cummings and Bromiley, 1996]

1. We check to make sure that other team members continue to work on team projects.
2. We monitor each others progress on team projects.
3. We check whether everybody is meeting their obligation to the team.
4. We watch to make sure everyone in the team meets their deadlines.

The Jarvenpaa et al. [2004] Questionnaire

Construct: Initial Trustworthiness

[Pearce et al., 1992]

We will have confidence in one another on this team.

I will be able to rely on those I work with in this team.

There will be a noticeable lack of confidence among those I will work with.

Overall, the people will be very trustworthy.

We will usually be considerate of one another's feelings in this team.

The people in my team will be friendly.

Construct: Cohesion

[Chidambaram, 1996]

I feel that I am a part of the team.

My team works together better than most teams on which I have worked.

My teammates and I help each other better than most other teams on which I have worked.

My teammates and I get along better than most other teams on which I have worked.

Construct: Early Trust

[Schoorman et al., 1996]

I feel comfortable depending on my team members for the completion of the project.

I feel that I will not be able to count on my team members to help me.

I am comfortable letting other team members take responsibility for tasks which are critical to the project, even when I cannot monitor them.

I feel that I can trust my team members completely.

Construct: Satisfaction

[Valacich et al., 1992b]

How satisfied were you with your teams process?

How satisfied were you with the outcome of your teams project?

How satisfied were you with the other members in your team?

Overall, how satisfied were you with participating in this global virtual team collaboration?

Construct: Subjective Outcome Quality

[Maurer and Tarulli, 1994]

The business plan my team developed will earn a high grade from my professor in this course.

The business plan my team developed would convince a banker or venture capitalist to finance our new consulting firm.

The business plan my team developed would convince experienced consultants to join our new consulting firm.

The business plan my team developed would convince prospective clients to hire our new consulting firm.

The Costa [2010] Questionnaire

Propensity to trust

y1 Most people don't hesitate to help someone in need of help (in an emergency situation).

y2 'Treat people how you wish to be treated' is a motto that most people go by.

y3 Most people stand by what they believe in.

y4 People usually tell the truth, even if they know they would be better off by lying.

y5 The average person is genuinely concerned about the problems of others.

y6 Most people are honest about their true opinion.

y7 The average person sticks to his opinion if he thinks he is right, even when others disagree with him.

Perceived trustworthiness

y8 Some people in my working unit are successful at the expense of others.

y9 Within my working unit, it occurs that one profits from the problems of someone else.

y10 People deceive each other within my working unit.

y11 I have the feeling that some people in my working unit try to get out of their obligations.

y12 I have the feeling that some people in my working unit are trying to be the boss over others.

y13 I have the feeling that people within my working unit keep their word.

y14 I have the feeling that within my working unit, everyone's interest is taken into account.

y15 Within my working unit, it occurs that people in a vulnerable situation, are made use of.

Cooperative activities

y16 Within my working unit, people tell each other as little as possible about themselves.

y17 There are mostly conversations about the work itself rather than any other topic.

y18 People are reserved about giving their opinions in the work meetings.

y19 In my working unit, there is hardly any conversation about the work itself.

y20 In my working unit, people are not easily completely honest/open.

y21 Most people in my working unit do not care about the ideas or suggestions of another.

y22 Within my working unit, there are people who distance themselves from the rest, so that others cannot strongly influence their work.

y23 We sometimes tell each other things that we don't want others to know about.

y24 We take each others opinions into account when decisions need to be taken.

Monitoring activities

y25 Within my working unit, people keep an eye on each other.

y26 There are checks to see if everybody is fulfilling their obligations.

y27 In my working unit, there are people who tend to check/control the work of others.

Online Questionnaire

Thank you for your participation!

The purpose of this text is to tell you about the study and highlight issues concerning your participation.

Information:

I am currently working as an EngD research student at the University of York in the U.K. and am conducting a research project involving immersion and presence in online team based computer games and other multi-user virtual environments. The purpose of this study is to measure social engagement in a team based online game. If you have any questions regarding this study please ask on the forums where the study has been posted or contact me at mh712 at york dot ac dot uk.

About the study:

I. Purpose of the investigation.

This is a study of Social Presence in online multiplayer team-based digital games.

II. Confidentiality.

All data collected will be anonymised. All information provided will be treated confidentially, as specified by the Data Protection Act, 1998. If published, your name will not be associated with any of the data.

III. Voluntary Participation.

Your participation is completely voluntary. You therefore have the right to withdraw from the investigation at any time, and, if requested, your data can be destroyed.

IV. Questions.

Please feel free to ask me any questions you might have regarding the procedure. After testing is completed I will also be happy to answer any questions you might have about the project itself.

V. Consent.

By completing this form you agree to take part in this investigation. This will indicate you have read the above information and understand your rights as a participant, as well as understanding my obligation to keep your data confidential.

If there are any issues, comments, opinions you have with any of the questions please comment at the end.

Instructions:

1. Play Chivalry team-based multiplayer for a typical gaming session.

2. When you finish playing or take a break fill out this questionnaire.

Please answer honestly and please complete all questions. If you would like to be entered into the prize draw please include your email address, if not simply leave it blank.

Participant Info

Name: [TEXT]

Email: [TEXT]

Age: [TEXT]

Sex: [TEXT]

Generally how many people were on your team? [TEXT]

How familiar were you with the other players?

Please show who you were sharing the server with by chosing any number of the following:

☐ Real-Life Friends

☐ Online Friends

☐ Clan-mates

☐ Acquaintance (server regulars)

☐ Strangers

What was the nature of the game? Pub play, organised battle/scrim, etc?: [TEXT]

Game specific question asking participants about load-out, team, class, etc. [TEXT]

Overall how well did your team perform? [5 point Likert Scale]

Did your team win or lose? [TEXT]

In general how challenging was the game in this session of play? [5 point Likert Scale]

How often did you check the scores of the other players? [5 point Likert Scale]

Section 1 *(Competitive Social Presence)*

Competitive Module 1.1 Awareness

I acted with my opponents in mind [5 point Likert Scale]

I reacted to my opponents actions [5 point Likert Scale]

I knew what my opponents were trying to achieve [5 point Likert Scale]

I was aware that my opponents might work out my goals [5 point Likert Scale]

The actions of my opponents affected the way I played [5 point Likert Scale]

I felt I affected my opponents actions [5 point Likert Scale]

Competitive Module 1.2 Engagement

My opponents were challenging [5 point Likert Scale]

The game was a battle of skill [5 point Likert Scale]

The game was a battle of wits [5 point Likert Scale]

I felt tense while playing my opponents [5 point Likert Scale]

My opponents created a sense of urgency [5 point Likert Scale]

The presence of my opponents motivated me [5 point Likert Scale]

My opponents played a significant role in my experience of the game [5 point Likert Scale]

It seemed as though my opponents were acting with awareness of my actions [5 point Likert Scale]

Section 2 *(Cooperative Social Presence)*

Cooperative Module 2.1 Cohesion

I felt like I was part of a team [5 point Likert Scale]

I felt a social connection to my team-mates/camaraderie [5 point Likert Scale]

I felt my team-mates were looking out for me [5 point Likert Scale]

I felt the team helped me [5 point Likert Scale]

My team-mates played a significant role in my game experience [5 point Likert Scale]

My team communicated well [5 point Likert Scale]

The team had a mutual understanding [5 point Likert Scale]

I put the performance of the team over my personal performance [5 point Likert Scale]

Being part of a team motivated me [5 point Likert Scale]

I felt my team was committed to working together [5 point Likert Scale]

My team-mates were useful [5 point Likert Scale]

I felt my team shared a common overall aim [5 point Likert Scale]

I felt my team shared common short term goals [5 point Likert Scale]

It was as much about the team as about my own game [5 point Likert Scale]

Cooperative Module 2.2 Involvement

I was aware of my team [5 point Likert Scale]

I acted with my team-mates in mind [5 point Likert Scale]

I considered my team-mates possible plans/thoughts [5 point Likert Scale]

I felt I contributed to the team [5 point Likert Scale]

I felt my actions made a difference to my team-mates [5 point Likert Scale]

The actions of my team-mates affected my thoughts and actions [5 point Likert Scale]

My actions were determined by the objectives of the team [5 point Likert Scale]

I wanted my team to value me [5 point Likert Scale]

I felt responsible for achieving the objectives of the team [5 point Likert Scale]

I made an effort to work with my team-mates [5 point Likert Scale]

I did not want my team to think I had let them down [5 point Likert Scale]

Contextualized Langfred [2004] Team Trust Items

I felt the team trusted each other a lot [5 point Likert Scale]

I knew I could count on the other team members [5 point Likert Scale]

I felt the other team members could count on me [5 point Likert Scale]

I trusted the other team members [5 point Likert Scale]

Comments on the questionnaire: Critiques, criticisms, general comments, anything you liked/didnt like, etc. [TEXT]

R Scripts/Commands Used

Correlation script:

```
cor(x, use="pairwise.complete.obs")
```

T-test and Kruskal-Wallis Test for Significance:

```
kruskal.test(x)


t.test(x)
```

Effect size (Cohen's D):

```
cohensD()
```

Cronbach's α:

```
cronbach.alpha(x, standardized = FALSE, CI = TRUE, probs = c(0.025, 0.975), B = 1000, na.rm

kmo <- function(x)
{
  x <- subset(x, complete.cases(x)) # Omit missing values
  r <- cor(x) # Correlation matrix
  r2 <- r^2 # Squared correlation coefficients
  i <- solve(r) # Inverse matrix of correlation matrix
  d <- diag(i) # Diagonal elements of inverse matrix
  p2 <- (-i/sqrt(outer(d, d)))^2 # Squared partial correlation coefficients
  diag(r2) <- diag(p2) <- 0 # Delete diagonal elements
  KMO <- sum(r2)/(sum(r2)+sum(p2))
  MSA <- colSums(r2)/(colSums(r2)+colSums(p2))
  return(list(KMO=KMO, MSA=MSA))
}
```

Chapter 8

Appendix 2: Deliverables

8.1 Introduction

The following are a set of deliverables from the Engineering Doctorate thesis 'Social Presence in Team-Based Digital Games', sometimes refereed to as implications for design. These deliverables are in the form of insights, produced from the qualitative and quantitative studies conducted throughout the accompanying thesis, which have implications for the design of virtual training scenarios. The deliverables outline how various contextual factors change the way virtual environments are experienced, some giving fresh insight and others giving an academic foundation to previous opinion and anecdotal reports. Many of the insights are strongly related and complement one another, for example it may be possible to mitigate the negative aspects of small team sizes on team trust (Deliverable 6) by increasing the perceived team cohesion (Deliverable 8). The deliverables below give insights into the Social Presence, Team Trust, the use of human/computer controlled entities in team-based scenarios, team dynamics, and how perceptions of virtual environments can influence used experience. In addition to the deliverables, an outcome from the thesis includes a validated measure Competitive and Cooperative Social Presence (CCPIG Questionnaire), which can be used to measure social presence in team-based virtual environments and was used to provide many of the insights below.

8.2 Implications for Design

The deliverables below include the core insight, further useful details and the implications for design, an example scenario, and the evidence within the thesis document which supports the insight. A number of deliverables also contain an element of risk which is also outlined along with possible solutions.

1. The Awareness of other Humans
Insight: The awareness of other humans within a virtual environment changes user perceptions of that environment.

Implication for Design: The awareness of another human within a virtual environment makes the environment seem more engaging and changes the way users perceive elements within that environment. Therefore including another human participants within a virtual training scenario could be used to make virtual environments with low interactivity or low fidelity become more engaging. Human team-mates are perceived as being more capable, human opponents are perceived as more challenging than their bot counterparts, and human opponents and team-mates can increase levels of motivation.

Example: A virtual training scenario such as air-to-ground fast-jet mission could be made more engaging if the the ground defenses were controlled by a human opponent and the trainee had a human team-mate.

Evidence: Chapter 3: Social Gaming Survey, Puji.

2. Limiting the Truth

Insight: People cannot always tell the difference between bots and humans in virtual environments (so we can lie).

Implication for Design: In an environment with limited interpersonal interaction or generally low communication bandwidth, people are less able to distinguish between computer and human controlled entities. This means that in these scenarios social presence is based as much on a users preconceptions of a virtual situation than any interaction taking place. Therefore people can be told that they are competing or collaborating with a human when they are in fact interacting with a bot. This means that a scenario can benefit from the increased engagement and perceived challenge from the awareness of other humans of deliverable 1. without the need for an actual human.

Risk: Deception can cause users to feel tricked, create distrust, and therefore lose interest in a scenario. If users suspects that an entity might be a bot rather than a human they may shift their focus away from the goals of the training scenarios to establishing the agency of an entity. To mitigate these risks deception should only be used in situations which have very limited interaction between entities and ideally no communication.

Example: A fast-jet pilot in a virtual training scenario could be informed that computer controlled surface-to-air missile (SAM) sites are being controlled by a human to increase the perceived challenge they present.

Evidence: Chapter 3: Cooperative Tetris, Problem with Bots, Ambiguity in Unreal Tournament.

3. Team Trust & Learning

Insight: Team Performance (winning or losing) has an substantial effect on team trust. However familiarity can reduce the effects.

Implication for Design: If a team wins then its members are more likely to feel increased team trust, while losing decreases levels of team trust. However to losing is often valuable in training, learning what one did wrong and why one failed. This creates the situation in which team training and developing team trust are conceptually at odds. High levels of familiarity within teams can reduce or negate the effects of performance on team trust, therefore scenario design for building trust in teams should reflect the level of familiarity with the team.

Risk: A risk with allowing teams to win scenarios is that they may develop a sense of complacency. Such risk could be reduced by allowing teams to achieve high performance rather than necessarily 'winning' a scenario. Team could be put in impossible situations, in which there is no 'winning' 1pt but team performance could still be perceived as high.

Example: In the training pipeline of a team it may be advisable to develop training scenarios in which they can achieve high performance levels while developing familiarity. Once a team has reached a high level of familiarity then the training benefits of failure will have less effect on levels of team trust.

Evidence: Chapter 5: Team Trust & Social Presence.

4. Tactical vs. Hectic

Insight: Hectic environments reduce social awareness.

Implication for Design: In hectic or chaotic team-based scenarios people become more focused on their opponents and have a reduced awareness of their team. People also become less aware/concerned about agency, as a result performance has less effect on Cooperative Social Presence and Team Trust. In the domain of fast-jet pilots a hectic situation could be defined as the difference between requiring tactical competency versus dogfight competency. In hectic situations survival is based upon individual skill over team-work, in which a person is in direct and immediate danger from multiple entities. The effect of hectic situations has a number of implications for design. In training scenarios which aim to focus on team training capabilities it may be advisable to avoid hectic situations so that the trainees can focus on team. Alternatively the effect could be designed into a scenario which aim to train team members to remain calm and retain situational awareness of their team in hectic situations. In terms of hardware rather than scenario design, interfaces could be designed to counteract the degraded social awareness caused by hectic situations.

Example: A training scenario could be designed for testing a squadron leader's ability to retain team awareness and command & control capabilities throughout a hectic situation.

Evidence: Chapter 3: Ambiguity in Unreal Tournament, Chapter 5: Team Trust & Social Presence.

5. Range of Engagement

Insight: The range at which a person must engage their opponents in a virtual environment changes their levels Competitive Social Presence.

Implication for Design: Engaging an opponent at a great distance reduces Competitive Social Presence in team-based virtual environments, while engaging an opponent in close combat increases a person's awareness of challenge. Similar to deliverable 4, these effects could be designed in or out of a training scenario depending on the training requirements. To ensure a greater team focus opponents could be kept at a distance, while high levels of challenge and competitive focus could be stimulated by creating close encounters.

Example: A virtual team training which aims to focus purely on procedures and high level strategy should maintain a significant distance between the trainees and their opponents.

Evidence: Chapter 5: Team Trust & Social Presence.

6. Team Size

Insight: Small team sizes produce large effects.

Implication for Design: Small team size seems to intensify social connections within virtual environments.

Small teams create a stronger correlation between Cooperative Social Presence & Team Trust and team performance has a larger impact on Cooperative Social Presence and Team Trust. This means that team trust may develop more quickly in smaller teams however failure will have a greater negative impact on the team trust. Therefore team trust may be considered as potentially more fragile within small teams. Designing training scenarios which allow small teams to feel part of a larger entity may alleviate this fragility.

Example: In an early stage of training small teams completing scenarios which create the perceptions of high performance could accelerate the development of team trust.
Evidence: Chapter 5: Team Trust & Social Presence.

7. Disparity

Insight: Disparity between team members can have a negative effect on team trust.

Implication for Design: Disparity, differences in cognitive motivation, specialized knowledge and age, between team members can stunt the emergence of trust. Disparity can lead to a lower levels of team trust and increase the effects of performance on team trust. As low performance will produce a substantial negative impact on team trust within teams with high disparity, efforts must be made to either reduce team disparity or produce perceived high performance while team trust is fostered.

Example: Disparity may occur between junior and senior personnel and may be a factor in joint forces training.

Evidence: Chapter 5: Team Trust & Social Presence.

8. Perceived Team Cohesion

Insight: The perceived level of team cohesion is a central aspect of team trust.

Implication for Design: Perceived team cohesion is a component of the CCPIG Questionnaire used to measure Social Presence. The level of cohesion a team member perceives to be present within their team correlates strongly with team trust. The more a team member perceived their team to be a cohesive unit, the greater the level of trust that member will have in their team. In addition perceived team cohesion is generally highly sensitive to performance, with members of losing teams perceiving their team to be cohesive. Therefore when aiming to build team trust training systems should be designed to encourage team cohesion, promote an awareness of team cohesion, and where possible explicitly present the team as cohesive.

Example: An information system which not only promoted an awareness of the location of their teammates but tasks they were completing to work towards the joint objectives of the team may increase the perception of team cohesion and thus increase team trust.
Risk: Perceived team cohesion is generally highly sensitive to performance, with members of losing teams perceiving their team to be less cohesive.

Evidence: Chapter 5: Team Trust & Social Presence.

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