Is Game Immersion Just Another Form of Selective Attention? An Empirical Investigation of Real World Dissociation in Computer Game Immersion

by

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DECLARATION

I, Charlene Ianthe Jennett, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Although some of this research has been published with my supervisors Anna L. Cox and Paul Cairns as co-authors, the work reported is my own.

ABSTRACT

When your daughter is playing video-games and you call her to dinner but she fails to respond, do you assume she heard you and ignored you? Everyday descriptions of game immersion suggest that the real world dissociation experienced by gamers could be an extreme form of selective attention. If this were the case, this would mean that your daughter really did not hear you call, due to the complexity of the game environment and a lack of available cognitive resources.

This thesis describes a grounded theory that suggests that immersion is a result of self-motivated attention which is enhanced through feedback from the game. Five experimental studies are then described. The experimental studies show that the extent to which a player thinks they are doing well in the game significantly affects their level of immersion, as measured via the Immersive Experience Questionnaire; and has objective effects on their awareness of other things in the environment, namely recall of auditory distracters and reaction time to a visual distracter.

Together the evidence suggests that immersion cannot be accounted for solely by selective attention: much of the real world is attenuated during game-play due primarily to the gamer's motivation to continue the immersive experience. Interestingly, the auditory items that do get through the attenuation filter and are heard by the gamer are those that are personal in some way; so if you used your daughter's name when you called her, and she did not respond, then based on our findings one might suggest that she chose to ignore you in order to keep her sense of immersion.

Additionally, the final experiment shows a dissociation between immersion and cognitive load. This suggests that the differences in immersion were not a result of increased sensory features or task demands, but purely due to motivation.

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Chapter 1

Introduction

1.1. PLAY AND GAMES

Clark (2006) writes that no place is entirely immune from people's willing participation in play. No newspaper would be complete without puzzles such as crosswords and sodoku. In pubs around England one will find pub quizzes, as well as gaming machines, dart boards and pool tables. In school playgrounds children play football, marbles, hopscotch, skipping, and tag games. Local leisure centres provide activities such as badminton, swimming, volleyball, basketball, tennis and martial arts. People will even go on holiday to play, visiting amusement parks, beaches, mountains, and so the list goes on. Play can be seen in land, sea and air; there is even a fledgling industry that aims to take tourism into space.

Huizinga (1950) defines play as "a free activity, standing quite consciously outside 'ordinary' life as being 'not serious', but at the same time absorbing the player intensely and utterly". Similarly Caillois (2001) also defines play as being accompanied by a special awareness of a second reality, as against real life. Play is governed by its own rules, and it is engaged within precise limits of time and space. It is uncertain, as the course of a game can not be determined beforehand. It is unproductive as it creates no physical goods or wealth. Yet due to its free and voluntary nature, people find play a source of great joy and amusement.

There are many different forms of play. Caillois (2001) proposes a division of games into four main categories: "agon", "alea", "mimicry" and "ilinx". "Agon" involves games of competition, where rivals confront each other under ideal conditions, e.g. football, billiards, chess. "Alea" involves games of chance, where winning is the result of fate, e.g. roulette, a lottery. "Mimicry" involves games of simulation, where a person temporarily sheds his/her personality in order to feign another, e.g. pretending to be a pirate. "Ilinx" involves the pursuit of vertigo, attempting to momentarily destroy the stability of perception, e.g. spinning until one achieves a state of dizziness.

Almost all forms of play have been touched by technology. Quiz programmes, sport and reality TV all have competitive game formats as their core appeal. Entire TV channels are even dedicated to sports. However, it is the creation of computer games that have had the most pronounced effect on play (Clark, 2006).

Although Huizinga (1950) and Caillois (2001) originally considered play in the context of sports, board games, card games and children's make believe, one can argue that many of these same principles apply to computer games. Computer games often provide people with a second reality to immerse themselves in, proving a popular form of escapism. In fact, one might even suggest that computer games are simply modern transformations of traditional modes of play. For example, driving games and fighting games are forms of "agon", computer solitaire and poker can easily be classed under "alea", and role playing games are a more advanced form of "mimicry".

However computer games also have a number of benefits over traditional modes of play. Due to their high accessibility, a variety of different games can be played in the same space on the same computer console. If a person wants to play a competitive game their competitors no longer have to be physically present: one can play against the computer or other people online. Also there are fewer limits on time of play. Whereas most physical sports must be played during daylight and ideal weather conditions, sports computer games can be played at any time.

Furthermore, computer games provide visual experiences unlike any other game. They allow people to explore virtual worlds, sometimes beyond the scope of one's imagination. They also allow people to enjoy playing one game for a longer period of time. For example, adventure games will often take months to complete, a person progressing a little bit further each time they play. Some online games do not even appear to have endings, like the more recent massively multiplayer online role-playing games (MMORPGs) in which large groups of players interact within a virtual game world.

Computer games come in a variety of different shapes and sizes. There are arcade games than run on coin-operated machines, computer games that run on personal computers and video games that run on consoles and display on your TV (Beck and Wade, 2006). There are also a number of small portable devices that allow people to play games. Some are dedicated to games, such as Gameboy. Others have games in-built as an extra feature, e.g. mobile phones.

As well as the delivery platform, computer games also differ in the nature of the games played and the way users play them. Genres of gaming include shoot 'em ups, driving, role-play, etc. although it can often be difficult to classify a game as many games overlap. Some games have sophisticated graphics involving characters within a 3D virtual environment, e.g. the first person shooter "Half Life". Others are much more simplistic, e.g. the puzzle game "Tetris". Games can be further distinguished as single player or multiplayer. Plus, with the use of the internet, it is possible to play games with others that are not physically present or even known to the user.

However, it must be noted that the word "play" is not synonymous with the word "game". In other words, not all activities that involve play are considered games. Therefore, before we move onto describing the main focus of this research, it is necessary to define what a game actually is.

1.2. DEFINING COMPUTER GAMES

Smed and Hakonen (2003) write that a game involves three components:

- Rules which define the limits of the game, and consequently the goal of the game;

- Players who are willing to participate in the game for enjoyment, diversion or amusement, and therefore agree to follow the rules;
- Goals which give arise to conflict and rivalry among the players. Each player's goal is to win however conflict arises because opponents obstruct the players from achieving the goals. These opponents can include unpredictable humans and unpredictable random processes.

For example, Solitaire is a game because there are rules for play, the player abides by these rules, and the randomness of the deck opposes the player because they can not determine what cards will be dealt next. Sports such as football, board games such as Monopoly and card games such as Poker would also be regarded as games: there are rules, players abide by the rules, and players act as opponents because they are all trying to score the most points / achieve a better hand either for themselves or for their team.

In contrast, a soft toy can be played with; however it is not a game because its play is not bound by rules. Similarly, when a child plays make believe this is not a game because the child may change the rules as they go along.

An ordinary crossword puzzle is not a game because it presents no conflict, due to its lack of interactive elements. However, if a time limit was imposed and players were instructed that they must try to get as many words as possible and whoever gets the most words will win, then it would become a game. Thus, although puzzles are not games by themselves, games can include puzzles as subtasks (Smed & Haknonen, 2003).

Considering games in more depth, Juul (2003) suggests that games have six features. He defines a game as a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels attached to the outcome, and the consequences of the activity are optional and negotiable, see Table 1.

Thus Juul (2003) explains that checkers, chess, soccer, tennis, Hearts, Solitaire, pinball, and computer games such as "Quake III" and "EverQuest" are games. However pen and paper role-playing games are not normal games: with a human game master their rules are not fixed beyond discussion. Open-ended simulations such as "Sim City" are borderline cases: no explicit value is attached to the possible outcomes of the game, there are no explicit goals. Games of pure chance, such as bingo, and chance-based gambling, such as roulette, are also borderline cases: although the player desires to win, the player's actions can not influence the game state and game outcome.

Computer games differ from ordinary games because it is now the computer that upholds the rules (Juul, 2003). Smed and Hakonen (2003) identify three roles for a computer program in a game:

- Co-ordinating the game process, e.g. evaluating the rules and upholding the game state;
- Illustrating the situation, e.g. providing a proto-view for the human player and a synthetic view for the synthetic player, also providing sensory feedback;

- Participating as a synthetic player, e.g. an opponent, a non-player character, or godly powers that intervene in game events.

Thus the use of a computer adds a lot of flexibility to a game because it frees the players from having to enforce the rules and it allows for games where the player does not know the rules from the outset (Juul, 2003).

Table 1.

Six Features of Games, as Defined by Juul (2003).

Game Feature	Description
1. Rules	The rules of games have to be sufficiently well defined so that you do not need to argue about them every time you play.
2. Variable and quantifiable outcome	The game must fit the skills of the player. If players always achieve a draw or if a master player plays his/her best against a beginner, it does not work as a game activity. Also the goal of the game must be clear and unambiguous, e.g. the goal is to get the highest score.
3. Value assigned to possible outcomes	The different potential outcomes of the game are assigned different values, some being positive and some being negative. In a multiplayer game individual players are usually assigned conflicting positive outcomes, this is what creates the conflict in the game.
4. Player effort	The player invests effort in order to influence the outcome, i.e. games are challenging, contain a conflict.
5. Player attached to outcome	The player will be the winner and 'happy' if a positive outcome happens, and loser and 'unhappy' if a negative outcome happens. Part of the 'game contract', the spoil sport is one who refuses to seek enjoyment in winning or refuses to become unhappy by losing.
6. Negotiable consequences	The same game (set of rules) can be played with or without real-life consequences, e.g. people can bet on a card game, or play football professionally, however these activities are still considered games because one is aware that they can be played in non-professional settings.

Computer games also allow players to play against synthetic players or people that are not physically present, i.e. online game-play. Thus, whereas before a person could only play a few games when they were alone, such as solitaire or squash, computer games make it possible for a person to play a variety of games, e.g. computer sports, role playing games.

Furthermore, the use of a computer allows for more complex rules and as a result more complicated games. For example, MMORPGs involve complicated 3D virtual worlds for the participant to explore with many human players and synthetic players playing at once. Also in online role-playing games such as "EverQuest", rather than reaching a final outcome, players only ever reach temporary outcomes. In other words, there is no official end point (Juul, 2003).

1.3. THE CONCEPTS OF IMMERSION, SELECTIVE ATTENTION AND REAL WORLD DISSOCIATION

One of the appealing aspects of game-play is that it can be an immersive experience. "Immersion" is a term that is used in a variety of contexts outside of gaming; for example, virtual reality systems, watching films, and reading books. However, as shall be discussed in more detail later in the thesis, what makes immersion in gaming differ is that it makes use of both interactivity and narrative devices in order to engage users. Due to this complexity, there is considerable debate over "immersion" actually means when in reference to computer games. For example, when defining immersion the gamer designer Francois Dominic Laramee (2002) writes that:

> *"All forms of entertainment strive to create suspension of disbelief, a state in which the player's mind forgets that it is being subjected to entertainment and instead accepts what it perceives as reality".*

Thus Laramee (2002) argues that the power of games lies in their ability to make a player truly believe that he or she is part of an imaginary world. Salen and Zimmerman (2004) on the other hand refute this idea; they refer to it as "the immersive fallacy". They argue that immersion is not tied to a sensory replication of reality; instead games create meaning for players as something separate from, but connected to, the real world. This is further illustrated by the fact that gamers can often be seen moving between different frames of mind during game-play. For example, at one point the gamer might be emotionally identifying with their character ("I can't believe I survived that trap!"), at other points they might view themselves as just a player ("This cutscene sucks!") or a person in a larger social setting ("No thanks, I don't want a cup of tea right now"). Therefore, rather than striving to design games so immersive that players experience a 'character' viewpoint only, Salen and Zimmerman (2004) suggest that it is the multi-layered state of consciousness that appeals to players. The enjoyment of game-play lies in knowing that you are only playing, that what you are experiencing is not real; coming in and out of moments of immersion is an important part of this.

In this thesis we tend to support the latter viewpoint. Using Brown and Cairns (2004) grounded theory as a basis, we argue that game immersion is a cognitive phenomenon that occurs at different levels. "Total immersion", wherein the player feels that the game is reality, occurs at the height of immersion; however this is by no means the only enjoyable level of immersion. Getting to grips with the game interface ("engagement") and empathizing with the characters ("engrossment") are other levels, also enjoyable, on the spectrum of the immersive experience.

Aiming to explore the nature of consciousness further, in this thesis we were particularly interested in the player's awareness of their surroundings during game-play. Being able to escape from the "real world" is often cited as one of the reasons why people like to play games:

> *"Just as some people drink to forget, some videogamers slip out of a world of overbearing parents, demanding teachers, and dismal failure, to enter a world of simple challenges and frequent glorious successes. Their loss of awareness of the world around them is no happenstance; it's an important part of the appeal of the experience." (Crawford, 2003)*

> *"Games have become this generation's ultimate weapon against all the dead time that life throws their way. As they see it, there is never a good reason to be bored; that's why God invented Game Boy. From the back seat of mom's mini-van to those slow moments around the Thanksgiving table, you can always count on Mario…" (Beck & Wade, 2006)*

Sometimes game-play experiences are so intense that gamers report devoting entire nights or weekends to playing games without consciously deciding to do so (Jones, 1998). At these moments in time, almost all of the players' attention is focused on the game, even to the extent that some people describe themselves as being "in the game" (Brown & Cairns, 2004).

Everyday descriptions of game immersion such as these suggest that the immersion experienced by gamers could be an extreme form of selective attention (SA). SA is a well known concept in the psychology literature, and refers to when a person attends to one source of information over others (Kahneman, 1973). Consider the following example for instance: you call your video-game-playing daughter to dinner and she fails to respond. Do you assume that your daughter heard and ignored you? Or was your daughter so immersed in the game that she really was telling the truth when she said she did not hear you? If it were the case that immersion was an extreme form of SA, the explanation would be that the game environment is so complex that the gamer is unable to attend to things in the real-world due to a lack of available cognitive resources; so this would mean that your daughter really did not hear you call.

In a factor analytic study, Jennett et al. (2008) identified five factors of immersion: cognitive involvement, real world dissociation, emotional involvement, challenge and control. The concept of SA shares similarities with one immersion factor in particular, that of "real world dissociation" (RWD). RWD can be defined as the extent to which a person is less aware of their surroundings outside of the game; this factor had strong loadings for items expected to measure mental transportation and being less aware of your surroundings.

However, as of yet, it is still unclear what RWD actually involves. Indeed, out of all five of the immersion factors identified by Jennett et al. (2008), one can suggest that RWD is the factor that researchers know least about. Part of the reason for the lack of investigation could be that whereas game factors such as "control" and "challenge" can be easily manipulated by altering the design of a game, it is not clear how to manipulate RWD. In order to compare conditions in which people will experience more or less RWD, first researchers need to gain knowledge of what is necessary for RWD to occur.

Therefore, by exploring the immersion factor RWD, we aimed to gain a greater understanding of immersion as a whole and how immersion is similar / different to SA. The literature of immersion and SA will be considered in more detail later in the thesis. However, for this Introduction, it is simply important to note how these concepts relate to each other.

1.4. POSSIBLE APPLICATIONS OF IMMERSION RESEARCH

As well as theoretical implications, such research could have possible practical applications for a number of different gaming contexts. Three possible applications will now be discussed: stress relief, educational games, and limiting excessive game-play.

1.4.1. Stress Relief

Trenberth and Dewe (2002) suggest that leisure activities provide a mechanism for coping with tension and stressful events. By "escaping" into an alternative reality, players are able to get their minds off any problems that they have in the real world, thus working as a means of stress relief.

Like the more traditional modes of play, computer games are also viewed as beneficial in terms of providing people with a sense of stress relief. This is illustrated in the following quote from "WorldWinner" player Jeff R:

> *" I've found that taking a few minutes and challenging myself with a word game, puzzle or card game can really boost my productivity; I return to work with a fresh perspective and improved creativity. Playing games also gets me revved up before I start a big project – especially when I win." (Clark, 2006)*

Jeff R is not alone in this view; Clark (2006) writes that in a poll of players of the game "WorldWinner" they found that 34% of people said they played during work hours (500 polled in total). Out of these, 72% thought it reduced work stress, 76% thought it improved their productivity and 80% felt that they were better focused. In a study of adolescent computer game-play, Colwell (2007) also highlights "stress relief" as a reason for playing computer games; other factors included "companionship" (e.g. "helps me to forget I am alone"), "prefer to friends" (e.g. "more exciting than being with people") and "fun challenge" (e.g. "feeling part of the action"). Thus it is evident that one benefit of gaming is that by "escaping" into the game world, players are able to temporarily forget about their stressors in the real world. Such escapism might allow a person to come back to their real life problems later with a fresh perspective. Or it might simply allow a person to get a break from their thoughts, as they spend time thinking about something else, i.e. the game, instead of their life.

As well as everyday work, family and school stressors, it has also been suggested that computer games could be an effective means of helping people to cope with more chronic stressors. For example, Holmes et al. (2009) suggest that visuospatial games can be used to prevent post traumatic stress disorder (PTSD) flashbacks by disrupting memory consolidation. In their study Holmes et al. (2009) compared a group of participants that played "Tetris" half an hour after viewing a traumatic film to a group that did not play "Tetris". They found that the "Tetris" group had significantly less flashbacks. Therefore they suggest that playing "Tetris" after viewing traumatic material acted as a "cognitive vaccine", reducing unwanted, involuntary memory flashbacks to the traumatic film while leaving deliberate memory recall of the event intact.

1.4.2. Educational Games

Being able to escape into the game world involves the player being highly engaged. If the processes behind this mental transportation were better understood this could mean that serious games designed for educational and therapeutic contexts could be made more immersive and more appealing for users (Jones, 1998). As described by Prensky (2003), a well designed game possesses the ability to keep people in their seats for hours on end at rapt attention, actively trying to reach new goals and determined to overcome their failures. It is a learning experience unlike many others, an experience in which users actively seek information from an interface and enjoy doing so.

One of the possible reasons that computer games are so compelling is that computer games are informal learning environments, promoting playfulness and creativity. They involve alternative realities that differ from real life, therefore engaging the player's interest due to curiosity. In line with this view, Rosas et al. (2003) suggest that educational computer games are perceived as attractive because they present challenge, curiosity and control over what is happening to the individual student; an increase in motivation is directly related to a person's attention and concentration. Similarly, Eow et al. (2009) suggest that game-play is joyful because it is a natural way to learn; educational computer games allow diverse opportunities for students to be creative, compared to when they are in a more conventional learning environment.

Oblinger (2004) writes that another factor to consider is that students born in or after 1982 differ from students of the past. These students began using computers from an early age and as a result they are fascinated by new technologies. Therefore, any learning activity that involves technology will immediately gauge a student's interest.

Several studies have been conducted which support the idea of educational computer games as being beneficial for learning. For example, Tuzun et al. (2009) found that compared to a traditional school environment, when primary school students played a geography learning game they had higher intrinsic motivations (interest in the subject) and lower extrinsic motivations (learning just to achieve high grades). Students with attention problems and low achievement have also been described as spending more time concentrating when playing an educational game, compared to other learning methods (Rosas et al., 2003; Bioulac et al., 2008).

It has also been suggested that computer games can be a useful aid for therapists. Exploring role play and coping strategies with clients by using a computer game could be viewed as more fun, and perhaps less intimidating, than asking clients to act out the role in real life scenarios. For example, Lawrence (1986) explains that the client can take on new roles in the game, pretending to be someone else, and see the consequences of their actions in the game. As a result of such game-play, coping strategies are revealed and the therapist can relate the play events to the client's real life.

There are several examples of therapists using computer games for this purpose (Goh et al., 2008). For example, Parsons et al. (2004) used a computer game, "Virtual Café", as a tool for social skills training for people diagnosed with Autistic Spectrum Disorder. In the game "Virtual Café" participants had to complete a list of tasks, such as paying for food and drink. Participants showed significant improvements in their communication skills after a few trials of training. Similarly, Silver and Oakes (2001) used a computer game to teach people with Autistic Spectrum Disorder to recognise and predict emotional responses.

In another study, Sharry et al. (2003) describe the use of computer games in teaching relaxation techniques to people that suffer from anxiety. In their case study of a 12 year old boy that suffered from anxiety attacks they demonstrated that by using a bio-feedback racing game, in which relaxation was measured via the player's galvanic skin response, the boy learned to use the relaxation techniques in order to play the game. The boy was then able to generalise these techniques and apply them to real life.

Furthermore, one can suggest that playing computer games could be a useful way for therapists to gauge the attention of clients that find it hard to concentrate or are reluctant to participate in therapy. For example, Bioulac et al. (2008) write that children with attention deficit / hyperactivity disorder (ADHD) are reluctant to engage in tasks that require sustained mental efforts; however they will spend considerable time playing computer games.

1.4.3. Limiting Excessive Game-Play

There are also situations in which researchers may want to limit a person's immersion. For example, it has been suggested that children spending increasing amounts of time playing games and not being physically active could be linked to the rise in childhood obesity (IT News, 2007). It has also been suggested that excessive game-play can lead to addiction, guilty feelings about wasted time, and social conflict (Wood et al., 2007; Eggen et al., 2003a; Eggen et al., 2003b). In extreme cases, playing can even lead to death. For example, in 2002 a Taiwanese man was reported to have died from exhaustion after playing for 32 hours straight (Garite, 2003). Similarly, in 2007 it was reported that an online games addict died after playing for seven days in a row (Metro News, 2007). Although computer game addiction is not currently recognised as an official disorder by professional bodies such as the American Psychiatric Association, Freeman (2008) writes that game players who spend excessive amounts of time in virtual worlds have similar symptoms to people with other addictions. They may get irritable or restless if they are unable to play. They may sacrifice time from family, friends and work. Personal health and hygiene may be even neglected. Thus, the performance of "life activities" becomes problematic as a person finds his or herself unable to control the amount of time they spend gaming (Freeman, 2008).

Several researchers suggest that addictive gaming behaviour is most likely to be seen in regards to one particular type of game-play, MMORPGs (Freeman, 2008; Caplan et al., 2009; Hsu et al., 2009). Interpersonal behaviour and relationships are central features of MMORPGs, perhaps more than any other kind of computer game (Caplan et al., 2009). MMORPGs involve elaborate, detailed fantastical virtual worlds where players create characters and form guilds or networks with other players to achieve common goals, fight enemies, and live and work in communities. With players around the world, any game can be played online 24 hours a day. Also players can only have input when they are online, leading many people to be reluctant to leave the game to take care of routine tasks of daily living (Freeman, 2008).

Hsu et al. (2009) suggest that there are five significant factors that can be used to predict MMORPG addiction. These include long-term cyber social relationships among guild members (belonging and obligation), motivation to make new discoveries about the game world (curiosity), reinforcing reward loops in the game (reward), motivation to progress the character and the player's emotional attachment to the character (role playing). As a result of such findings, Hsu et al. (2009) suggest that there is a need in games research to maintain the "fun factor" of MMORPGs, while decreasing the possibility of addiction. For example, if a person has been logged in for too long, the system can discourage users from playing further by preventing them from travelling to new zones, slowing the pace of the character and / or reducing the power of their weapons. Therefore the game is still fun to play, but only when they play it within the limits of a set daily playing time.

There is also evidence to suggest that certain users are more susceptible to game addiction than others. For example, Caplan et al. (2009) found that loneliness, introversion, aggression and depression were significant predictors of Problematic Internet Use (PUI) for players of MMORPGs. Loneliness was the single most influential predictor in the model, supporting the idea that the most addictive element of MMORPGs is the sense of community derived from online relationships. If a person is having problems in their real life, it is easy to understand why they might choose to escape to a "game life" in which they feel they have a sense of belonging.

Co-morbidities such as mood disorders, attentional disorders and substance dependencies are also cited in relation to game addiction, as such users find it difficult to control the amount of time they spend playing online games (Freeman, 2008). Supporting this, Bioulac et al. (2008) found that ADHD children are less likely to stop playing of their own accord compared to a control group. Therefore one can suggest that for populations that already find it difficult to control their behaviour and suffer from impulsivity, their computer game use should be carefully monitored.

Overall it would appear that with certain games, such as MMORPGs, depending on the characteristics of the person there is a danger of game addiction. However it must be emphasised that for the majority of computer games, players do not experience life style problems as a result of gaming. For example, in a study of adolescent students Durkin and Barber (2002) found that game players scored more favourably than non-game players for several measures, including family closeness, activity involvement, positive self concept, positive school engagement and positive mental health. Therefore one can suggest that gaming is just another leisure activity for those who are active social participants. In other words, people enjoy engaging in activities that challenge them and games are one such activity, along with many others.

1.5. RESEARCH QUESTIONS AND METHODOLOGY

Evidently gaining a greater understanding of immersion could have possible practical applications for a variety of different gaming contexts. The current research aims to expand existing immersion knowledge by answering the following question: 'Is immersion just another form of SA?' In particular, SA is most similar to one aspect of the immersive experience, that of RWD. Therefore, to explore the relationship between immersion and SA, the current research aimed to gain an insight into RWD and answer the following questions:

1. What factors affect RWD?
2. To what extent is a person "less aware" of their surroundings?
3. Can RWD be measured objectively?

We started the research with a very exploratory question, what is the nature of RWD? Therefore the first study that was conducted was a qualitative study, to gain an insight into gamers' experiences of RWD. On the one hand, it was possible that we would observe similar attentional mechanisms as those highlighted in the existing psychological literature. On the other hand, it was possible that due to the more complex nature of gaming, the attentional mechanisms involved in gaming might be different. The resulting grounded theory allowed us to gain a better understanding of RWD in gaming, in particular the important role of a sense of progression, feedback underpinning this sense of progression.

Then, with more specific hypotheses in mind, we conducted several experimental studies to provide evidence of the factors actually having a causal influence on RWD. We wanted to show that RWD is not just something that people talk about, but it does exist and can be measured. In particular we aimed to validate the claim that manipulating the sense of progression gained via performing well in the game can lead to differences in the players' awareness of distracters.

The Immersive Experience Questionnaire (IEQ; Jennett et al., 2008) was used to show that the experimental conditions differed significantly in immersion. A single question measure of immersion (rate how immersed you felt from 1 to 10) was also used, to show that the IEQ is accurately reflecting people's own understandings of immersive experiences. However, as noted by Slater (1999; 2004), questionnaire measures can be problematic because they rely on participants' subjective opinions. The search for objective measures to corroborate subjective measures is a common way to overcome this problem (IJsselsteijn et al., 2000): whereas subjective measures require users to have a fair understanding of what it means to be "immersed"; objective measures relate to user responses that are, in general, produced automatically and without much conscious deliberation. Therefore, using the SA literature as inspiration, objective measures of RWD were created and used alongside the questionnaire measures.

1.6. OUTLINE OF THESIS STRUCTURE

The thesis is structured as follows:

- Chapter Two consists of a literature review of game immersion and SA research. It highlights the similarities between the two concepts and suggests how SA research might be useful in informing us more about the possible processes involved in game immersion.
- Chapter Three describes a qualitative study, in which gamers were interviewed about their experiences of RWD and a grounded theory was developed. The grounded theory highlights sense of progression as being key to RWD, feedback underpinning this sense of progression. The grounded theory also suggests that when processing distracters there is selectivity for relevance, in line with a popular theory in the SA literature, Attenuation Theory.
- Chapter Four describes two experimental studies that were conducted to investigate how awareness of distracters differs for games differing in feedback, sense of progression, and other game features. The studies show that RWD can be measured via recall of auditory distracters. The studies also show that when a player is immersed they are less aware of irrelevant sounds compared to relevant sounds, supporting the idea of an attentional filter for relevance.

- Chapter Five describes two experimental studies that were conducted to investigate how awareness of distracters differs for groups of people differing in how they perform in a game. The first study was unsuccessful because "high performers" was not sufficiently defined. With a new classification of "high performers", the second study was successful in providing support for the grounded theory claim that high performers experience greater RWD, due to their greater sense of progression. The study also shows that RWD can be measured via reaction times to a visual distracter.
- Chapter Six describes an experimental study that was conducted to investigate how awareness of distracters differs for games rigged in terms of perceived performance. This study was designed to show that game immersion is more complex than ordinary SA tasks, because it involves feedback and perceptions of performance. As predicted, a dissociation is shown between game immersion and a popular theory in the SA literature, that of Cognitive Load Theory.
- Chapter Seven summarises the thesis findings and concludes by considering how the thesis has contributed to the research field of human-computer interaction (HCI).

Literature Review of Game Immersion and Selective Attention

2.1. INTRODUCTION

As outlined in Chapter One, everyday descriptions suggest that game immersion could be an extreme form of selective attention (SA). To explore this idea further, this thesis aims to gain an insight into real world dissociation (RWD), the aspect of the immersive experience that is most similar to SA. In a factor analytic study Jennett et al. (2008) found that the factor RWD had strong loadings for items expected to measure mental transportation and being less awareness of your surroundings, see Table 2.

Table 2.

Factor Loadings for the Immersion Factor "Real World Dissociation".

Factor Loading	Questionnaire Item	
-.796	Q8	To what extent were you aware of yourself in your surroundings?
-.778	Q6	To what extent did you feel consciously aware of being in the real world whilst playing?
-.666	Q9	To what extent did you notice events taking place around you?
+ .629	Q12	To what extent did you feel as though you were separated from your real-world environment?
+.592	Q14	To what extent was your sense of being in the game environment stronger than your sense of being in the real world?
+.403	Q7	To what extent did you forget about your everyday concerns?

RWD is an important topic for immersion research because it is an aspect of the immersive experience that is often referred to, e.g. gamers describing themselves as being "in the game" (Brown and Cairns, 2004). However little is known about the characteristics of RWD. For example, when a person is less aware of their surroundings, what exactly does this mean? Are they completely unaware of all aspects of their surroundings, or only certain aspects? What factors affect the level of RWD experienced? Thus, by investigating RWD one can hope to have a better understanding of the experience of game immersion.

Little is currently known about RWD; however there has been a lot of research for the concept of SA. SA can be defined as the ability to focus on relevant information that is pertinent to the task, while filtering out irrelevant information (Barlett et al., 2009). Similarly, RWD in gaming refers to when a person chooses to attend to the game over other aspects of their environment, such as their mother calling their name. Therefore this thesis begins its exploration of RWD by positioning what is currently known about RWD in games in relation to what is currently known about SA in the psychology literature.

However, before making this comparison, it is necessary to explain the current state of game immersion research and how the five components of immersion came to be identified. Therefore the chapter shall be organised as follows:

- First an overview of game immersion research, including game immersion as conceptualised by Brown and Cairns (2004), the Immersive Experience Questionnaire (IEQ), and why the IEQ differs from other questionnaire measures of gaming experiences;
- A brief overview of SA research, including the identification of three broad categories of factors that influence the processing of distracters in SA research;
- Then using similar categories, the identification of three broad categories of factors that are likely to influence RWD in gaming;
- Followed by a discussion of which particular aspects of the literature review were most useful for our research aims, and where this thesis plans to go from here.

2.2. THE CONCEPT OF GAME IMMERSION

2.2.1. The Term "Immersion"

Immersion is a metaphorical term derived from the physical experience of being submerged in water. As illustrated in this quote from Janet Murray, immersion involves a sense of being deeply engaged, entering a virtual environment (VE) as if it were real:

> *"We seek the same feeling from a psychologically immersive experience that we do from a plunge in the ocean or swimming pool: the sensation of being surrounded by a completely other reality, as different as water is from air, that takes over all of our attention, our whole perceptual apparatus… in a participatory medium, immersion implies learning to swim, to do the things that the new environment makes possible… the enjoyment of immersion as a participatory activity."* (Murray, 1997)

Thus immersion involves being absorbed in a new reality, something different from the "normal air" that we breathe in real life. Furthermore, it is implied that when one is immersed in an activity they become less aware of other things that are around them, only the new reality matters.

Immersion can be experienced in a variety of different contexts, and depending on the context different aspects of the experience are emphasised as being important. In virtual reality (VR) systems such as head mounted displays or CAVE-like systems (a surround-screen projection-based virtual reality) the virtual environment (VE) completely surrounds the user and the user can make a full 360 turn. As well as realistic images and sounds, some VR systems even use synthetic tactile stimuli and smells. VR systems are also designed to be as detailed and naturalistic as possible in how a person responds to the environment with body movement, voice input, and / or object manipulation (Coomans & Timmermans, 1997). Therefore as long as the visual, acoustic and haptic representations are coherent, it is easy for a person to feel that they have entered a new reality as soon as they put on the headset or enter the CAVE.

In contrast, for other contexts that do not completely monopolise the senses of the user, immersion is more a result of the person's "mental absorption" in the virtual world. For example, when listening to a story, reading a book or watching a film it is a person's interest in the characters and the storyline, i.e. what will happen next, that allows them to feel "transported" into the new reality. Green et al. (2004) conceptualise such transportation as an integrative melding of attention, imagery and feelings, drawing comparisons with Gerrig's (1993) analogy of physical travel:

> *Someone (the traveller) is transported, by some means of transportation, as a result of performing certain actions. The traveller goes some distance from his or her world of origin, which makes some aspects of the world of origin inaccessible. The traveller returns to the world of origin, somewhat changed by the journey. (Gerrig, 1993)*

Like a physical journey, Green et al. (2004) explain that the enjoyment of feeling "lost in a story lies in temporarily leaving one's reality behind and emerging from the experience somehow different from before. For example, one might find that they are less stressed or have gained new knowledge. People who spontaneously form vivid mental images may gravitate towards media that allow them to exert this ability, such as radio and literature. In contrast, people who do not "think in pictures" may prefer films, as this media provides the imagery for them.

In any context (VR, books, films, games), poor design is one of the greatest threats to suspension of disbelief. For example, if one of the characters in the VE does something wildly out of character, or if something highly improbable happens, immersion might be broken (Rollings & Adams, 2003). A lack of harmony might also destroy a player's suspension of disbelief. All parts of the VE must feel like they belong to a single coherent whole.

2.2.2. Immersion in Computer Games

Computer games differ from traditional representations of narrative such as books and films because they involve interaction. Qin et al. (2009) explain that the aim of computer game narrative is not only to tell something to the players but also to provide an environment for play. The player constructs the story by actively participating in the game. The player has to make the avatar act and must learn to behave in accordance with the game's rules (Garite, 2003). Furthermore, due to such interactivity, the emotions experienced during game-play are more self-directed (Tavinor, 2005). For example, the player is not empathising with their character's frustration at losing a race; they are frustrated at themselves for losing the race. Thus, players are not only readers, but they are also performers and narrators (Qin et al., 2009).

However interest in the narrative, finding out what will happen next in the game and overcoming obstacles, is not the only motivation that drives a person to become immersed in a game. Sometimes a person is immersed because they are simply enjoying exploring the VE, making such game-play more like the immersive experiences of VR systems. For example, in games such as "Grand Theft Auto: San Andreas", due to the complexity of the fictional world the player is often unconcerned with the objectives of the game but is simply enjoying driving around the streets. In other words, they are enjoying the interactive experience (Tavinor, 2005).

Thus, it is evident that the aspects of a game that make it immersive can differ, depending on the constraints of the game. There have been two approaches taken to deal with this complexity: one is to investigate the typology of game immersion, e.g. the SCI model of immersion; the other is to investigate the gradation of immersion.

2.2.2.1. The SCI Model of Game Immersion

In the SCI model, Ermi and Mayra (2005) identify three types of immersion: Sensory, Challenge-based and Imaginative. Sensory immersion relates to the audiovisual execution of games and their attempt to overpower the senses. Challenge-based immersion is when one is able to achieve a satisfying balance of challenge and abilities. Imaginative immersion is when one becomes absorbed with the stories and the world, or begins to feel for or identify with the game character. Ermi and Mayra (2005) suggest that most games contain all three of these types of immersion; however they differ in terms of which of these components of immersion are most dominant.

The SCI model is appealing because it is able to explain the different mechanisms through which people become immersed in a variety of different games. Furthermore, when the SCI questionnaire was completed by participants it was shown to divide contemporary games into the three identified immersion components as expected (Ermi & Mayra, 2005). For example, sensory immersion was experienced particularly strong in the shooter game "Half Life", a game that has stunning audio-visual effects, players exploring the VE via a first-person perspective. In terms of challenge-based immersion, the puzzle game "Nethack" was scored highest. Imaginative immersion was found to be the strongest in role-playing games and plot-driven adventure games, such as "Star Wars: Knights of the Old Republic 2".

However, a limitation of such an approach is that it is possible to categorise immersive experiences in a number of different ways. Indeed, several other categorisations have also been proposed. For example, Arsenault (2005) suggests two modifications to the SCI model. Firstly, Arsenault (2005) suggests that to say that a player is making use of their imagination is too broad; therefore imaginative immersion should be replaced with fictional immersion. Fictional immersion is defined as when the game strives to make the player feel that there is more to the fictional world represented than what the text makes of it, i.e. a backside to objects, a mind to characters, and time and space extending beyond the display. Secondly, Arsenault (2005) suggests that a player can be immersed in a system without necessarily being challenged by it; therefore challenge-based immersion should be replaced with systemic immersion. Systemic immersion occurs when one accepts that a system of rules and laws governing a mediated object replaces the system governing a similar facet of unmediated reality. For example, in shooting games by accepting "Hit Points" and "Attack Values" rather than factors such as arm size or weight of weapon, the player is adopting the game's system and rejecting the laws of real-world physics.

In his Gamasutra article, Adams (2004) describes another break down of immersion types: tactical, strategic and narrative. Tactical immersion is defined as the moment-by-moment act of playing the game, typically found in fast action games; it is physical and immediate, produced by challenges simple enough to allow the player to solve them in a fraction of a second. Strategic immersion is defined as being observing, calculating and deducing; in order to achieve strategic immersion a game must offer enjoyable mental challenge. Narrative immersion is defined as when a player starts to care about the characters and wants to know how the story is going to end; like in films and books, good storytelling is essential. Although this breakdown of immersion is similar to the SCI model, tactical immersion similar to sensory immersion, strategic immersion similar to challenge-based immersion, narrative immersion similar to imaginative immersion, it does not map completely. For example, although tactical immersion refers to the physical response of the game, it is described in terms of challenge rather than sensory features.

More recently, Calleja (2007) describes a model that divides the experience of game-play into six components: tactical, performative, affective, shared, narrative and spatial involvement. Incorporation (i.e. immersion) results from a synthesis of internalised tactics (tactical involvement), designed and personally created narrative (narrative involvement), communication and the presence of other agents (shared involvement) and movement (performative involvement) within a habitable domain (spatial involvement). This model has similarities with the SCI model because it also recognises that immersion can arise from a number of different game components; however it differs in terms of what these game components are.

Therefore it is evident that grouping different games into different types of immersive experiences can be problematic, as there is a large number of possible ways of categorising an experience.

2.2.2.2. Game Immersion as a Graded Experience

Rather than investigating the typology of immersion, Brown and Cairns (2004) chose to investigate the gradation of immersion. Such an approach emphasises the commonalities between all gaming experiences. It implies that although games may differ slightly in terms of why they are appealing and which features draw you into the game-play, in terms of the immersive experience itself and the way that it progresses as a person's immersion in the game world deepens, all games follow a similar course of events.

Brown and Cairns (2004) conducted a qualitative study, in which they interviewed seven gamers and asked them to talk about their experiences playing computer games. The resulting grounded theory found that immersion was used to describe a person's degree of involvement with a computer game. The theory also identified a number of barriers that could limit the degree of involvement. These barriers arose from a combination of human, computer and contextual factors (e.g. gaming preference, game construction, environmental distracters), and the type of barrier suggested different levels of immersion.

Table 3.

Three Levels of Game Immersion, as Defined by Brown and Cairns (2004).

Level of Immersion	Description	Barriers
Engagement	An engaged user is one that has invested time, effort and attention in learning how to play the game and getting to grips with the controls.	Gaming preference, e.g. liking a certain style of game. Investment of time, effort and attention.
Engrossment	An engrossed user is one whose emotions are directly affected by the game. The gamer is now less self aware than before.	Game construction, e.g. visuals, interesting tasks, plot. Distractions in the environment.
Total Immersion	A user that is totally immersed is one that feels detached from reality to such an extent that the game is all that matters. Presence is an important part of this characterization.	Empathy, e.g. growth of attachment to a main character. Atmosphere, e.g. development of game construction, game features must be relevant to the action and location of the game characters.

In total three distinct levels of immersion were identified: engagement, engrossment and total immersion, see Table 3. Brown and Cairns (2004) state that total immersion required the highest level of attention and was a rare and rather fleeting experience when gaming, whereas engagement and engrossment were more likely to occur. Thus this gives the impression of immersion not involving a steady incline in which a person gradually becomes more immersed over time, progressing from engagement to engrossment and then total immersion. Instead this suggests that the experience of immersion is very momentary: immersion can quickly increase or decrease depending on momentary factors such as events that take place in the game or the player's mood. For example, a person might be making good progress in a game and be less aware of their surroundings (engrossment), then suddenly the person hits a difficult obstacle in the game and so they must focus on the controls more, becoming more aware of their surroundings (engagement).

Support for the idea of immersion as a graded experience can be found in the existing gaming literature. For example, Bayliss (2007) describes how a player's attention might initially be focused on the controls while learning to play a particular game, but after a certain competency is reached this attention shifts away. Bayliss (2007) calls this aspect of game-play "embodiment" - the controls move from being present-at-hand to being ready-at-hand.

Similarly, Carr (2006) describes how the fluidity and ease with which players move around the interface and the game world shapes the experience of play in the game "Baldur's Gate". As players learn and gain familiarity with the game, the amount of conscious effort required in order to perform routine actions changes. Certain aspects of "Baldur's Gate" setting, narrative and game-play begin to require less deliberate effort, moving from being engaging to being immersive; or in accordance to Brown and Cairns (2004)'s conceptualisation, moving from engagement to engrossment. At the same time, the game counterbalances this shift, by continually confronting the player with new twists and increased challenges, bigger monsters and more complex situations, so that the potential for engagement is constantly renewed.

In terms of limitations, it is evident that the last stage of immersion may need to be re-conceptualised. For example, Arsenault (2005) suggests that in games such as "Doom" and "Battlezone" notorious for their absence of plot and characters it is unlikely the player will identify with the game characters, yet it may still be possible for them to feel detached from reality to the extent that only the game matters. Thus one might suggest that rather than empathy with the character per se, the stage of total immersion is associated with the player having strong emotions to achieve their goals in the game, i.e. a strong desire to win.

Overall, this research argues that Brown and Cairns (2004)'s gradation of immersion is a good basis for immersion research. There appears to be a common gradation of immersion for all games and as a result, one can hope to develop a common metric in order to compare the immersive experiences of a wide range of games. This is what Jennett et al. (2008) aimed to achieve in the creation of the IEQ.

2.2.3. The Immersive Experience Questionnaire

2.2.3.1. Creation of the IEQ

Quantifying the extent to which a person is immersed is important because it allows researchers to investigate which situations are more immersive than others. Jennett et al. (2008) developed the IEQ items using Brown and Cairns (2004)'s grounded theory of immersion as a basis, as well as previous studies in the related areas of flow (Csikszentmihalyi, 1990), cognitive absorption (Agarwal & Karahanna, 2000) and presence (Witmer & Singer, 1998).

Some key features of the IEQ include the following:

- It focuses on cognitive aspects of the player's experience as well as game-play;
- It refers to the player's particular experience of the given task rather than their experience of software in general;
- The questionnaire aims to measure the immersive experiences of a wide variety of games. Therefore questionnaire items related to presence ask players to reflect on the extent that the game world was more real than the real world, rather than the extent to which the user felt like they were the character, because not all games are character-based.
- Social aspects of gaming are not measured. Although social factors can add to a person's immersion in a game, it is also possible to have a highly immersive experience while playing alone. Therefore Jennett et al. (2008) argue that it is important to quantify individual experiences of game immersion first; then afterwards one can expand this questionnaire to quantify game immersion in a group setting.

The first version of the IEQ was successful in indicating participant levels of immersion in two studies (Cairns et al., 2006; Cox et al., 2006), which compared a game that was highly immersive (the first person shooter "Half Life") with a game that was not immersive (a simple clicking task). Furthermore, the studies showed that there was a strong correlation between the IEQ scores and a single question measure of immersion, i.e. on a scale of 1 to 10, how would you rate your immersive experience? This suggests that the IEQ is accurately reflecting people's immersive experiences (Jennett et al., 2008). However a limitation of the questionnaire was that the mixture of negative and positive wording of questions was found to be confusing to participants at times. Therefore a second version of the questionnaire was developed with simpler wording (Jennett et al., 2008).

The updated version of the IEQ consists of 31 items. Participants are asked to rate from a scale of 1 to 5 how they felt at the end of the game (where 1 = not at all and 5 = very much so). The first half of the questionnaire was concerned with varying degrees of attention during the task, factors included: basic attention, temporal dissociation and transportation. The second half of the questionnaire was concerned with factors that could influence a person's motivation during the task: challenge, emotional involvement, enjoyment. In terms of scoring, the majority of questions were marked positively; only 6 questions are subjected to negated marking. Immersion scores were computed by summing participants' answers to all 31 questions.

2.2.3.2. Validation of the IEQ and the Identification of Five Components of Immersion

In order to validate the IEQ, Jennett et al. (2008) administered it to a large sample of gamers that were recruited via adverts posted in the top 10 most popular gaming forums and in forums dedicated to the top 10 games (by sales) of 2006. Taking part in the study involved being over 18 and filling in the questionnaire online based on your most recent gaming experience. A factor analysis was conducted on the 244 valid results and revealed that there was one omnibus factor that included all but 6 of the 31 questions. Thus this suggests that as a whole, the IEQ is measuring one concept, that of immersion.

Table 4.

Five Components of Game Immersion, as Defined by Jennett et al. (2008).

Immersion Factor	Description
Cognitive Involvement (CI)	Strong loadings with items expected to measure effort and attention, e.g. "To what extent did you feel focused on the game?"
Emotional Involvement (EI)	Strong loadings for items expected to measure affect and suspense, e.g. "To what extent were you interested in seeing how the game's events would progress?"
Real World Dissociation (RWD)	Strong loadings for items expected to lack of awareness of surroundings and mental transportation, e.g. "To what extent did you feel consciously aware of being in the real world whilst playing?"
Challenge (Ch)	Strong loadings for items expected to measure how difficult the user found the game, e.g. "Were there any times during the game in which you just wanted to give up?"
Control (Con)	Strong loadings for items expected to measure the ease of the use of the gaming interface, e.g. "At any point did you find yourself become so involved that you were unaware you were even using controls?"

The factor analysis also indicated that there were several underlying components with eigenvalues greater than 1 which should also be investigated. Using Catell's Scree Plot method five main factors were identified, accounting for 49% of the total variance. The five components that were identified in the factor analysis were dubbed "cognitive involvement", "emotional involvement", "real world dissociation", "challenge" and "control", see Table 4.

The identification of these five components of immersion allows one to break down the general graded experience of immersion into its various components. It suggests that immersion as measured by the IEQ involves a mixture of psychological and game factors. Psychological factors include cognitive and emotional involvement in the game and a sense of dissociation from the real world. Game factors include the level of challenge and control provided by the game.

However, as of yet it is not clear what the characteristics of these immersion factors are or how they are related to each other. For example, when a person is less aware of their surroundings, what exactly does this mean? This is the aim of the current research, to further investigate the immersion component of RWD.

2.2.4. Other Questionnaires Measuring Gaming Experiences

The notion of creating a questionnaire to measure absorbing and engaging experiences is not a new concept however; there are several other questionnaires that have been used to measure gaming experiences. Therefore, before we describe the current research, first it is necessary to explain why none of the other measures fully capture the experience of game immersion in the same way as the IEQ (Jennett et al., 2008) and Brown and Cairns (2004)'s conceptualisation of immersion.

2.2.4.1. Questionnaires Measuring Presence in Games

Sometimes players become immersed to such an extent that they even describe themselves as being "in the game" (Brown & Cairns, 2004). This aspect of immersion shares similarities with a concept often studied in the context of VR systems, the concept of presence. Presence is defined as the sense of being in a virtual environment (VE) rather than the place in which the participant's body is actually located (Sanchez-Vives & Slater, 2005). "Being there" is usually considered the ability to "do there", however recent research has highlighted the possibility of "feeling there" too. For example, during a public speaking task participants responded to a virtual audience as if they were real people (Pertaub et al., 2002). Similarly, in a virtual reprise of the Stanley Milgram Obedience Experiments, participants responded to the situation of administering electric shocks to a virtual character as if it were real, behaviourally and physiologically (Slater et al., 2006).

Presence research typically focuses on user experiences while wearing head mounted displays (HMDs) or interacting within CAVE-like systems (i.e. a surround-screen projection-based virtual reality; Sanchez-Vives & Slater, 2005). In a literature review of the field, IJsselsteijn et al. (2000) state that there are four factors thought to underlie presence: the extent and fidelity of sensory information, i.e. the ability of a technology to produce a sensorially rich VE; the match between the sensors and the display, i.e. the mapping between the user's actions and the perceptible spatio-temporal effects of those actions; content factors, i.e. a person's ability to interact with the objects, actors and events represented by the VE and modify them; and user characteristics, i.e. a person's perceptual, cognitive and motor abilities.

Recently however, the presence experiences of gaming have also been investigated, see Table 5.

Table 5.

Presence Questionnaires Used in Studies Investigating Computer Game Experiences.

Questionnaire	Factors	Used to measure computer game experiences by:
Presence Questionnaire (Witmer and Singer, 1998)	Control factors, e.g. immediacy. Sensory factors, e.g. multimodal presentation, consistency. Distraction factors, e.g. isolation, interface awareness. Realism factors, e.g. scene realism	Eastin & Griffiths, 2006
ITC Sense Of Presence Inventory (Lessiter et al., 2001)	Spatial presence, engagement, ecological validity / naturalness, negative effects	Ravaja et al., 2004a; Ravaja et al. 2004b; Ravaja et al., 2006
MEC Spatial Presence Questionnaire (Vorderer et al., 2004)	Process factors, e.g. attention allocation. Factors relating to states and actions, e.g. high cognitive involvement, suspension of disbelief. Trait factors, e.g. domain specific interest	Laarni et al., 2005; Kallinen et al., 2007; Lindley et al., 2008

The Presence Questionnaire (PQ; Witmer and Singer, 1998) consists of 32 items and was created to measure the degree to which individuals experience presence in a VE and the influence of possible contributing factors on the intensity of this experience, e.g. distractions. Using the PQ, Eastin and Griffiths (2006) found the unexpected finding that less presence was experienced in games played on HMDs, compared to games played on a standard console. They suggest that this is possibly due to participants' increased familiarity with standard gaming controls.

A key distinction between Brown and Cairns' conceptualisation of immersion and the PQ is that the PQ emphasises the perceptual features of the VE as being important for presence, e.g. Witmer and Singer (1998) write that the highest presence is experienced in VR systems, where a person can be completely surrounded by the VE. In contrast, the presence that occurs at the height of game immersion is more a result of psychological factors (e.g. engagement in the game-play, wanting to find out what happens next). As a result, graphical and behavioural realism are less of a necessity: good game-play can cover for a lack of perceptual richness (Pinchbeck, 2005). For example, despite gaps in the manifestation and behaviour of avatars (e.g. avatars having hands but no legs, character jumping abilities suddenly increasing ten fold) players are still able to have compelling gaming experiences (Hutchinson, 2006; Cheng & Cairns, 2005).

The ITC Sense Of Presence Inventory (ITC-SOPI; Lessiter et al., 2001) therefore appears to be more appropriate for measuring presence experiences in gaming because it includes the factor of engagement. The ITC-SOPI consists of 44 items and was created to evaluate presence across a range of media, e.g. 2D versus 3D, control versus no control, large screen versus small screen, surround sound versus stereo. Using the ITC-SOPI, Ravaja et al. (2004a) investigated the sense of presence elicited by video games of different characteristics and found that the highest spatial presence was elicited by "James Bond 009: Nightfire", a game that involves a VE and a first person perspective. Ravaja et al. (2004b) found that there was a relationship between spatial presence and emotion-related psychophysiological responses to success in a computer game, e.g. facial electromyographic activity, electrodermal activity, cardiac beat intervals. Ravaja et al. (2006) found that playing against a human elicited higher spatial presence than playing against a computer, and playing against a friend elicited higher spatial presence than playing against a stranger.

The MEC Spatial Presence Questionnaire (MEC-SPQ; Vorderer et al., 2004) also includes engagement in its conceptualisation of presence, i.e. the factor "high cognitive involvement". The MEC-SPQ consists of nine scales and was designed to measure the different concepts integrated in the MEC theoretical model. These concepts include process variables, variables relating to states and actions, and trait variables (see Table 5). Using the MEC-SPQ, Laarni et al. (2005) compared the presence experiences of a rally game-played on a PC (large screen, keyboard input) compared to a PDA (small handheld device) and found that although there were no differences in attentional engagement between the two conditions, participants experienced higher levels of presence in the PC condition. Kallinen et al. (2007) found that more spatial presence was experienced when a game was played in a first person perspective, compared to when the same game was played using a third person perspective. Lindley et al. (2008) compared three game levels designed to differ in game-play (e.g. strength of opponents, choice of weapons, pacing of the game) and found that spatial presence was lowest in the game level designed to be boring, whereas the game level designed to be immersive scored high for "self location" and "possible actions".

Thus ITC-SOPI and MEC-SPQ are better suited than the PQ to measure the presence experiences of games, engagement being an important component. Regarding Brown and Cairns (2004) conceptualisation of immersion however, although presence may occur at the highest level of immersion (total immersion), this does not necessarily mean that games that involve the most presence are the most immersive. For example, one could imagine a person feeling present in a VE but not experiencing a lost sense of time, e.g. carrying out a tedious task in a virtual simulation. Therefore one can suggest that presence is only a small part of gaming: whereas presence is a state of mind, immersion refers to a specific experience in time.

Furthermore, even though games with simple graphics do not involve presence such games can still be immersive, leading to time loss and not noticing things around you. For example, Ravaja et al. (2004a) found that "Tetris" scored low for spatial presence (you are unlikely to feel like you are in a world of falling blocks), however one could argue that "Tetris" is still an immersive experience, as attested by its immense popularity when it was first released in the 1990s. Similarly, Laarni et al. (2005) found that although the presence experiences differed between playing on a PC and a PDA, there were no differences in terms of attentional engagement. Thus a double dissociation between the two concepts can be observed: immersion can occur without presence and presence can occur without immersion.

2.2.4.2. Questionnaires Measuring Flow in Games

Another concept that bears similarities with immersion is that of flow. Csikszentmihalyi (2000) explains that there are hundreds of activities that people do simply for the sake of doing the activity, without expecting any external rewards such as money or status. For example, people take part in various forms of art, such as music, dance and drama. People take part in various sporting activities, such as basketball and rock climbing. People play games such as tag, hide-and-seek and chess. People also enjoy various forms of passive entertainment, such as reading novels or listening to music. Csikszentmihalyi claimed that all of these activities involved a common experiential state, which he named "flow". The name "flow" was chosen because it was a term that many respondents used in their interviews to explain what the optimal experience felt like. Flow is described as an experience "so gratifying that people will do it for its own sake, with little concern for what they will get out of it, even when it is difficult or dangerous" (Csikszentmihalyi, 1990). Flow is enjoyable because it stands out from the formless, confusing, and often frustrating conditions of normal, everyday life. During flow, due to the person's high level of concentration on the activity at hand, one experiences a great inner clarity as their awareness becomes logically coherent and purposeful (Csikszentmihalyi, 1998).

Eight major components of flow were identified: a challenging activity requiring skill; concentration on the task at hand; clear goals; direct, immediate feedback; a sense of control over one's actions; a loss of self-consciousness; an altered sense of time; and a merging of action and awareness (a deep but effortless involvement that removes awareness of the frustrations of everyday life). However not all eight elements necessarily have to be present at any one time in order for flow to be experienced.

Recently flow has also been said to occur during gaming. For example, Chen (2007) argues that descriptions of the flow experience are identical to what players experience when immersed in games, e.g. losing track of time, a match between challenge and skills, etc. Furthermore, Chen (2007) claims that as a result of more than three decades of commercial competition most of today's video games deliberately include and leverage the eight components of flow. For example, they deliver instantaneous, accessible sensory feedback and offer clear goals the player accomplishes through the mastery of specific game-play skills.

Several researchers have created questionnaires to measure the flow experiences that occur in gaming, see Table 6.

Table 6.

Questionnaires Used in Studies Investigating Computer Game Experiences that Utilize the Concept of Flow.

Questionnaire	Factors	Used to measure computer game experiences by:
Video game Experience Sampling Method (Holt, 2000)	Hard to concentrate, challenge, skill, control of actions, wish doing something else, depth of consciousness, something at stake in the activity and success	Holt, 2000
GameFlow questionnaire (Sweetser & Wyeth, 2005)	Concentration, challenge, player skills, control, clear goals, feedback, immersion, social interaction	Sweetser & Wyeth, 2005
EGameFlow questionnaire (Fu et al., 2009)	Concentration, challenge, knowledge improvement, control, goal clarity, feedback, immersion, social interaction	Fu et al., 2009

Holt (2000) created a modified version of Csikszentmihalyi's Experience Sampling Method (ESM) termed the Video game Experience Sampling Method (VESM). The VESM composes of a) whether the participant was thinking about what they were doing and b) nine variables from the ESM (see Table 6). Conducting a study in which participants were asked to fill in the VESM every six minutes during a one hour session of game-play, Holt (2000) found that the results revealed differences in flow over time. For example, sense of control increased as the game was played, initially the game was too difficult but as players practiced more their skills and involvement with the game increased.

Despite the obvious similarities between flow and gaming however, one can argue that flow theory needs to be carefully re-assessed before directly adopting it. For example, Finneran and Zhang (2003) write that in the original flow activities, such as rock climbing or chess playing, the tools or artifacts were not taken into much consideration because it was assumed that they are well mastered by the people who experience flow. In contrast, when it comes to studying flow experiences in HCI, researchers are sometimes investigating people's flow experiences using unfamiliar software and / or unfamiliar interfaces. Mastery of artifacts within computer mediated environments cannot be taken for granted due to the complex and dynamic nature of computers. Therefore, there is a need for activity to be broken down into the task (main goal of the activity) and the artifact (tool for accomplishing the activity).

Sweetser and Wyeth (2005)'s concept of GameFlow is a model that takes some of these issues into account. Conducting a comprehensive review based on the elements of flow and the evidence of flow in games, Sweetser and Wyeth (2005) constructed a model of game enjoyment which consists of eight core elements (see Table 6). As well as players feeling a sense of control over their character / units in the game world, part of their conceptualisation of "control" is that players should feel a sense of control over the game interface and input devices. Another departure from the original flow theory is the inclusion of the final element of game enjoyment, "social interaction". Although social interaction does not map to the elements of flow, Sweetser and Wyeth (2005) write that it is highly featured in the literature on user-experience in games: people play games to interact with other people, regardless of the task, and will even play games they do not like.

The GameFlow questionnaire (Sweetser & Wyeth, 2005) consists of 35 items and was created to measure enjoyment in games. Using the GameFlow questionnaire, Sweetser and Wyeth (2005) compared two real-time strategy games, one rated highly in professional game reviews and one rated poorly, and were able to successfully distinguish between the two games and identify why one succeeded and the other failed.

However, despite the modifications that have been made in the GameFlow model, one could argue that it is still not giving a complete picture of the immersive experience of gaming. Flow is specifically an optimal and therefore extreme experience. In contrast, game immersion is not always so extreme: games can fail to provide flow, while still being immersive. For example, many games do not provide clear goals, instead the player must either work it out or set their own goals, e.g. "Grand Theft Auto 3" (Seah & Cairns, 2008). A player can still have an immersive experience even when failing to achieve a clear goal, e.g. killing the boss monster. Also playing games can be frustrating at times and not necessarily a positive experience, yet the experience can still be immersive (Seah & Cairns, 2008).

Thus, one can argue that game immersion is more of a suboptimal experience. At the very height of game immersion, in which a person experiences "total immersion", a person might be said to be in flow. However "total immersion" is a fleeting experience, the other stages of immersion, "engagement" and "engrossment", being much more common (Brown & Cairns, 2004). Therefore one can suggest that flow is not a common experience in gaming: the player is usually immersed in the game to some extent, but they are not immersed to the exclusion of all else and therefore not in flow. For example, a person can be highly engaged in playing a videogame but still be aware of things like needing to leave the game soon in order to catch a bus or go to a lecture.

Expanding upon this, Seah and Cairns (2008) explain that whilst immersion need not be consistent with flow, it does seem that immersion is a precursor to flow. Immersion, as defined by the five components of the IEQ, overlaps with three factors of GameFlow: concentration (CI), challenge (Ch), control (Con) and immersion (EI, RWD). However, GameFlow also includes other factors such as player skills, clear goals, feedback and social interaction. These set GameFlow more in line with flow, whereas Brown and Cairns (2004)'s conceptualisation of immersion is set apart from flow because of the superfluity of these same factors in having an immersive experience.

The EGameFlow questionnaire (Fu et al., 2009) is an adaptation of the GameFlow questionnaire (Sweetser & Wyeth, 2005) that was created to assess user enjoyment of e-learning games. The EGameFlow questionnaire consists of 42 items and also consists of eight dimensions; however the factor of "player skill" is replaced with "knowledge improvement" to better suit the goals of e-learning games. Using the EGameFlow questionnaire, Fu et al. (2009) used participant responses to four e-learning games for scale verification. Their results support the reliability and validity of the questionnaire.

Like the GameFlow questionnaire, again one can argue that flow is an optimal experience, whereas game immersion is more of a suboptimal experience. Furthermore, one can argue that although knowledge improvement is an essential part of e-learning and EGameFlow, it is not essential for immersion to occur. For example, a person can be immersed in a game without necessarily learning new knowledge, re-playing a game that they have played before.

2.2.4.3. Questionnaires Measuring Other Aspects of Gaming

As well as questionnaires measuring presence and flow, there are several other questionnaires that have been developed to measure a specific aspect of the gaming experience, see Table 7.

The Core Elements of the Gaming Experience questionnaire (CEGE; Calvillo-Gamez et al., forthcoming) has 38 items and was created to measure the necessary but not sufficient conditions to provide users with a positive experience while playing games. In other words, it measures five factors that are necessary for a person to have a positive experience (see Table 7); however if a person was to have a highly immersive experience then it is likely that more factors would be needed on top of these. Using the CEGE questionnaire, Calvillo-Gamez et al. (2009) investigated the impact of two different input devices when playing Tetris, a keyboard and a knob-like device. They found that for the knob-like device, because the person did not feel in control of their actions (the CEGE factor of control was missing from the experience) it resulted in a negative experience.

Table 7.

Questionnaires Used in Studies Investigating Computer Game Experiences that Measure a Specific Aspect of the Gaming Experience.

Questionnaire	Factors	Used to measure computer game experiences by:
Core Elements of the Gaming Experience Model Questionnaire (Calvillo-Gamez et al., Forthcoming)	Puppetry factors: control, facilitators, ownership. Video game factors: environment, game-play	Calvillo-Gamez et al., Forthcoming
Extended Technology Acceptance Model Questionnaire (Hsu & Lu, 2004)	Social norms, perceived critical mass, perceived ease-of-use, perceived usefulness, flow experience, attitudes towards online games, behavioural intentions to play online games	Hsu & Lu, 2004
Immersion in the Game Narrative Questionnaire (Qin et al., 2009)	Curiosity, concentration, challenge, control, comprehension, empathy	Qin et al., 2009
Computer Apathy and Anxiety Scale (Charlton, 2002)	High engagement, addiction, comfort	Charlton & Danforth, 2007; Seah & Cairns, 2008
Social Presence in Gaming Questionnaire (de Kort et al., 2007)	Empathy, negative feelings, behavioural engagement	De Kort et al., 2007; Gajadhar et al., 2008

Regarding Brown and Cairns (2004) conceptualisation of immersion, one could argue that the CEGE questionnaire only measures the lowest level of immersion, that of engagement. In other words, it indicates whether a person is involved to the extent that they feel that they have some sense of control in the game, however this engagement does not involve the deeper emotional involvement or RWD that occurs in more immersive levels of game-play. Therefore, the CEGE questionnaire is not sufficient to measure the full range of immersive experiences (engagement, engrossment, total immersion).

The Extended Technology Acceptance Model Questionnaire (Hsu & Lu, 2004) has 19 items and was created to measure acceptance of online games, extending the Technology Acceptance Model (TAM) to incorporate social influences and flow experiences as belief-related constructs. Using the Extended TAM Questionnaire, Hsu and Lu (2004) found that social norms, attitude and flow experience accounted for 80% of game-playing. Thus this supports the idea that social influence and flow experiences are important additional factors when it comes to technology acceptance in online gaming.

Considering the Extended TAM Questionnaire in relation to game immersion, one can argue that although a person's perceptions of games is a good predictor of how often a person plays games, such perceptions can not predict whether a person is going to have a highly immersive experience in a specific instance of game-play. Therefore, for measuring the immersion experience in a specific instance of game-play, the IEQ is more appropriate. This argument is similar to that presented by Jennett et al. (2008) for why immersion is different to the concept of Cognitive Absorption, a well known concept in HCI that is concerned with technology acceptance (see Jennett et al., 2008, for more details).

The Immersion in Game Narrative questionnaire (Qin et al., 2009) consists of 27 items and aims to measure player immersion in the game narrative. Qin et al., (2009) define the computer game narrative as the methods or styles used to tell the story of the game, the story including the plots pre-written by game writers and developers and the story created by players in the course of playing the game. The questionnaire was developed using research on flow, cognitive absorption, presence and immersion. It was validated by a factor analytic study involving a large sample of gamers (Qin et al., 2009), which revealed that the questionnaire could be divided into several components (see Table 6).

Immersion, as defined by the five components of the IEQ, appears to have some overlap with six of the factors of the Immersion in Game Narrative Questionnaire: curiosity (CI), challenge and skills (Ch), control (Con), comprehension (Con), empathy (EI, RWD), concentration (EI, RWD). However the factor of familiarity does not bare any similarities with any of the IEQ components. One can argue that although familiarity with the cultural background of the game can add to a person's immersive experience, adding to one's sense of control, it is not necessary for immersion to occur.

A further distinction between immersion as measured by the Immersion in Game Narrative Questionnaire, compared to immersion as measured by the IEQ, is that the questionnaire items of the former are often character focused. As such, one could argue that the Immersion in Game Narrative Questionnaire only measures one type of immersive experience, that which occurs in imaginative immersion (see Ermi and Mayra's SCI model, 2005). In contrast, the IEQ aims to provide a general measure of immersive experiences, spanning a variety of different games including games that are not character-based, such as "Tetris".

The Computer Apathy and Anxiety Scale (CAAS; Charlton, 2002) was originally created to distinguish behavioural addiction in computing (a high degree of computer usage that is pathological) from high engagement (a high degree of computer usage that is not pathological). Two adapted versions of the CAAS have since been created to measure these concepts in relation to gaming. Charlton and Danforth

(2007) used only the Addiction-Engagement portion of the CAAS (19 items) and adapted the questions to ask about a specific game, "Asheron's Call". Similar to the original study, they found that there was a division between engagement and addiction in gaming, thus supporting the idea that they are distinct concepts. However in a separate study, Seah and Cairns (2008) also adapted the questions of the CAAS, replacing general "computing" with "computer games", and did not find the same distinction. They argue that a two factor model of engagement and addiction was not well supported by the data; instead a single factor model of engagement / addiction provided a more coherent interpretation, where higher engagement does entail more addiction in gaming. Seah and Cairns (2008) also found a correlation between engagement and addiction, as measured by the IEQ and the adapted CAAS.

Regarding Brown and Cairns (2004) conceptualisation of immersion, it appears that the degree of immersive experience is closely related to how addictive or engaging people find computer games, addiction being an extreme form of engagement and immersion (Seah & Cairns, 2008). However whereas the CAAS is concerned with the degree of computer usage, a highly engaged person being someone that plays games a lot, according to Brown and Cairns (2004) the degree of computer usage is not necessary. For example, a person can be highly engaged having only just started playing a game. Thus the IEQ is concerned with specific instances of playing, rather than people's behavioural patterns over time. Furthermore, although the extent to which a person is able to live a stable and functional life is important to immersion research, it is not essential to the immersive experience and therefore is not measured by the IEQ.

The Social Presence in Gaming Questionnaire (SPGQ; de Kort et al., 2007) consists of 25 items and was designed to measure gamers' awareness of involvement with their co-players. Using the SPGQ, de Kort et al. (2007) found that co-located settings showed the highest scores on all social presence measures. Gajadhar et al. (2008) found that social presence progressively increased from playing against a computer, playing against a mediated co-player, and playing against a co-located co-player.

Regarding immersion as measured by the IEQ, social factors are not measured. Jennett et al. (2008) explain that it is important to quantify individual experiences of game immersion first because although social factors can add to a person's immersion in a game, it is also possible to have a highly immersive while playing alone. Thus, one can argue that for a general characterisation of the graded experience of immersion such as that described by Brown and Cairns (2004), social factors are superfluous and not an essential part of the experience.

2.2.4.4. Questionnaires that Aim to Capture the Full Gaming Experience

As well as questionnaires investigating aspects of gaming, there are also several questionnaires that have been created with the aim of capturing the full experience of gaming, see Table 8.

Table 8.

Questionnaires Used in Studies Investigating Computer Game Experiences that Aim to Capture the Full Gaming Experience.

Questionnaire	Factors	Used to measure computer game experiences by:
SCI Model Questionnaire (Ermi & Mayra, 2005)	Sensory immersion, challenge-based immersion, imaginative immersion	Ermi & Mayra, 2005
EVE-GP Questionnaire (Takatalo et al., 2007).	Role engagement, attention, interest, importance, co-presence, interaction, arousal, physical presence, valence, impressiveness, competence, challenge, enjoyment, playfulness, control	Takatalo et al., 2007
Game Experience Questionnaire (Ijsselsteijn et al., manuscript in preparation)	Immersion, tension, competence, flow, negative affect, positive affect, challenge	Nacke & Lindley, 2008a; Nacke & Lindley, 2008b; Lindley et al., 2008; Grimshaw et al., 2008
Game Engagement Questionnaire (Brockmyer et al., 2009)	Immersion, presence, flow, absorption	Brockmyer et al., 2009

The SCI Model Questionnaire (Ermi and Mayra, 2005) consists of 18 items and was created to measure three components of immersion that are experienced in game immersion: sensory, challenge-based and imaginative. As described earlier, the IEQ differs because it aims to measure the general graded experience of immersion that is common to a variety of different games. Furthermore, the components of the IEQ do not represent different types of immersion; they are components of the general graded experience of immersion and represent factors that are common to all games.

The EVEQ-GP questionnaire (Takatalo et al., 2007) consists of 180 items and is based on the Presence-Involvement-Flow Framework (PIFF), which was developed to understand multidimensional user experiences in games. The PIFF incorporates several concepts that are commonly referred to in gaming (e.g. presence, flow). Takatalo et al. (2007) conducted a study in which over 200 participants filled in the questionnaire and based on multivariate data analysis 15 dimensions were identified (see Table 8).

Immersion, as defined by the five components of the IEQ, appears to have some overlap with seven of the factors of the EVEQ-GP questionnaire: attention (RWD), physical presence (RWD), interest (CI), role engagement (CI), arousal (EI), control (Con), challenge (Ch). However the EVEQ-GP also includes other factors such as co-presence, enjoyment, playfulness and interaction. One can argue that although these factors can add to a person's immersive experience, they are not essential for immersion to occur. Therefore the IEQ differs from the EVEQ-GP because it does not aim to provide a complete measure of gaming experiences, it aims to provide a measure of just those factors which are common to all immersive gaming experiences.

The Game Experience Questionnaire ($GEQ_{(a)}$; Ijsselsteijn et al., manuscript in preparation) consists of 42 items and was created to provide a comprehensive measure of the range of feelings and experiences that people have when they play games. The $GEQ_{(a)}$ measures various components of gaming experience, including immersion, flow, challenge and several emotions (see Table 8). The $GEQ_{(a)}$ has been used to compare participants' experiences of three game levels designed to differ in game-play (strength of opponents, choice of weapons, pacing of the game) in a pilot study (Nacke & Lindley, 2008a) and an experimental study (Nacke & Lindley, 2008b; Lindley et al., 2008). The results included "positive affect" being highest for the level designed to be immersive and "immersion" being lowest for the level designed to be boring.

The $GEQ_{(a)}$ has also been used by Grimshaw et al. (2008) to compare participants' experiences of a first person shooter under four different sound conditions, involving the presence or absence of sound and / or music. They found that the combined presence of sound and music appeared to have a soothing effect on play, ratings for "tension" and "negative affect" being low in this condition. In contrast, when auditory feedback was missing (music only) there was a decrease in the feeling of "competence". The condition that had no sound and no music, i.e. a complete absence of sound, was rated the lowest for "immersion".

Immersion, as defined by the five components of the IEQ, appears to have some overlap with the seven factors of the $GEQ_{(a)}$: immersion (CI, EI, RWD), flow (CI, EI, RWD), negative affect (EI), positive affect (EI), challenge (Ch), tension (Ch), competence (Ch, Con). However one can argue that whereas the $GEQ_{(a)}$ aims to measure different aspects of gaming experience, its factors being looked at as separate measures in the studies in which it has been used; the IEQ differs because it aims to measure the experience of game immersion only. The IEQ does not aim to be a comprehensive measure of the range of experiences and feelings that people have when playing games; its focus is measuring the experience of game immersion and the factors that are common to all immersive gaming experiences.

The Game Engagement Questionnaire ($GEQ_{(b)}$; Brockmyer et al., 2009) consists of 19 items and was created to measure different levels of game engagement. The questionnaire items for the $GEQ_{(b)}$ are based on the concepts of immersion, presence, flow, psychological absorption. Furthermore, the $GEQ_{(b)}$ proposes that there is a gradation of game engagement, progressing from immersion to presence, then flow and absorption. Immersion is defined as the experience of being engaged in the game-playing experience while retaining some awareness of one's surroundings. Presence is defined as the experience of feeling like you are inside a VE, while retaining a normal state of consciousness. Flow is defined as the experience of an altered state, being "one with the activity", so it is expected to be a less common experience. Flow also involves having a specific goal, immediate performance feedback, balance between challenge and skill, etc. Absorption is defined as total engagement in the experience. Like flow it also involves an altered state of consciousness. In this altered state there is a separation of thoughts, feelings, and experiences and affect is less accessible to consciousness, i.e. one feels at peace.

Administering the $GEQ_{(b)}$ to a sample of 153 students, Brockmyer et al. (2009) found that in line with their theoretical expectations, the easiest items for participants to agree with were associated with immersion (e.g. "I really get into the game") and presence (e.g. "I play long than I meant to", "things seems to happen automatically"). The more difficult items for participants to agree with were associated with flow (e.g. "I play without thinking how to play", "the game feels real", "I can't tell I'm getting tired", "I don't answer when someone talks") and absorption (e.g. "I lose track of where I am", "time seems to stand still or drop"). In a second study Brockmyer et al. (2009) also found behavioural evidence in support of their questionnaire. Participants played a computer game, during which the statement "Excuse me did you drop your keys?" was played into the room, increasing in volume each time. Video tapes of the participants behaviour were then coded (0 = no reaction, 1 = head turn, 2 = search for keys while seated, 3 = gets up to talk to experimenter in adjoining room). The results revealed that participant behaviour correlated in the expected direction with their $GEQ_{(b)}$ scores.

In relation to Brown and Cairns (2004)'s conceptualisation of immersion, it is evident that the $GEQ_{(b)}$ supports the idea of game immersion being a graded experience, the majority of participants experiencing one of the lower levels of engagement. Furthermore, the $GEQ_{(b)}$ also support the idea of flow being an optimal and less likely gaming experience, absorption being an even less likely experience.

A limitation of the $GEQ_{(b)}$ is that Brockmyer et al. (2009) claim that immersion is the most common gaming experience, however according to their categorisation of the questionnaire items there is only one questionnaire item associated with immersion, i.e. "I really get into the game". Thus, one can argue that the IEQ provides a more complete measure of immersion, emphasising a range of factors that are involved in this experience.

Another limitation of the $GEQ_{(b)}$ is that when one inspects the questionnaire items that are said to be associated with "presence" and "flow" in Brockmyer et al. (2009)'s study, the differences between the concepts seem to be confused. For example, "The game feels real" is said to be associated with flow, whereas "I play longer than I intended to" is associated with presence. In contrast, it is hoped that in this thesis it has been made very clear to the reader how the concepts of flow and presence differ from each other, and how these concepts subsequently relate to game immersion as conceptualised by Brown and Cairns (2004) and the IEQ.

2.2.5. Summary

To summarise, this thesis argues that Brown and Cairns (2004)'s conceptualisation of immersion is a good basis for game immersion research. Rather than investigating the typology of immersion, Brown and Cairns (2004) chose to investigate the gradation of immersion. Such an approach emphasises the commonalities between all gaming experiences. Their grounded theory revealed that gamers use the term "immersion" to describe their degree of involvement with a computer game. Three levels of immersion were identified: engagement, engrossment and total immersion. The theory also identified a number of barriers that could limit the degree of involvement (e.g. gaming preference, game construction, environmental distracters).

The IEQ allows one to quantify which situations are more immersive than others. Jennett et al. (2008) created the IEQ using Brown and Cairns (2004)'s conceptualisation as a basis, as well as the related concepts of flow, presence, and cognitive absorption. A factor analytic study provided validation for the IEQ and revealed that the IEQ measures five components of immersion: these are a mixture of psychological factors (CI, EI, RWD) and game factors (Ch, Con).

As well as describing Brown and Cairns (2004)'s conceptualisation of immersion and the creation of the IEQ, this thesis has also explained how none of the other questionnaires currently used by researchers to measure gaming experiences fully capture the experience of immersion in the same way. CEGE (Calvillo-Gamez, Forthcoming) was described as corresponding to the lowest level of immersion, whereas flow was an optimal experience and corresponded to the highest level of immersion, see Table 9. Presence was also described as occurring in the highest level of immersion (see Table 9); however it is also possible to have presence without being immersed, e.g. carrying out a tedious task in a virtual simulation.

Table 9.

Brown and Cairns (2004)'s Conceptualisation of Immersion in Relation to the Concepts of CEGE, Presence and Flow.

Brown and Cairns (2004)'s Gradation of Immersion	Mappings of Other Related Concepts		
Engagement	CEGE		
Engrossment			
Total Immersion		Presence	Flow

It has been emphasised that the IEQ aims to measure the general experience of immersion that is common to all games. It does not aim to measure different types of immersion (e.g. SCI model, Ermi and Mayra, 2005) or provide a comprehensive measure of the range of experiences and feelings that occur during gaming (e.g. $GEQ_{(1)}$, Ijsselsteijn et al., manuscript in preparation). Social factors are considered superfluous: although the presence of other people can add to an immersive experience, it is not considered necessary for immersion to occur. A positive attitude towards gaming is also not considered as sufficient for immersion to occur, as it does not predict whether a person is going to have a highly immersive experience in a specific instance of game-play.

In terms of addiction, it was noted that the degree of immersive experience appears to be closely related to how addictive or engaging people find computer games, addiction being an extreme form of engagement and immersion (Seah & Cairns, 2008). However, although the extent to which a person is able to live a stable and functional life is important to immersion research it is not essential to the immersive experience and therefore is not measured by the IEQ.

2.3. REAL WORLD DISSOCIATION AND SELECTIVE ATTENTION

Having positioned the conceptualisation of game immersion in relation to other concepts, the creation of the IEQ and the identification of the five components of immersion, this thesis now turns to exploring the factor of RWD in more detail. Little is currently known about RWD; however there has been a lot of research for a similar concept in the psychology literature, that of selective attention (SA). Therefore this thesis begins its exploration of RWD by positioning what is currently known about RWD in games in relation to what is currently known about SA in the psychology literature.

2.3.1. Selective Attention and Gaming

SA can be defined as the ability to focus on relevant information that is pertinent to the task, while filtering out irrelevant information (Barlett et al., 2009). Spence (2002) explains that due to the mind's limitations, it would be impossible to process all events in the world around us: our senses are constantly being bombarded by information (vision, audition, touch, olfactory, gestation). Thus mechanisms of selective attention are important because they help us to focus primarily on just that information which is behaviourally relevant in terms of avoiding threat and achieving our goals. As a result of such selectivity, a person is less aware of the other things around them because their mind is engaged with the current task.

In relation to gaming, SA has been referred to by researchers in two different contexts. Some researchers refer to SA in terms of the ability to focus on relevant game stimuli over irrelevant game stimuli. For example, Castel et al. (2005) found that video-game players are not more accurate at detecting targets than non-video-game players; however they are faster at detecting targets. Similarly, Dye et al. (2009) found that action video-game players of all ages have enhanced attentional skills that allow them to make faster correct responses to targets. It has been suggested that expert gamers are able to efficiently detect the presence of targets on the screen because they have a larger visual attention span (Green & Bavelier, 2003; Smith et al., 2008). Green and Bavelier (2003) suggest that this increase in visual attention span is a result of the repeated experience in gaming of simultaneously juggling a number of varied tasks, e.g. detecting new enemies, tracking existing enemies, avoiding getting hurt.

However, one can also refer to SA in terms of the ability to focus on game stimuli over non-game stimuli. For example, Witmer and Singer (1998) write that SA contributes to the sense of presence:

> *"The observer's willingness or ability to focus on the VE stimuli and to ignore distractions that are external to the VE should increase the amount of presence experienced in the environment." (Witmer and Singer, 1998).*

In this thesis, when positioning SA in relation to RWD, it is this latter form of SA that we are referring to. In other words, to what extent is a person less aware of the real world as a result of playing a game?

First a brief background of the investigation of SA in the psychology literature will be presented, e.g. the history of the research domain, the types of issues that have been investigated. This will be followed by a description of some of the factors that have been found to influence the processing of distracters in SA, including two theories often cited in SA research, Attenuation Theory and Cognitive Load Theory.

Then, using similar categories as those used when reviewing the SA literature, this thesis will explore what is currently known about the factors that influence RWD. By making comparisons between what is currently known about RWD and what is currently known about SA, this thesis aims to identify gaps in the existing knowledge of RWD. This thesis also aims to gain an insight into the possible processes involved in RWD and possible methodologies that could be used in measuring a person's awareness.

2.3.2. A Brief Background to the Investigation of Selective Attention in the Psychology Literature

Research investigating SA began in the 1950s, motivated by problems experienced by radar operators during the Second World War (Pashler, 1999). Radar operators found it difficult to communicate with several different pilots at once, whose voices were all relayed over a single loudspeaker. However if a person was asked to selectively attend to one of the sources of information, ignoring all others, they seemed to have very few problems at all. Hence it was evident that by choosing to attend to only a subset of the incoming auditory stimuli, rather than trying to attend to multiple sources at once, a person is able to deal with the information more effectively.

Cherry (1957) describes another classic example of SA, known as the cocktail-party problem. In a noisy party room, like the cockpit experience of the pilots, many voices enter a person's ears at once. Despite the noisy environment however, party guests do not appear to find it difficult to pick out those sounds that are currently relevant to them. They attend to the conversation they are taking part in, ignoring the other conversations taking place in the room.

In order to investigate this phenomenon, researchers developed laboratory tasks to identify the extent to which people could attend to a task within a busy environment. They attempted to answer two questions:

1) How effective is the processing of the relevant message?
2) How effective is the rejection of the irrelevant message?

It was commonly thought that whereas any selectivity of processing for auditory stimuli must rely on neural processes, in regards to visual stimuli people can move their eyes or close their eyes to unwanted inputs, and so visual selectivity was more a result of mechanical processes (Broadbent, 1971). Therefore at first the majority of researchers interested in SA only investigated auditory stimuli. These experiments were concerned with participants attending to one auditory stimulus over another (e.g. dichotic listening task; Cherry, 1953).

However, other researchers argued that the idea that visual selectivity was only a result of mechanical processes was a misconception, as there are instances where it is possible for a person to choose which visual stimulus to attend to without moving their eyes. For example, when reading a page of a book words become less legible as they move towards the periphery of our visual field, but nevertheless one can easily choose to read the word above or below the fixated word (Pashler, 1999). One can even move one's eyes to scan one line of text while reading the line immediately above or below this line (although doing so feels effortful and unnatural). Thus, visual selection is not exclusively due to the movements of the eye, but like auditory selection it depends on internal mechanisms also. Over time this viewpoint grew, particularly in the 1960s and 1970s, during which a number of visual SA studies were conducted. These experiments were concerned with participants either attending to one visual stimulus over another (e.g. inattentional blindness studies; Neisser, 1979; Simons & Chabris, 1999) or attending to one aspect of a visual stimulus over another (e.g. Stroop effects and Flanker effects; Stroop, 1935; Eriksen & Hoffman, 1973).

More recently, researchers have also investigated SA within the sensory modalities of touch, olfaction and gustation (Spence, 2002). Investigating cross-modal links in SA is another topic of growing interest, because, as Spence (2002) explains, real life is multi-modal. Even the cocktail party problem, which was originally considered a uni-modal auditory selection issue, on closer inspection is revealed to be a multi-sensory selection problem. In order to understand what someone is saying at a noisy cocktail party, a person needs not only to select one particular voice from amongst many others, but also to extract relevant visual information from lip movements, facial expressions, and even gestures.

In terms of explaining the results of SA research, in the 1950s and 1960s researchers tended to fall into one of two camps: early selection or late selection. Those in favour of early selection, such as Broadbent (1958), proposed that the human information-processing system is limited in its ability to perform multiple tasks; therefore SA is necessary to stop the system from being overloaded. First a filter sorts stimuli by obvious physical characteristics, such as position, voice and colour. Then further perceptual analyses are carried out, but only to those stimuli which share the property that defines the relevant channel or message, e.g. words presented to the right ear, or letters in blue. Other stimuli are rejected and filtered out. Those in favour of late selection on the other hand, such as Deutsch and Deutsch (1963), proposed that all sensory messages are perceptually analysed at the highest level; however, only the most important signals lead to memory storage and motor output.

Nowadays, rather than an all-or-nothing filter, most researchers would agree that SA is much more complex. In some situations distracters are noticed and in others they are not.

2.3.3. Factors that Influence Selective Attention

In the SA literature the factors that influence the processing of distracters can be divided into three broad categories:

- Features of the message(s) to be attended;
- Features of the message(s) to be ignored;
- Factors associated with the person that is attending the message, i.e. individual differences.

The majority of SA research focuses on the first two categories. For example, in the auditory SA literature factors such as spatial localization cues, frequency differences, the volume of the to-be-attended message and the number of messages to be rejected have been investigated and identified as important (Pashler, 1999). In the multi-sensory SA literature there is also a rapidly-growing body of research (behavioural, electrophysical and neuroimaging) suggesting that tactile, auditory, and visual attention are normally directed to the same spatial location at the same time (Spence, 2002).

However, rather than reviewing all of the SA literature for these first two categories, this thesis will focus on just two theories: Treisman (1960)'s Attenuation Theory and Lavie (1995)'s Cognitive Load Theory. These theories were selected because they are often cited in the Auditory SA literature and the Visual SA literature and were ground breaking at their time, being able to explain results that at first appeared conflicting and thus providing possible resolutions to the early-late selection debate. Some of the research that has been undertaken to investigate individual differences in SA will also be described.

2.3.3.1. Attenuation Theory: Relevance of the Distracter

The dichotic listening task, developed by Cherry (1953), was a popular experimental paradigm used to investigate Auditory SA. This involved listening and shadowing (repeating out loud) one message, while ignoring another. The degree to which a person's attention was focused could then be assessed from the level of shadowing efficiency achieved. After the task, participants were also often asked to recall as much as they could about the content of the ignored message.

Findings from the Auditory SA studies revealed that participants were usually only able to recall physical features of the ignored message and very little semantic content (Pashler, 1999). However, there were certain instances in which the semantic content of the ignored message is noticed. For example, if the word was personally-significant, such as the person's name, or the word was context-relevant, e.g. related to the message in the attended channel.

Treisman (1960)'s Attenuation Theory is one of the most successful theories in terms of explaining the findings of Auditory SA studies. Treisman (1960) explains that when Person A is listening to Person B in a crowded room usually there is perfect selection most of the time. However, sometimes a word spoken by another person will catch Person A's attention if it is context-relevant, e.g. Person C talking about the same conversation topic. Treisman (1960) also explains that there are some words that are always likely to catch Person A's attention because of their high personal significance, e.g. Person D saying Person A's name.

Styles (1997) likens Treisman's (1960) ideas to those of Morton's logogen model of reading (Morton, 1969). Morton (1969) proposed that when a person listens to a sentence, the words at the beginning of a sentence will lead them to expect certain words to follow, raising the activation level of the logogens for the most likely words. For example, "The cat on the ………?" If "rainbow" is the next word, one would be slower to read it than if "mat" were the next word. Similarly, Treisman's (1960) Attenuation Theory neatly explains that although there is perfect selection most of the time, sometimes words in the unattended channel will break through due to priming (context-relevance). Some units, such as that corresponding to one's own name, might be expected to have permanently lower thresholds due to their high personal significance.

This idea of different words having different thresholds is supported by the cognitive neuroscience literature. For example, Hebb (1949) also proposes that the processes going on in the brain at any one time depend heavily on those which have previously occurred. As a result, SA can be viewed as the emergent properties of competitive processes within many different brain areas, in which neural events inconsistent with the ongoing stream of activity are inhibited (Desimone & Duncan, 1995). Recent findings in cognitive neuroscience provide further support for Treisman's (1960) theory: most cellular evidence shows attenuation rather than total elimination of sensory responses to unattended stimuli (Driver, 2001).

In Visual SA research, although images are used rather than words, some of these ideas still apply. For example, in their study investigating Inattentional Blindness, Simons and Chabris (1999) found that observers were more likely to notice a man in a black gorilla costume if they were attending the black team rather than the white team. Furthermore, Stroop effects and Flanker effects both demonstrate that distracting attributes / objects are more likely to be noticed if they are associated with the opposite response to the target letter, rather than a neutral response (Pashler, 1999).

2.3.3.2. Cognitive Load Theory: Task Demands

Measurements used to assess the degree to which a person is aware of distracters / aware of the ignored message in the Visual SA literature include: recall of distracters (e.g. Inattentional Blindness studies), mistakes made in reading the attended message (e.g. Stroop effect) and slower reaction times to the attended object (e.g. Flanker effects).

The findings revealed that in some experimental paradigms the content of the ignored message goes unnoticed. For example, in a well known Inattentional Blindness study participants viewed a video of two super-imposed ball-passing games and were asked to count the number of passes made between either the ball players dressed in white or the ball players dressed in black. At some point during this task, the figure of a woman with an umbrella strolled through the basketball court carrying an umbrella. However, due to their attention in the counting task, only 21% of participants reported the woman's presence when asked whether they had seen any unusual events (Neisser, 1979).

In other experimental paradigms however the content of the ignored message is noticed. For example, in the Stroop effect, participants are instructed to read aloud the colour of the ink in which a word is printed (Stroop, 1935). When the word spells out the name of an incompatible colour (e.g. "GREEN" printed in red ink), the participant is slower to respond "red" than in a neutral condition (e.g. "CHAIR" printed in red ink), often over a 100 msec difference. This difficulty is particularly noticeable when participants read through a long list of incompatible colour/word stimuli, as participants tend to make hesitations and errors, e.g. saying the word out loud rather than the colour. Therefore the Stroop effect demonstrates that people can not completely turn off their word recognition machinery, even when trying to selectively attend to one attribute of a stimulus over another.

The irrelevant message is also processed in studies investigating Flanker effects. For example, Eriksen and Hoffman (1973) conducted a study in which participants had to respond to a central letter as quick as possible, e.g. pressing the left key for an "A" or a "U" and the right key for an "H" or an "M". Next to this letter were other letters ("flankers") that the participant attempted to ignore. The results indicated that when these flankers were associated with the opposite response, for example an "H" surrounding a target "A", reaction times to the target letter were slower compared to when the flankers were associated with the correct response.

Lavie (1995)'s Cognitive Load Theory was one of the most successful theories in terms of explaining the findings of Visual SA studies. This theory incorporates aspects of both early and late selection approaches in its explanation (Driver, 2001). Like Deutsch and Deutsch (1963), Lavie (1995) assumes that perceptual processing is automatic, i.e. we perceive whatever it is in our capacity to perceive. However like Broadbent (1958), it is also assumed that perceptual capacity is limited. Lavie (1995) explains that when a person is doing a difficult task this consumes all of their attention capacity (high load), thus they are unaware of anything not related to the task. By contrast, when the same person is doing an easy task they do have some spare attention capacity (low load); therefore things that are not related to the task are more likely to catch their attention.

High cognitive load is defined as those tasks which include more target stimuli and / or require more difficult operations for the same target stimuli. Lavie (1995) describes Inattentional Blindness studies as having high load, which explains why a gorilla walking across a basketball game can go unnoticed. By contrast, Stroop and Flanker tasks are described as having low load, which explains why incongruent distracters have an impact on participant reaction times.

Lavie (1995; Lavie & Cox, 1997) conducted a series of experiments in order to validate this theory. Using an experimental paradigm similar to the Flanker effect, participants were instructed to decide whether a central target letter was one of two pre-specified letters as quickly as possible while attempting to ignore a peripheral distracter letter. Cognitive load was manipulated by increasing the number of letters among which the target appeared, i.e. making the target appear alone (low load) or among five other non-target letters (high load). In line with the Cognitive Load Theory, the results indicated that reaction times were slower under conditions of high load. In other experiments, cognitive load was manipulated by manipulating task difficulty. For example, participants were instructed to either detect presence / absence (low load), or for the same stimuli make a difficult size and position discrimination (high load). Again the results indicated that distracter incongruency with the target influenced reactions times in tasks of low perceptual load, but distracter effects were eliminated under conditions of high perceptual load (Lavie, 1995; Lavie & Cox, 1997).

The effects of cognitive load have also been observed in Inattentional Blindness studies. For example, Simons and Chabris (1999) found that observers were more likely to notice a man in a black gorilla costume if they were doing an easy task (counting total number of passes) rather than a hard task (counting aerial passes and bounce passes). Cartwright-Finch and Lavie (2007) also investigated the role of Cognitive Load in Inattentional Blindness, conducting a series of experiments using visual search tasks and cross-tasks. In line with Cognitive Load Theory they found that participants were more likely to notice the critical stimulus under conditions of low load, rather than high load. Thus these results indicate that cognitive load influences the entry of distracters into conscious awareness, i.e. memory, as well as having an effect on reaction times.

In Auditory SA studies, task demands have also been shown to play a role. For example, when the shadowing task was made more difficult by giving the participant unclear spatial localization cues, lowering the volume of the attended message, or increasing the number of messages to be rejected, this resulted in participants making more mistakes (Pashler, 1999).

Cognitive Load Theory is further supported by cognitive neuroscience studies. For example, Rees et al. (1997) found that visual cortex activity related to moving distracters was found in conditions of low task-relevant load (requiring detection of letter case in fixated target words) but was eliminated by high task-relevant load (involving a more complex words discrimination task).

2.3.3.3. Individual Differences: Working Memory, Previous Experience

Individual differences, such as working memory and previous experience, may also play a role in terms of whether distracters are processed.

The function of working memory is to actively maintain goal-relevant information during situations which require complex cognition. In a recent study, Conway et al. (2001) suggest that there is a relationship between the cocktail party effect and working memory. The operation span task was used to compute the working memory capacity of each participant. This task involves solving simple mathematical problems and remembering unrelated words, the span being based on the number of mathematical problems a person can solve while still able to recall the words. Participants then took part in a replication of the selective listening study conducted by Wood and Cowan (1995). Conway et al. (2002) found that 65% of low-span participants detected their name in the ignored message, compared to 20% of high-span participants. Therefore they suggest that participants with low working memory capacities have difficulty blocking out, or inhibiting, distracting information.

Previous experience has also been shown to have an effect on the processing of irrelevant items. Using a similar method to Simon and Chabris (1999), Memmert (2006) found that basketball experts (those that had played for over 5 years) were more likely to notice unexpected events compared to novices (those with little experience). One could suggest that due to their familiarity with the game, experts found the task of following the ball game less challenging; thus in accordance with Cognitive Load Theory (Lavie, 1995) they had less cognitive load and were able to direct their attention to stimuli that initially appeared irrelevant.

In another study, Vidnyanszky and Sohn (2005) suggest that attentional suppression of task-irrelevant stimuli becomes more efficient with practice. Thus this suggests that, as a person practices a task and grows in expertise, over time they become better at blocking out distracters and not responding to them.

2.3.4. Factors that Influence Real World Dissociation

RWD refers to the component of the immersive experience in which a person is less aware of the real world as a result of their involvement in the game world. Thus one can infer that like SA, a higher level of RWD is associated with less distracters being processed.

Using similar categories as those used to categorise factors that influence SA (features of the relevant message, features of the irrelevant message, individual differences), three broad categories were identified as likely to influence RWD: features of the game, features of the environment and the features of the person (i.e. individual differences); see Figure 1.

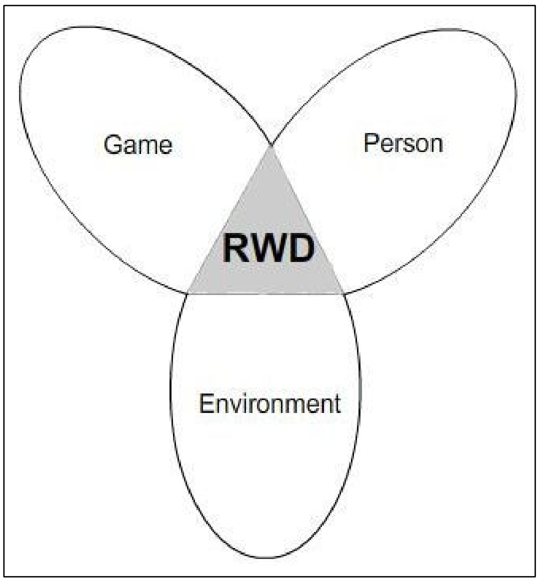

Figure 1. A Figure Depicting that the Immersion Factor "Real World Dissociation" is Influenced by Game, Person and Environment Variables.

Thus, the level of RWD that occurs is likely to be influenced by a mixture of factors. In this section, what is currently known about these three factors will now be described.

2.3.4.1. The Game: Attentional Demands, Believability of the Game World

Immersive games have been described as those that require high concentration, due to the combination of ongoing perceptual, cognitive and motor demands sufficient to engage a high proportion of the player's attention. For example, in a comparison of two real-time strategy games, Sweetser and Wyeth (2005) write that the game "Warcraft 2" is an immersive game because it requires high concentration, the player is required to perform many tasks and there are many things to monitor. As a result of such immersion, "Warcraft 2" causes players to feel tension, excitement, anger at enemies, and feel a personal connection to their units and heroes. In contrast, the game "Lords of the EverQuest" is not immersive because the game is too slow, there is not enough to concentrate on and there is not enough challenge.

Similarly, King and Kryzywinska (2006) write that in strategy games the player is required to make a constant stream of abstract decisions, and as a result the game "absorbs" the conscious mind.

Game demands have been emphasised as having an influence on the experience of time loss during gaming. Interviewing gamers, Wood et al. (2007) suggest that time loss was associated with games that were complex and immersive, i.e. "they made you feel like you were part of the action". These games had compelling goals and levels, plot driven stories, and were exciting and stimulating. Features that involved completing levels, missions, or beating personal high scores, were also cited as reasons as to why time loss occurred.

Manipulating game difficulty has also been found to be an effective way of breaking game immersion. In their study Eggen et al. (2003a; 2003b) investigated children's experiences of three different ways of breaking game flow in a modified version of "Pac Man". One of these interventions involved a decrease in game difficulty when the person was due to stop playing, e.g. ghosts stop hunting the player's avatar. Although this version of the game was not popular with the participants (it was said to impact the game-play of the game, making it boring), by decreasing in difficulty the game was effective in achieving its goal of breaking game immersion at the required time.

In terms of studies that have attempted to manipulate game features and measure the RWD that occurs as a result, one such study is Jennett et al. (2008). They conducted a study in which they measured people's abilities to switch from an immersive game to a task in the real world. First the time participants took to complete a tangram task was measured; this task was distinct from the game because it involved moving physical objects. Then participants were instructed to play either an immersive game (first person shooter "Half Life", involves characters and a VE) or a non-immersive task (clicking boxes task, 2D graphics and repetitive). Afterwards participants were instructed to complete the tangram task again. Participants that had played the non-immersive task showed greater improvements in their tangram task completion times than participants that played the immersive game. Thus this suggests that being increasingly immersed in a game decreased one's ability to re-engage with the "real world", supporting to some extent the idea of a transitional period between coming out of immersion in the "world of the game", and returning to the "real world".

However, one must note that higher game demands are not always associated with higher game immersion: sometimes challenge can create the gaming experience and sometimes it can completely destroy it (Juuso, 2007). Similar to Flow Theory (Csikszentmihalyi, 1998), if the challenge fails to engage the player, the player quickly loses interest and tends to leave the game (e.g. Eggen et al., 2003a; Eggen et al., 2003b); however if the challenge is beyond the person's ability, this also causes game immersion to be broken as the activity can become so overwhelming that it generates anxiety. For example, Ang et al. (2007) describe several cognitive overloads that can occur in massively multiplayer online role playing games (MMORPGs) which can sometimes be detrimental for players, especially beginners. Therefore, in line with Flow theory, many game designers argue that in order for a game to maintain the right level of challenge, as the player gains mastery the problems must become harder to solve. For example, Koster (2005) suggests that as the gamer progresses through the game, challenges can be made more difficult by requiring the gamer to do something more thoroughly, e.g. by increasing the number of obstacles, or by requiring the gamer to do something quicker, e.g. by imposing a time limit.

The consistency of the game environment has also been highlighted as playing an important role in game immersion, as poor design is one of the greatest threats to suspension of disbelief in the game world. For example, if one of the people in the VE does something wildly out of character, or if something highly improbable happens, immersion might be broken (Rollings & Adams, 2003). A lack of harmony might also destroy a player's suspension of disbelief: all parts of the game must feel like they belong to a single coherent whole. McMahon (2003) claims that three conditions are needed to create a sense of immersion in a computer game: the user's expectations of the game or environment must match the environment's conventions fairly closely; the user's actions must have a non-trivial impact on the environment; and the conventions of the world must be consistent, even if they don't match those of the real world. Narrative and genre are used as ways of defining the conventions of a world and helping the user align their expectations with the logic of the world.

Thus the gaming literature suggests that both the attentional demands of the game (level of game challenge) and the believability of the game world (game consistency) play an important role in the level of RWD experienced. Similarly, Carr (2006) explains that players are slowly drawn into the game world of Baldur's Gate via their attentional investment (manipulating numerous variables, digesting large amounts of information) and their imaginative investment (believing in the game characters and environment).

Overall these findings clearly bare similarities with the SA literature, as Cognitive Load Theory (Lavie, 1995) also emphasises task demands. However RWD in gaming also has an added complexity: due to the length of time that a person plays a computer game, the game needs to have consistency throughout to make the game world believable. The level of challenge also needs to adjust, the game becoming more difficult as the person gains mastery.

2.3.4.2. The Environment: Social Factors, Minimising Distractions

As well as game factors, features of the environment are also likely to influence RWD. For example, the presence of other players can enhance a person's immersion in a game. Ravaja et al. (2006) found that when participants played against another human they experienced higher levels of physiological arousal, spatial presence and engagement, compared to playing against a computer opponent; participants also experienced higher levels of arousal, presence and engagement when playing against a friend rather than a stranger. Similarly, Wood et al. (2007) found that games that involved the ability to interact with other real players were associated with the experience of time loss; as well as competition, interaction included socialising with other players, solving problems as a group, and trading virtual items particularly while playing MMORPGs. People will even play games they do not like, just to interact with other people (Sweetser & Wyeth, 2005).

However the presence of other people does not always enhance game immersion. For example, if a person playing a game is interrupted by someone not playing the game, this can break the person out of their immersion in the game-play. Wood et al. (2007) suggest that this is a strategy used by some gamers in order to prevent time loss, getting someone else to interrupt them or remind them of the time. Other common strategies for preventing time loss included positioning a clock, watch or mobile phone displaying the time somewhere in view, or to set an alarm or timer on a clock or mobile phone. All of these strategies involved the person making themselves more aware of the real world.

Similarly, in their study investigating ways of breaking children's experiences of game flow, two of the interventions used by Eggen et al. (2003a; 2003b) involved real world objects that were designed to draw the player's attention away from the game. One of the interventions involved a pop up box that appeared on the game screen, stating "Your time is almost up", which had to be clicked to disappear. The other intervention involved a physical object in the real world that resembled the player's avatar (a yellow Pac man figurine) which made noises and lit up when the person's time was close to being up. Both of these interventions were found to be effective in breaking players' game immersion.

Wood et al. (2007) found that people also reported engaging in strategies to minimize their awareness of distracters. For example, in the same study investigating time loss, Wood et al. (2008) reports that some gamers would turn their clock away from them while playing because they did not want to be reminded of the time. Similarly, Nunez and Blake (2006) suggest that gamers successfully engage in strategies in order to maximise their experience of presence when gaming. These strategies include minimizing attention distracters, e.g. playing when you won't be interrupted by other people; and improving display fidelity, e.g. maintaining up-to-date equipment.

Thus the gaming literature suggests that social factors can enhance or disrupt immersion. It also suggests that people set up their environment in order to enhance or break immersion. However, in contrast to the SA literature, it is not clear in the gaming literature the specifics of this experience of being less aware of the environment. For example, as well as the features of the environment that do catch a person's attention, such as someone interrupting game-play or a person's alarm going off, it would also be interesting to investigate what features of the environment *do not* catch a person's attention.

2.3.4.3. Individual Differences: Experts versus Novices, Game Engagement

Another factor likely to impact awareness of distracters is previous experience playing a certain game. For example, Rau et al. (2006) conducted a study investigating time distortion. They found that expert gamers of "Diablo 2" underestimated the time they spent playing the game and they perceived the 60 minutes playtime as passing more quickly. Rau et al. (2006) suggest that good experiences take up less cortical space and are therefore experienced as having taken less time. In contrast, novices were more likely to overestimate the perceived time. This could suggest that they had a less positive experience, possibly because they were still trying to get to grips with the game at this stage of game-play.

However, as well as experts being able to get to grips with the game quicker and becoming more immersed, it is also possible for the opposite to occur, i.e. experts being less immersed than novices, due to them finding the game too easy. For example, Sweetser and Wyeth (2005) write that the game "Lords of EverQuest" was below average, the campaign mission lacked strategic depth, only requiring superior fire power to win; thus the challenge was especially poor for experienced players, and would probably only accommodate novice players. In contrast, the game "Warcraft 2" was successful in terms of challenge because as the campaign progresses the difficulty of the mission increased; thus accommodating both experts and novices.

Expert gamers clearly have more knowledge of the game domain, due to their greater experience. Several studies have also proposed that expert gamers think in a different way to novice gamers. For example, Maglio et al. (2008) write that expert gamers use the game world more effectively than novices: while playing "Tetris", experts make more epistemic actions (rotating the falling game pieces) in order to enhance their ability to decide whether the piece will fit in a game board. In another study, Hong and Liu (2003) found that expert gamers were more likely to use analogical thinking while playing "Klotski", whereas novice players were likely to use trial-and-error thinking. Similarly, Blumberg (1998) found that experts playing "Sonic the Hedgehog 2" were more standard-driven, they placed a greater emphasis on specific goals for mastering the game; whereas novices were more affect-driven, i.e. they just referred to the game in terms of liking. It has also been suggested that expert gamers have greater selective vision, perhaps because their gaming experience has helped them to learn to use their larger visual span more efficiently in order to detect the presence of targets on screen (Green & Bavelier, 2003; Smith et al., 2008).

Experience is not the only factor that can affect RWD however. For example, one can imagine a situation in which two people of similar experience play a game, however they differ in their immersive experience of the game: one person hits an obstacle that they can not overcome after several attempts of trying, becoming frustrated and giving up; in contrast the other person is able to overcome the obstacle after three or four attempts and is able to happily progress in the game, playing for a longer period of time as they reach new levels, trying to overcome new obstacles. Thus one can suggest that although expertise can play a role in how easy or difficult a person finds a game, overall it is the specific instance of game-playing that matters.

Measuring engagement using the $GEQ_{(b)}$, Brockmyer et al. (2009) investigated the relationship between engagement and responding to an auditory distracter. In their study, participants played a computer game, during which the statement "Excuse me did you drop your keys?" was played into the room, increasing in volume each time. Video tapes of the participants behaviour were then coded (0 = no reaction, 1 = head turn, 2 = search for keys while seated, 3 = gets up to talk to experimenter in adjoining room). The results revealed that participant behaviour correlated in the expected direction with their scores.

Thus like the SA literature, the gaming literature suggests that previous experience can play a role in how easy or difficult a person finds a game, which in turn influences their RWD. However, more importantly, it is the person's experience of a specific instance of game-play that matters most.

2.4. DISCUSSION

To summarise, currently little is known about RWD in gaming; however there is a lot known about a concept that bears similarities to RWD, that of SA. Therefore, this thesis began its investigation of RWD by reviewing the game immersion literature in relation to the SA literature. By comparing the two domains this thesis aimed to identify gaps in the existing knowledge of RWD. Another aim was to gain an insight into the possible processes involved in RWD and possible methodologies that could be used in measuring a person's awareness.

First the existing state of game immersion was presented, in which it was argued that Brown and Cairns (2004)'s conceptualisation of game immersion was a good basis for game immersion research. It was also argued that the IEQ was an effective measure of the general experience of immersion common to all games. The IEQ measures five components of the immersive experience, one of which being RWD.

Then a brief overview of the SA literature was presented. Three factors that influence the processing of distracters in SA were identified. Features of the relevant message included task demands (Cognitive Load Theory; Lavie 1995). Features of the irrelevant message included relevance of distracters (Attenuation Theory; Treisman, 1960). Individual differences included working memory load and previous experience. Using similar categories as those used to categorise factors that influence SA (features of the game, features of the environment, features of the person) an overview of what is currently known about RWD was presented. Game factors included the attentional demands of the game, and the believability of the game world. Environmental factors included social factors and strategies used to minimize distracters. Individual differences included game expertise and game engagement.

Compared to the SA literature, it is evident that although attention plays a role in gaming, the experience of RWD in gaming is more complex. For example, the attentional demands of a game need to adjust as the player gains mastery. Also, sometimes social factors can play a role.

It is also evident that, compared to the existing SA literature, there is a lot less known about the specifics of RWD. For example, loss of time has been specifically investigated. Gamers have been interviewed about their experiences of time loss (Wood et al., 2007). Also an experimental study investigated differences between experts and novices in their estimations of the time they had been playing a game (Rau et al., 2006). However, the extent to which people are unaware of other aspects of their environment has not been specifically investigated. Thus one can ask, to what extent is a person less aware of physical objects, sounds or tactile sensations? When a person is immersed are they less aware of all aspects of their environment, or are they less aware of some aspects of their environment more than others?

By reviewing the SA literature this has provided insight into some of the possible processes that could be involved in RWD. For example, irrelevant distracters might be less likely to be noticed than relevant distracters (Attenuation Theory; Treisman, 1960). Also distracters might be processed less in games with high attentional demands (Cognitive Load Theory; Lavie, 1995). There is already some indication of the latter in the gaming literature (e.g. Wood et al., 2007; Eggen et al., 2003a; Eggen et al., 2003b).

The SA literature also gives us an insight into possible ways to measure awareness of distracters. See Table 10 for a summary of the measures that have been described in this thesis which have been used to measure processing of distracters in the SA literature and the game immersion literature.

Table 10.

A Summary of the Measures Described in this Thesis Used to Measure Processing of Distracters in the Selective Attention Literature and the Game Immersion Literature.

Type of Distracter	Measures	Used to measure SA by:	Used to measure RWD by:
Auditory Distracters	Recall of the irrelevant message	Selective listening tasks (e.g. Cherry, 1953)	
	Mistakes in shadowing the relevant message	Selective listening tasks (e.g. Cherry, 1953)	
	Coding behavioural observations of responses to the auditory distracters		Brockmyer et al., 2009
Visual Distracters	Recall of the visual distracter	Inattentional Blindness studies (e.g. Neisser, 1935)	
	Mistakes in reading the relevant message	Stroop effects (e.g. Stroop, 1935)	
	Slower reaction times to the relevant message	Flanker effects (e.g. Eriksen & Hoffman, 1973)	
Awareness of Time Passing	Estimation of the amount of time that has passed		Rau et al, 2006

As can be seen in Table 10, with the exception of Rau et al. (2006)'s study of time estimation and Brockmyer et al. (2009)'s study of behavioural responses to an auditory distracter, there have been few objective measures used to assess the extent to which a person is less aware of distracters during game immersion. Drawing from the SA literature, one can propose the use of recall and reaction time measures as possible ways of measuring the processing of auditory and visual distracters in future experimental studies investigating RWD.

Overall, one can conclude that reviewing the RWD literature in relation to the SA has been a useful approach. The comparison has highlighted the gaps in the existing RWD knowledge. For example, not much is known about the processing of distracters in RWD. Furthermore, the comparison has provided useful insights regarding possible ways of measuring RWD, e.g. recall and reaction times. The comparison has also provided insights into possible processes involved, e.g. Attenuation Theory, Cognitive Load Theory.

However, it must be noted that whereas the majority of studies in the SA literature have focused on simple experimental tasks and single modalities (audition, vision), games are multi-modal and more complex, making them more like tasks in real life. Therefore it is also possible that the attentional mechanisms involved in gaming may be slightly different. For example, as has already been highlighted in the literature review, it is not just enough that a game is attentionally demanding, but the attentional demands of a game need to increase as a person gains mastery.

Thus, in order to explore these issues further and shed light on the nature of RWD, for the first stage of this research a qualitative study was conducted. Several gamers were interviewed about their experiences of RWD and then a grounded theory was developed based on their responses. This study shall be described in the next chapter.

Study One: Interviewing Gamers

3.1. INTRODUCTION

Although people have talked about being less aware of their surroundings as a result of gaming, as of yet this aspect of gaming has not been extensively studied by researchers. Therefore this thesis begins its investigation of RWD with research questions of a very exploratory nature. It aims to explore what does it mean to be less aware of your surroundings? Is the player less aware of all aspects of the real world, or only some aspects? Also what factors impact this experience?

On the one hand, it is possible that similar attentional mechanisms will be observed as those highlighted in the existing SA literature. As suggested in the literature review presented in the previous chapter, the concepts of SA and RWD share similarities. In both cases a person attends to one source of information, ignoring other available sources of information in the environment.

On the other hand, it is also possible that due to the more complex nature of gaming, the attentional mechanisms involved in gaming may be slightly different. Whereas the majority of SA research is usually concerned with simple experimental tasks, often using only single modality sources of information; the experience of gaming is a multi-modal experience, involving vision, hearing, and tactile sensations. At times gaming can also be a social experience.

Strauss and Corbin (1998) explain that qualitative methods can be used to explore substantive areas about which little is known. Furthermore, qualitative methods can reveal intricate details about phenomenon that might be difficult to extract from more conventional research methods, e.g. details such as feelings, thought processes, and emotions. Therefore, due to the exploratory nature of our initial research questions, the qualitative method was deemed appropriate for our first study investigating RWD. To be more specific, gamers were interviewed about their experiences, and then transcripts were analysed using open coding, axial coding and selective coding, and a grounded theory was developed.

Brown and Cairns (2004) also used a qualitative method in which they interviewed gamers and developed a grounded theory. However, whereas Brown and Cairns (2004) took a top-down approach, aiming to understand immersion by understanding its barriers, this study took a bottom-up approach. It aimed to understand the reasons why people play computer games and characteristics of the experience itself. For example, to what extent are people aware of their surroundings while they are immersed? Also why are some gaming experiences more immersive than others?

The chapter shall be organised as follows: first the methodology of Study One and the resulting grounded theory will be described; this will then be followed by a discussion of how these findings relate to existing game immersion research and SA research.

3.2. METHODOLOGY

3.2.1. Design and Participants

The aim of Study One is to understand what is the nature of experience of people that play games and become less aware of their surroundings (RWD)? Due to the exploratory nature of this question, a qualitative method was used in order to gain a rich source of information. Participants were recruited via an email sent to university students which stated a message along the following lines: "Do you enjoy playing computer games? Tell us all about it! We are conducting a study interviewing gamers in order to find out more about the experience of gaming, please contact us if you would like to take part." Some of the participants were people that the researcher knew beforehand, for other interviews it was the first time the researcher and the participant had met. However for both participants known and unknown, the researcher conducted the interview in a friendly manner in order to put the participant at ease, so that it felt like more of an informal chat.

Originally 14 were gamers interviewed, however Participant 6 was excluded from the study due to a corruption of the voice recording. Therefore the results are based on the interviews of 13 gamers in total. 8 were male and 5 were female. Their ages ranged from 19-32 years (SD = 3.66). Between them they had experience in playing a wide range of games and consoles, see Table 11.

3.2.2. Interview Procedure

Interviews were conducted face-to-face in a room at the researcher's university for a period of approximately one hour. Interviews were audio recorded with the participant's consent. Each interview lasted for approximately 45-60 minutes and questions were semi-structured to cover the following:

- What are your gaming habits?
- What are your reasons for playing?
- Which gaming features are important?
- What does it mean to be immersed in a game?

Table 11.

Age, Gender and Gaming Background of Participants Interviewed in Study One.

Participant	Age	Gender	Console used most often	Favourite games	Games disliked	Max. no. hours played in one session
1	22	M	Playstation	Football	Violence, Minesweeper, Pinball	Did not say
2	22	F	SNES	Platform games	Football, Tetris	Did not say
3	32	M	PC -online	MMORPGs	Games that are not online / social	36-40 hours
4	22	F	PC -online	Online strategy, platform games	Sports, realistic fighting	4 hours
5 *	18	M	PC	First person shooters	Role playing games	Did not say
7	20	F	PC -online	Online puzzles	War games, football, Pacman	2 hours
8	19	M	PC -online	Multiplayer first person shooters	Counterstrike	12 hours
9	19	M	PC	WW2 role playing	Fantasy	4 hours
10	19	M	PC	Adventure, football manager	Did not say	Did not say
11	21	M	Playstation, Mac	Adventure, driving	Did not say	Did not say
12	25	M	Playstation	Beat 'em ups, role play, adventure	Multiplayer, football, snooker	6-7 hours
13	24	F	Wii	Wii	Violence, single player	2 hours
14	22	F	PC	Sims	Racing, football	Did not say

** Participant 6 was excluded from the study due to a corruption of the voice recording.*

As can be seen by the Interview Schedule (see Appendix 1), the questions covered a wide range of topics. These questions were developed to be used as a starting point by the researcher, in order to get the participant talking about their gaming experiences. In particular open questions were used, in order to encourage the participant to speak as much as possible. The idea behind this approach was that the participant should be encouraged to speak freely and lead the way in the interview, while the researcher carefully crafts questions grounded in the participant's discourse. Sometimes the researcher delved into the participant's experiences of RWD, at other times the researcher discussed other topics such as the participant's favourite game, whether they liked realistic graphics or graphics that are more cartoon-like, etc. Although the grounded theory would later focus on just those responses that were relevant to RWD, it was decided that asking participants about a number of different aspects of gaming was important in order to keep the participant talking and to get them thinking about a wide variety of different gaming experiences, enjoyable and not enjoyable. The researcher conducted the interviews in a friendly manner, in order to put the participant more at ease. Water was also made available during the course of the interview.

3.2.3. Transcription of Interviews

A cassette recorder was used to record all verbal exchanges between the researcher and participant. Once the interview was completed the audio recordings were then played back and all talk between the researcher and the participant was transcribed. Pauses, laughter, sighs, and other non-verbal sounds were noted alongside the text, which was supplemented by notes made immediately after the interview regarding details such as gestures used, e.g. snapping fingers while saying "just like that". The punctuation used in the transcripts, such as full stops and commas, were an interpretive approximation by the researcher. The fact that the interviewer and transcriber were the same person happened to be advantageous, as in certain areas where speech was muffled the researcher could recollect what had been discussed in order to make sense of the audio recording.

3.2.4. Data Analysis

The data was analysed using a qualitative methodology known as grounded theory. A grounded theory is a theory that is "grounded" in data. In other words, there is an emphasis of empirical research in conjunction with the development of theory. A grounded theory is derived from data, systematically gathered and analysed through the research process (Strauss & Corbin, 1998). It is suggested that because grounded theories are drawn from data, they are likely to offer insight and enhance understanding. Furthermore, by enabling users to explain and predict and events, a grounded theory can also providing a meaningful guide to action.

It is important that a researcher does not begin a project with a preconceived theory in mind (unless his or her purpose is to elaborate and extend existing theory). Instead, the researcher begins with an area of study and allows the theory to emerge from the data. Three coding procedures were used in the current study: open coding, axial coding and selective coding. Open coding is the analytic process through which categories are identified and their properties and dimensions are discovered in the data. Axial coding is the process of relating categories to their subcategories, and understanding how categories relate to each other. Selective coding is the process of integrating and refining categories, in order to form a central theory.

Strauss and Corbin (1998) explain that in order to develop a grounded theory, the data must be coded as it is collected. Data analysis relies on the interplay between the researcher and the data. The researcher identifies categories, subcategories and their properties in the initial transcript, and with each new transcript the researcher decides how the new data fits in with the existing categories. The researcher may find some categories may need to be re-defined or expanded, and will adapt the questions they ask in subsequent interviews accordingly. The researcher may also find that some categories may need to be dropped because they are not directly relevant to the central theory; again this will influence the interview procedure, as they learn to focus on some topics more than others. The data-gathering process is complete once the researcher reaches theoretical saturation. In other words, the researcher stops conducting interviews and analysing the transcripts when no new categories and properties appear to emerge from the data. In the current study, theoretical saturation was reached at 13 participants.

At the end of the data analysis, we were also able to reflect and draw comparisons between our theory of RWD in gaming and existing theories of SA. These comparisons will be discussed later in the chapter, once the grounded theory has been presented.

3.2.5. Reliability and Validity

Two important criteria to assess the internal validity and reliability of qualitative research have been suggested by Smith (1996). These are internal coherence and presentation of evidence. Internal coherence refers to whether the argument presented within a study is internally consistent and supported by the data. Presentation of evidence refers to the publication of sufficient quotations from the participants' discourse to enable readers to evaluate the interpretation. In line with the criteria, we will present the main themes of the grounded theory with some of the corresponding quotes from the participants' transcripts, so that the reliability and validity of our interpretations can be assessed by the reader.

Further validation for the grounded theory will be evident if some of the main themes are found to be in line with the existing immersion literature. Thus, after the grounded theory has been presented, comparisons between our theory of RWD in gaming and existing theories of immersion will also be discussed.

3.3. GROUNDED THEORY

For the purposes of this research, only participant responses that were relevant to RWD in gaming were included in the grounded theory. First we will describe RWD in terms of it being a reason why people choose to play games, i.e. they desire a sense of escapism. Then we turn to presenting the main part of the grounded theory, in which we explain the experience of RWD in gaming. As can be seen in Figure 2, the grounded theory found that a sense of progression in the game was key to RWD.

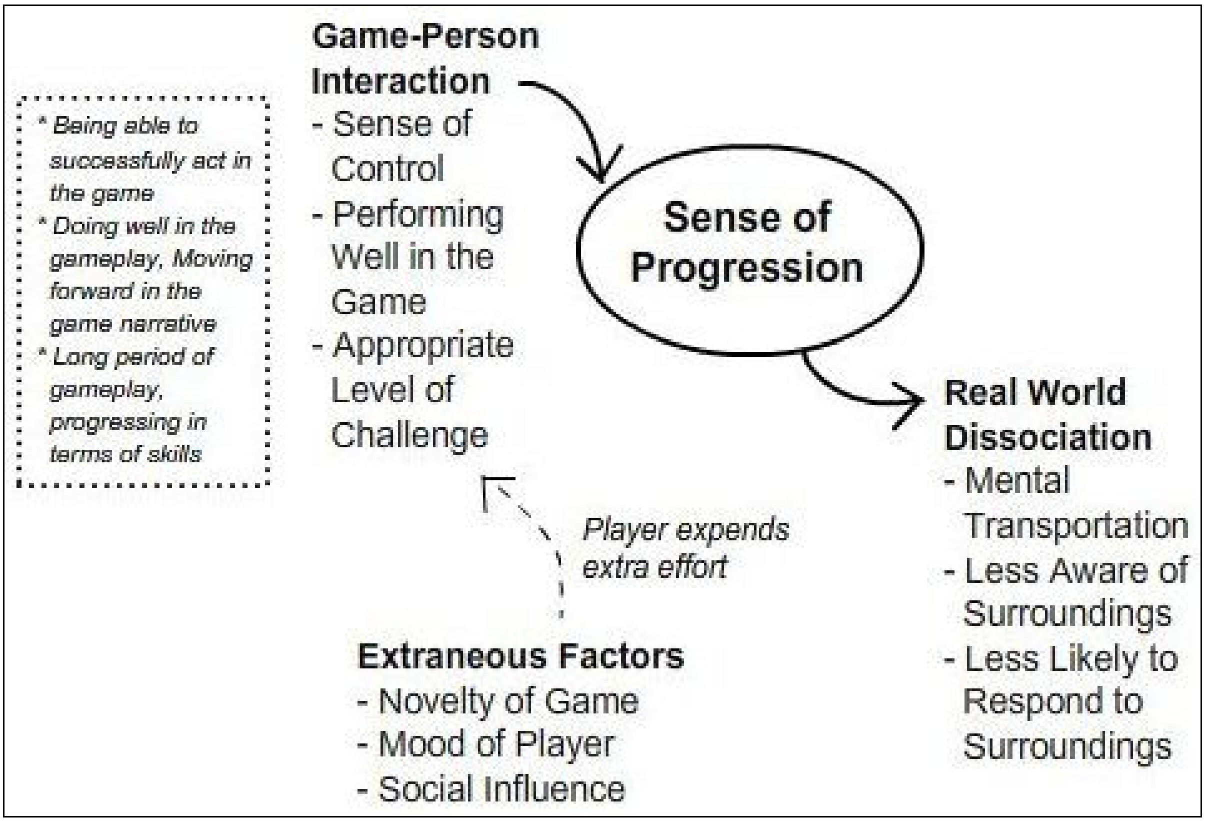

Figure 2. A Figure Depicting the Central Theme of the Grounded Theory, that a Sense of Progression is Key to Real World Dissociation.

The following parts of the grounded theory will be described:

- Aspects of the game-person interaction that lead to a sense of progression;
- Extraneous factors that are not essential for RWD to occur, and are also not directly associated with a sense of progression, but can add to a person's motivation and RWD.
- Characteristics of RWD that occur as a result of a sense of progression;

It is important to note that we do not intend to produce an exhaustive account of RWD in all types of gaming. Instead our aim is to highlight just some of the important issues which have arisen from the grounded theory, allowing us to gain an initial insight into the experience of RWD in gaming.

As well as describing each category / subcategory, corresponding quotes from participant transcripts will be also be shown. Note that these quotes are not all of the instances of a category / subcategory that were coded; instead they are a select few instances to serve as examples.

3.3.1. RWD as a Reason for Playing Games

A sense of escapism was one of the main reasons gamers cited for playing games (other reasons including a sense of achievement and a basis for social interactions). This desire to escape is significant because it means that people sometimes play games with the intention of experiencing RWD, i.e. they *want* to be less aware of their surroundings. Escapism can be thought of in terms of what it is a person is escaping to, but also what it is a person is escaping from. In this section we will explore why people want to escape into a world of fantasy, i.e. the game world, and escape from their life in the real world. See Table 12 for an overview of the categories that will be described.

Table 12.

Real World Dissociation as a Reason for Playing Games, Categories and Subcategories.

Categories		Subcategories (if any)	
1	Escaping into a world of fantasy	-	
2	Escaping from the real world	1	Escaping from boredom
		2	Escaping from stress

3.3.1.1. Escaping Into a World of Fantasy

When gamers referred to escapism they talked about escaping into a world of fantasy, see Table 13. What makes the game world so fantastical is that it is different from the real world. For example, you can "eat mushrooms and become tiny" (Participant 4), you can "go around and shoot people" (Participant 12). It is precisely this "other world-liness" that makes playing a game so appealing, as you are able act out things that you could not normally do in real life.

Furthermore, it would appear that part of the enjoyment from escapism comes from the knowledge that you are just playing. For example, shooting people in real life would be "insane" and if you did do that you would be a "mess". However, when you shoot people in the game world you know that it is not real and you are just playing a role, so it is viewed as "a cool thing to do" (Participant 4). Unlike real life, there are no serious consequences in game; the worst that can happen to you is that you lose. Your goals in the game are also much simpler than your goals in real life and often much easier to achieve: all you desire is to conquer the game and to have fun while you do it.

Table 13.

Examples of Escaping Into a World of Fantasy.

Participant	Quote
11	*"It's like um playing fantasy, like a role playing game y'know y-you're living out another life in a- in a world that you are never going to actually be into…"*
4	*"It's like in a game I want to be flying off the walls or eating mushrooms and becoming tiny or weird things like that which couldn't possibly happen in real life."*
12	*"You can't really go around and shoot people, that's just insane, whereas in a game if it's just for fun and it's really.. depending on your kind of sense of humour it's really funny, just to go around and shoot the hell out of people, it's such a cool thing to do, taking chain saws and blowing people up, blowing cars up, y'know what I mean. It's just like when you're playing games it's really cool doing it, 'cos like afterwards you come back to reality and it's like y'know if you really do that you'd be in a mess like <laughter> y'know what I mean?"*

3.3.1.2. Escaping From the Real World

Almost as important as being part of a new world, is the sense of escaping from the "old" world. Games are used as a way to escape from boredom, see Table 14. Games allow people to keep themselves "occupied" when they are at home and do not have much to do (Participant 2). Furthermore, because people know that when they are having a good time playing a game the minutes / hours seem to fly by, a person might purposively play a game in order to "kill time" (Participant 9). Much in the same way as a person might choose to read a book or watch TV, games can allow you to escape from boredom by providing entertainment and keeping your mind engaged.

Games are also used to escape from stress, see Table 15. It is evident that at times games are viewed as quite therapeutic. Playing a game is a way of "distracting oneself" and allows a person to get their minds off any problems they are having, by focusing on something less serious (Participant 13). This does not necessarily solve the problem itself but it can allow you a person to calm down and "give you a rest from it" (Participant 10). After getting away from those thoughts, later one might find that you are able to return to it with a "fresh perspective" (Participant 11).

Again it is the "other-world-liness" of games that makes them so appealing. You know that you are only playing, any stressors you encounter in a game are nothing compared to the stressors of real life. Therefore it provides an ideal source of escapism when you are feeling worried. Furthermore, "it is a nice feeling to be able to focus on something, something not like anything else" (Participant 5). Playing a game can lift your mood and possibly cheer you up.

Table 14.

Examples of Escaping From Boredom.

Participant	Quote
7	*"It's sort of like 'okay I'm bored, what's the most entertaining thing I can do?"*
2	*"When you're about 8 or 9 or even 10 you've not got much to do really, so like you can't really go cinema because you're kinda young… y'know especially in the Winter or when it gets dark early it's like you can't really go out and play after school… playing kind of like these games kept us y'know occupied for a while…"*
9	*"… reason I'd say is to kill time <laughter> because it's boring just sitting having nothing to do…"*

Table 15.

Examples of Escaping From Stress.

Participant	Quote
13	*"Instead of focusing on your own problems, I think.. I think it's a way of distracting oneself. Um and it's.. when you switch it on it's like 'I'm not going to think about anything else right now, I'm just going to think about this'…"*
5	*"It's nice in a sense, because you get to forget about everything else and just sort of concentrate on other things.. I dunno, I think it's sort of a nice feeling to be able to focus on something, something not like anything else."*
10	*"It's sort of good to.. if there are things worrying you sometimes it can give you a rest from it."*
11	*"If something's worrying you before y'know trouble at school or family stuff and you're not around them it just- it just doesn't play on your mind for a long time and it is kind of.. y'know it gets to that escapism thing again where if you get something stuck in your brain and you go to a computer game you've kind of got a fresh perspective on it, you've not been working over it for ages and ages and ages and you can take another look at it, take a step back and re-evaluate things, and er.. y'know I suppose that that's quite a.. that may be quite a big reason why I've played at certain points in my life maybe without really realising it, just to get away from certain thoughts y'know…"*

3.3.2. The Game-Person Interaction

However, although a person may desire to escape, this does not necessarily mean that RWD will occur. Similarly, a person may not play a game aiming to experience RWD, but may experience it nevertheless. Thus it is not a person's reasons for playing, but the specific game-person interaction, that is most important in terms of RWD occurring. The grounded theory identified three aspects of the game-person interaction that are associated with RWD: sense of control, game performance and appropriate level of challenge. In this section we will explore each of these factors in turn. In particular, we will describe how it was the sense of progression that these factors provide that was important for RWD to occur, and feedback underpinned this sense of progression. See Table 16 for an overview of the categories that will be described.

Table 16.

Aspects of the Game-Person Interaction Associated with Real World Dissociation, Categories and Subcategories.

Categories		Subcategories (if any)	
1	Sense of Control	1	Feeling in control
		2	Feeling not in control
2	Game Performance	1	Doing well / nearly there, keep playing
		2	Hit a barrier, stop playing
3	Appropriate Level of Challenge	1	Game being too easy
		2	Challenge being just right, escalating as game progresses

3.3.2.1. Sense of Control

In order to become immersed in a game, first the person needs to get to grips with the controls. Games with good game-play were those in which it was quick to learn the controls, see Table 17. Gamers used words such as “easy to use” (Participant 4) and “natural” (Participant 10) to describe their sense of feeling in control in such interactions. They felt able to make a connection between their actions on the interface and the response on the screen. This is important for RWD because the easier it is for a person to make a connection between their actions on the interface and the response on the screen, the easier it is for a person to become absorbed in the game itself. Instead of focusing on how to use the interface, i.e. their actions in the real world, the gamer focuses more on their progression in the game world, i.e. their actions in the game world. As a result, they are able to escape into the world of the game.

In contrast, games with bad game-play were those in which the person did not feel a sense of control, see Table 18. It is clear that when the gamer “can’t figure out how to move the controls” (Participant 13) or the controls are “just too much to remember” (Participant 4) the gamer will soon lose interest in the game, and thus they are less likely to experience RWD. As one gamer explains, “it fails to immerse me because I don’t feel connected with my hand movement and what I see on the screen” (Participant 4).

Table 17

Examples of Feeling In Control.

Participant	Quote
4	*"I suppose how easy it is to play the game, um the instructions, how easy they are to follow, once you're in the game can you navigate around the game well, I suppose how easy the controls are to use."*
9	*"How well you can- the game allows you to interact with it… and for example if it responds quick enough, if um it does what you actually ask it to, well tell it to, if you press the button does it actually do it, how long does it take to do it, is that delay deliberate or.. is it supposed to be in a story or is it not supposed to be in a story, or in a game.."*
10	*"It's just how natural it feels to play the game."*
11	*"It's just the way that you interact with that artificial environment, like y'know if.. if you can control a character and their movement is nice and fluid and responsive then that's good."*

Table 18.

Examples of Feeling Not In Control.

Participant	Quote
4	*"Some of the games that you can play online where it's just overly complicated for no reason, where they'd say press that letter to do this and that letter to do that , this letter to do this and it's just too much to remember, that will always be bad for game-play."*
11	*"Resident Evil had a particularly bad game-play […] I think it was just like third person perspective, particularly bad, so it was really hard to watch and work out where your character was pointing and get him to move somewhere, and when they'd walk into a wall and couldn't walk through they'd just walk on the spot, which was just really.. it was really odd, it wasn't realistic, it wasn't a kind of believable fluid game-play thing.."*
13	*"If it's too challenging you can't really get into it… like there's this one game I just can't figure out how to move the control like just it's just really hard, and then it fails to immerse me because I don't feel connected with my hand movement and what I see on the screen so I'm not immersed.."*

Thus it is evident that receiving feedback for one's actions is an important part of the player's sense of progression in the game, as it is feedback that allows a player to assess whether they have learnt to use the interface properly, e.g. if they want to move the character forward they press button A, if they want to pick up an item they press button B. Players are willing to spend some time trying to get to grips with the controls and experimenting through trial and error, however if after a certain amount of time they are still unable to make sense of the interface then they will give up and stop playing. Players need to feel like they are able to have some control over the game's events.

However it is not just any kind of feedback from the game world that the player wishes to achieve in their game-play. The player wants to receive positive feedback. In other words, the player wants to feel like they are performing well in the game world.

3.3.2.2. Game Performance

A person is more likely to experience time loss when they are doing well at a game and making good progress, or feel that they are close to making progress, see Table 19. When a person is doing well in a game they "can spend hours and hours" (Participant 8) and "end up playing for longer" (Participant 12). Similarly, when a person feels that they are close to overcoming an obstacle they also become less aware of their surroundings. It is the "sense of satisfaction" (Participant 11) that a person gets when they are able to overcome obstacles and make good progress that motivates a person to keep playing, drawing them into the world of the game and making them less aware of the real world.

Table 19.

Examples of Doing Well / Nearly There, Keep Playing.

Participant	Quote
12	*"If you're doing well in a game you end up playing for longer."*
8	*"When I'm doing well I can spend hours and hours and not realise how long..."*
7	*"So if I'm doing well and keep going from level to level I could be playing for y'know an hour or two, something like that. But then if I'm, if I'm not doing so well, if I try a couple of times and I lose then I just give up, so it depends."*
11	*"You know that you can do it and you get so close so many times and you get that one time where you get it right and there's this real like sense of satisfaction, it will probably last about ten seconds or so <laughter> and then you move onto the next bit and you forget about y'know the two hours you spent trying to get past this one puzzle, but um.. just to keep progressing..."*

In contrast, when a person is not doing well they are more likely to notice time, see Table 20. Gamers enjoy overcoming difficult obstacles, however if after several attempts they are still no closer to making progress they will feel "frustrated" (Participant 4, 7) or "fed up" (Participant 2). As a result of this frustration, the gamer becomes more aware of the real world surroundings. For example, when you "start losing" (Participant 9), or "when you're dying a lot" (Participant 8) you are more likely to notice time. Not doing well in a game is also a reason why a person might choose to stop playing a game (Participant 7, Participant 12).

Table 20.

Examples of Not Doing Well, Stop Playing.

Participant	Quote
4	*"You can spend a certain amount of time trying' to figure something out but after a while if you're not getting anywhere then it's a bit like 'oh I'll just do something different', 'cos otherwise it's too frustrating if you can't get beyond a certain point."*
7	*"I'll try a few times… like maybe like five to ten, something like that, and then if I'm not getting it I just get fed up and I'm just like "agh" y'know I'm frustrated, so I just put it aside."*
7	*"If I'm doing well and keep going from level to level I could be playing for y'know an hour or two, something like that. But then if I'm, if I'm not doing so well, if I try a couple of times and I lose then I just give up, so it it depends…"*
8	*"You notice time more like when you're out or when you're dying a lot."*
9	*"When you're playing a game and you're winning which just continues and the time doesn't really count, but when you start losing things- things change <laughter> and you need to change."*
12	*"Sometimes it might get annoying, so you'd be like 'ah forget this one' and get another one, play that instead."*

Thus it is evident that a sense of progression in the game is a key part of RWD, as it is what draws the person to keep playing the game. Game progression can be thought of in terms of the game narrative: the player is moving onto new levels, learning more about the characters and the game story. Game progression can also be thought of in terms of game-play: the player is winning points and gaining mastery, they want to see whether they can carry on improving their skills. One can argue that both of these types of progression are equally important in terms of a person becoming immersed in the game, i.e. game immersion involves the player feeling like they are doing well in the game and moving forward.

Furthermore it is evident that receiving feedback for one's actions is an important part of this sense of progression, as it is feedback that allows a player to assess their performance in the game. If the player is receiving some positive feedback this motivates the player to keep playing. In contrast, if all of the feedback is negative this de-motivates the player and they are more likely to give up.

However, although the player wants to receive some positive feedback, they do not want feedback to be positive all of the time, otherwise they would grow bored. Therefore it is evident that an appropriate level of challenge is another important aspect of game progression.

3.3.2.3. Appropriate Level of Challenge

If a player finds a game too difficult they will not perform well and this can be de-motivating. However players do not want a game to be too easy either, see Table 21. When a game is too easy, gamers view it as "boring" (Participant 2). In such instances the gamer is performing well but yet "you won't be happy about it" (Participant 9). This suggests that a certain level of challenge is necessary in a game, in order for one's performance to be meaningful. The player wants to feel like they have developed skills over time that have allowed them to succeed in the game, allowing them to progress in such a way that they were unable to when they first picked up the game.

Table 21.

Examples of Game Being Too Easy.

Participant	Quote
2	*"If I find a game too easy then it just becomes boring."*
9	*"It is important to have challenge in a game. Y'know you don't just manage to overcome an obstacle and that's it.. you won't be happy about it, you'll think 'oh that was easy'…"*
8	*"You can be really good and it could just be pathetically easy to kill everyone and I can't imagine that being that much fun, whereas I find not being that good actually probably helps me to enjoy it because it just means that you're constantly striving to do better."*

Therefore it is evident that in order for a game to be immersive, the player needs to feel that they are tackling an appropriate level of challenge. If a game is too challenging, the person will be de-motivated to continue playing. However, if a game is too easy then the person's sense of accomplishment will not be meaningful. Successful games are able to strike a careful balance between the two, see Table 22. As one gamer explains, "the learning curve is very important" (Participant 11). Although a good game needs a level of ease when a person starts to play, over time the game should become more difficult so that the user needs to learn more skills in order to succeed, keeping their sense of achievement at a satisfactory level. This balance can be tricky for game designers to achieve but "when it works right and the game pulls it off fantastically then people will play it lots and lots" (Participant 11).

Again it is evident that a sense of progression is key to RWD. The player needs to feel that they are progressing in terms of their game performance, reaching new levels and gaining points. However for long periods of game-play, the player also needs to feel that they are progressing in terms of their skills and competence, i.e. that that they are learning more as they move through the game, overcoming obstacles that are increasing in difficulty. As a result of this sense of progression, the player is more likely to become absorbed in the game-play and play for longer.

Table 22.

Examples of Challenge Being Just Right, Escalating as Game Progresses.

Participant	Quote
1	*"I mean I needed to get my foot in the door properly.. like a bit.. before I could get interested in the game, so it had to have a level of ease, but at the same time it had to have umm progression. If it was just hard at the beginning then no. If it was just easy from the beginning then no. It wouldn't have held my interest."*
4	*"Mostly um the games I tend to enjoy are not too hard because I need to be able to play it and progress, but I do want it to be challenging so that when you do pass a point you feel like you've accomplished something."*
11	*"Games have to be quite challenging to hold someone's interest for a long period of time.. you need to keep progressing, the learning curve is very important in.. well I think it's very important in the game's that I play. If it starts off too difficult and then you get really good at it and it's easy for the rest of the game then it gets boring. If it starts off pretty simple and you're always mastering something and then you go on for a little while and you use that and then you master another bit over the length of the game er I think that 's the perfect like balance. It's really hard to get the right kind of challenging levels y'know to- to keep escalating and getting more challenging engaged as you're getting better at the game, and when it works right and the game pulls it off fantastically then people will play it lots and lots."*

Furthermore, the grounded theory suggests that when a game is immersive the player receives a mixture of positive and negative feedback while playing. Some positive feedback is necessary because it motivates the player to keep playing. However some negative feedback is also necessary because it makes the player's success meaningful, it indicates that it is possible to lose the game. In order to succeed in the game, it is the player's goal to receive more positive feedback than negative feedback.

3.3.3. Extraneous Factors

As well as factors associated specifically with the person's interaction with the game, several extraneous factors also influence RWD. These factors are extraneous in the sense that they can enhance a player's immersive experience, but they are not essential for immersion to occur, i.e. they are superfluous. Furthermore, note that these factors only influence the player's sense of progression in the game indirectly, by influencing the amount of effort the player is willing to expend in game-play. Therefore, even with all the extraneous factors present, it is still possible for the player to have a poor gaming experience if the game-person interaction is not successful.

The grounded theory identified three extraneous factors in total: novelty of the game, personal motivation and social influence. In this section we will explore each of these factors in turn and how they affect RWD. See Table 23 for an overview of the categories that will be described.

Table 23.

Extraneous Factors Associated with Real World Dissociation, Categories and Subcategories.

Categories		Subcategories (if any)	
1	Novelty of Game	-	-
2	Mood of Player	1	Playing to win
		2	Playing "just to play"
3	Social Influence	1	Being competitive
		2	Social play as encouraging
		3	Social play as discouraging / intimidating

3.3.3.1. Novelty of Game

When a person is playing a game that they have never played before, or they have reached a new stage in the game completely different to any of the others, this is found to be particularly immersive. It is in these situations that some gamers claimed to lose track of time the most, see Table 24.

Table 24.

Examples of Novelty of Game.

Participant	Quote
8	*"It happens to me every time I find a new game, you sort of you want to learn like how to play it, you want to improve yourself…"*
11	*"Like when I've got new games and I'm really into it and there's nothing better to do I'll sit down, sometimes I'll sit down for six seven hours just playing almost constant."*
11	*"I'm replaying old games, I sort of know what to expect and I-I can relax more with it instead of kind of being stimulated by it."*

When you are playing a game for the first time with every move you are discovering new things about a game and improving your skills (Participant 8). This is all part of what makes a game exciting; the game world is a world unlike any other, and you have the chance to explore this new world and learn more about it through your game-play. Therefore one can suggest that game novelty is related to RWD because it can increase a person's motivation to keep playing. Learning things about the game world for the first time is highly motivating and draws the player into the world of the game. In contrast, re-playing games or re-playing levels that you have already completed can still be immersive; however it is not as "stimulating" as when you are unravelling things about the game for the first time, because you now know what to expect (Participant 11).

However, it must be noted that if the player is not performing well, no matter how novel the game is, the player will grow frustrated. Likewise, the player might be re-playing an old game but they could still have an immersive experience trying to beat an old high score. In fact, many short games revolve around the idea of the gamer playing multiple times, e.g. games such as "Tetris" and "Minesweeper". Thus one can conclude that, despite game novelty being an influential factor, it is superfluous compared to the actual game-play experience itself.

3.3.3.2. Mood of Player

Another extraneous factor associated with RWD is the mood of the player. Sometimes when a person plays a game they are playing to win, see Table 25.

Table 25.

Examples of Playing to Win.

Participant	Quote
1	*"Ahh those times when I'm just like 'one game', whenever I say that I end up seeming to lose the game and 'cos I don't like to go out on a loss I play the game again."*
11	*"Just because I know it's got to be possible to do and I know I can do it, it's just patience, and I run out of patience y'know ten.. ten fifteen times y'know whenever I play the game but I keep going back to it and I'll play it for a while and then one minor step forward and in a quick quick session I maybe get through some puzzles and then I'll hit a wall again, and I'll spend the next like the next three or four days going back through everything, the entire game, trying to open everything, and I can't do it and I give up again, and eventually I'll come back to it and I do it and I will do it! And that one day that-that satisfaction I'll get from beating that game when I'm like 60 years old and no-one even knows what a Nintendo Entertainment System is anymore, 'a cartridge what's a cartridge?' y'know, and I'll be so happy when I do it.. it'll be worth the time to do it... so..."*

In such situations, even when the gamer reaches a difficult part of a game they will keep persevering because they are internally motivated to succeed in the game. Such gamers "do not like to go out on a loss" (Participant 1). They believe that however hard the game is, if they keep on playing they will overcome the game obstacle eventually (Participant 11). As a result of this drive to win, the person is highly focused on the game world and so RWD is more likely to occur.

In contrast, there are also times when a person does not play to win, instead they are playing "just to play"; see Table 26. When a person does not feel alert or they just want to play a game to occupy time, then the game does not have to be an appropriate challenge level (Participant 1). In such situations a sense of achievement is not viewed as being as important, instead the person is just using the game as a source of release. Although such game-play can still be enjoyable, it is unlikely to last for as long a period of time as compared to when a person plays a game with the aim of winning (Participant 11). Furthermore, because the person cares less about the game world they will expend less effort playing the game, and so are less likely to experience RWD

Table 26.

Examples of Playing "Just to Play".

Participant	Quote
1	*"It depends on the time of day, it depends how alert I am. Hm sometimes when I play the game when I'm tired I'm not as concerned or interested when I lose, or if I win I win. But if I'm alert then, then boy it's game on, y'know what I mean, it's gear five straight away."*
1	*"If my intentions are to just play then no, I can just.. whether it's difficult or not, I just play. If it's um.. if I want to play to win then it needs some difficulty."*
11	*"It's a drive to keep you playing I suppose.. if you're sitting there and you're playing for no real reason then you're not going to play for very long, I wouldn't play for very long […] you always have to beat a certain challenge or a puzzle or you have to retrieve a certain artifact or uncover a certain storyline um.."*
4	*"I suppose within your own mind you've got to really feel like playing a game to enjoy it."*

However it must be noted that the player's mood can change as a result of game-play. For example, even though a person might be highly motivated when they begin playing, if the game interaction does not go well after a certain amount of perseverance they might lose this motivation and give up. Similarly, a person might play "just to play", but if they reach an exciting part of game-play they might find themselves being swept up in the game's events, experiencing RWD as a result. Thus the player's mood is an extraneous factor, as again it is the game-person interaction that is most important for immersion.

3.3.3.3. Social Influence

Social factors can also influence a person's motivation and the extent to which a person cares about the outcome of the game. For example, when a person plays a multiplayer game sometimes it is their desire to beat their opponent that motivates them to keep playing, see Table 27. Gamers described wanting to play again and again because they were "determined not to get out" (Participant 13) or wanted to "beat other people's high scores (Participant 7). If the gamer was not competing with their peers then they might have given up earlier (Participant 1). Therefore it is evident that in such situations it is a person's desire to do better than their peers that drives them to keep playing and become absorbed in the game-play, experiencing RWD as a result. Again challenge is important, this time not in terms of the amount of challenge the game provides but in terms of the amount of challenge one's opponent provides: if your opponent does not have a similar skill level to yourself then beating them in the game will not be as enjoyable (Participant 13).

Table 27.

Examples of Being Competitive.

Participant	Quote
1	*"If I was playing on my own, and you're constantly going up against and it gets harder then it's boring. But if you know someone else is playing it, and you're on a level either in front of them or behind them, then it kind of spurs you on to keep going or to press harder."*
7	*"Like they show you high scores and you want to beat other people's high scores."*
10	*"Especially with the sports games, because when it starts getting competitive you sort of say 'okay a rematch 'and it can last a long time."*
13	*"You want to play it again and again because you're so determined to not get out."*
13	*"I mean people enjoy winning y'know even if it's so simple, it's funny how much you enjoy it, but um… here the other thing is the people you're playing against have to be kind of the same kind of level as you, so like one of the boys we were playing with got bored because he was always winning, so it's not really engaging if um.. if it's not challenging, if the people you are playing with are not challenging or if the task itself…"*

However not all games played in social situations are played to win. Sometimes people play a game more for the social interaction. Even when gamers do not win they still have a good time, see Table 28. Gamers described receiving encouragement from others to keep playing (Participant 4, Participant 13). There is a real sense of community. When a person does badly it is a talking point for which players can laugh and joke around (Participant 13, 12). Even when playing multiplayer games online against people you have never met, gamers are able to talk to each other via headsets and laugh about the game (Participant 8). Thus the game acts as an activity by which social interactions are based. In such situations it is the gamers' enjoyment of being in each other's company that motivates them to keep playing.

Table 28.

Examples of Social Play as Encouraging.

Participant	Quote
4	*"So whereas one of you might have got stuck at one point and given up, it's like the other person may have found somethin' so it sort of keeps you goin' at it […] If I'm by myself I don't tend to play for as long."*
13	*"That's why it's enjoyable, because you're all immersed together, and that's why it's fun, because you're all socially as a group completely focused on one thing"*
13	*"We're all just laughing at each other because y'know somebody would be really rubbish or if someone does well we're like 'Oh wow you're doing so well!' and this is just girls, we're kind of encouraging each other..."*
12	*"Sometimes like more people will cheer you on, you have to like you have to put your game on, and it's like 'Ooh, look at that combo, you're losing badly! Yeah!' everybody's like 'Come on, what happened man' that kind of think, so it's cool like.. just sometime the adrenaline gets to you and you'll beat someone like 'Yeah sit down man' <laughter>"*
8	*"It means when you mess up it's a lot funnier, because you've got your entire team taking the piss out of you continuously."*

It must be noted however that social factors can also discourage a person from playing a game, see Table 29. If a gamer's friends do not want to play then the gamer might feel pressured to stop playing also (Participant 13). Furthermore, in social situations emotions tend to be heightened, negative as well as positive (Participant 5). Therefore a gamer might be reluctant to play because they feel too much pressure to be as competent as their peers, if not better (Participant 1). A gamer might also be reluctant to play because they are afraid of feeling embarrassed if they lose (Participant 4). For such gamers social play is likely to lead to less RWD, because they feel too self conscious.

Overall it is evident that the presence of others does not have a steady influence on immersion. Sometimes it can add to a person's motivation to beat one's opponents and keep playing. However sometimes it can also subtract from a person's motivation to play, due to intimidation and a fear of losing. One can suggest that it is the player's performance that matters most, as players desire to perform to a similar level to their peers. Furthermore, game immersion can occur in single player games, as well as multiplayer games. Thus, social influences are superfluous, compared to the actual game-person interaction itself.

Table 29.

Examples of Social Play as Discouraging / Intimidating.

Participant	Quote
13	*"I mean of course it's a social thing so the people around me found it not interesting and didn't want to do it, so then I didn't end up playing it anymore…"*
5	*"Er slightly higher feeling of satisfaction. And slightly more annoying and frustrating when you lose."*
1	*"I prefer when I'm on my own, it's alright. In front of people it gets a little pressurised […] you got pressure of trying to show off, 'cos you want to look brilliant. Um you've got pressure of not looking rubbish, 'cos you don't want to get beat in front of everyone. Um.. there's pressure of beating your opponent, y'know you've got to let them know you're the don. So the people, the winning, the losing, your opponent, yeah.. it's not as nice as when you're on your own."*
4	*"I always feel a bit intimidated to actually play those games because I'm not familiar with the game they've got there. I think 'oo I don't want to go online and be like really rubbish."*

3.3.4. Characteristics of RWD

So far the grounded theory has explained that the player experiences RWD as a result of a sense of progression in the game. Extraneous factors can add to RWD, by influencing the amount of effort the player is willing to expend in game-play, however they are not necessary for RWD to occur.

But what exactly does RWD involve? In this thesis RWD refers to the player being less aware of the real world as a result of game-play. The grounded theory identified three characteristics of RWD: a sense of mental transportation in the game world, being less aware of your real world surroundings and being less likely to respond to your real world surroundings. In this section we will explore each of these characteristics in turn. In particular, we will flesh out some of the details of these characteristics, suggesting possible attentional processes involved. We will also describe the role that a sense of progression plays for each characteristic. See Table 30 for an overview of the categories that will be described.

Table 30.

Characteristics of Real World Dissociation, Categories and Subcategories.

Categories		Subcategories (if any)	
1	Mental transportation	1	"Being" the character
		2	Having a place in the game world
2	Less aware of surroundings	1	Unaware of time passing
		2	Unaware of irrelevant sounds
		3	Unaware of lighting and proprioception
3	Less likely to respond to surroundings	1	Aware of time passing
		2	Aware of context-relevant sounds
		3	Aware of personally-significant sounds

3.3.4.1. Mental Transportation

When the player has a sense of mental transportation this means that rather than focusing on events in the real world, the player's concentration is focused on the events of the game world. Such mental transportation occurs as a result of the player's sense of progression in the game. The player wants to see what will happen next and whether they can continue winning points and improving their skills. In other words, they are engrossed in the game's events.

The extent to which a person feels "mentally transported" varies from gamer to gamer. A few gamers claimed that there were moments during game-play in which they felt like the game world was real, see Table 31. For such gamers the controls became so intuitive that you "forget that you're using a controller" (Participant 10). At times you might even get "so sucked in" that you "feel like you're the character" (Participant 11). There appears to be a blurring between a person's real world identity and their game world identity; you are not just acting a role, but you are completely taking on the mindset of your character.

For the majority of the gamers interviewed however, they claimed that they had never had an experience as extreme as that above, or if they did it was very short-lived. They claimed that they were always aware that they were just playing a game, see Table 32. Here we can see a second interpretation: for some gamers mental transportation does not literally mean that you feel like you are in the game, instead it refers to a person feeling like they have a "place in the game" (Participant 11). The game has been crafted in such a way that you can get to grips with the controls and interact with the objects in the world successfully; it is a world that you can believe in. Furthermore, a good game allows you to become emotionally involved with the characters and the game narrative to such an extent that you care about the outcome. You do not necessarily view yourself as completely being the character, but you recognise it as a "version of you" (Participant 11) and you want the character to succeed in the game; *you* want to succeed in the game. Again there appears to be some blurring between a gamer's real world identity and their game world identity; however in contrast with the prior viewpoint (Table 31) this second set of gamers claim to always have the clarity that they are just playing a game.

Table 31.

Examples of "Being" the Character.

Participant	Quote
2	*"You get kind of sucked in, it's like you're part of the game kind of thing. And that, because you're playing the character it's like you're in the character.. it's like you're that character kind of thing.. and then when you lose you become embarrassed, it's like 'I've lost'…"*
2	*"You get just so into that character you think it's kind of real, for like that moment in time."*
10	*"I find that it's quite easy using a controller to forget that you're using a controller if the game is good." P10*

Table 32.

Examples of Having a Place in the Game World.

Participant	Quote
10	*"I wouldn't say that I feel like I'm inside the game, but I'm not thinking about being in a room."*
11	*"It feels like you're in the game sometimes. You're always aware that you're obviously not, 'cos you're looking through a television screen… but you're kind of expressing yourself through the movement of the controller if you know what I mean.. you have a place in the game, an environment in the game…"*
14	*"I guess with Sims it's more like you can identify with the characters… it's not that you believe you're the character but it's just kind of a version of you"*

3.3.4.2. Less Aware of Surroundings

Due to their sense of progression in the game, the player focuses their attention away from the real world, as they become increasingly absorbed in the game's events. As a result of such immersion, the player is less aware of aspects of their real world surroundings that they would normally be aware of. For example, gamers described situations in which they played for longer than they intended because they lost track of time, see Table 33. In these examples people did not notice the amount of time that had passed until somebody interrupted them or until they reached a less engaging part of the game and happened to glance at the clock or out the window.

Table 33.

Examples of Unaware of Time Passing.

Participant	Quote
2	*"Like Sonic I would just get into the game, I'd be determined to like do the game and get it over with, so I would just like play and play and not realise the time."*
4	*"If I'm really into a game I don't really think about the time, I just think that I'm just playing it. I don 't really have a sense of time. So when someone tells me like 'you've been playing for like two hours' I don't really think it's two hours."*
8	*"You sort of notice the time when you er when the sun starts seeping through your window and my parents get really annoyed with me."*
8	*"Once it gets to night and like everyone else is like in bed you're just like you're playing and there's.. nothing else changes apart from the game, so you can't really tell how long it's been 'cos nothing outside of the game world has actually happened, you can just waste ages and then wake and realise that it's like seven o 'clock in the morning..."*
9	*"If you really get into a game you don't notice the time go by that much, until you look out the window and you think 'Oh shit, what's the time?' <laughter>"*

Gamers also described situations in which they were unaware of sounds that were unrelated to the game, such as the TV playing in the background, see Table 34. Even if a gamer's favourite TV show was playing in the background they might "not notice anything that's happened in terms of the programme" or even that it has ended (Participant 14). Thus it would appear that when a player becomes immersed in a game, they are no longer able to split their attention between the game and the TV effectively, and they end up ignoring the TV altogether.

Table 34.

Examples of Unaware of Irrelevant Sounds.

Participant	Quote
3	*"Even if my favourite movie in the entire world was on the game will overtake that because you have to interact with it, it's the actual interaction which causes your absorption um much moreso than the TV."*
14	*"Quite often I have my TV on when.. and so I might not notice that.. like anything that's happened in terms of the programme or that it's even.. or that it's ended or anything."*

As well as sounds, gamers also described being unaware of physical things, such as changes in lighting and proprioception while they were playing a game, see Table 35. Only afterwards, when their concentration was broken, did gamers claim to notice that "my eyes really hurt" or "my thumbs hurt" (Participant 4). Again this suggests that when a person is immersed in a game, they focus on the game to such an extent that they are unaware of anything not related to their goals in the game.

Table 35.

Examples of Unaware of Lighting and Proprioception.

Participant	Quote
4	*"It's just when you've turned off the game you notice afterwards 'Oh my goodness my eyes really hurt' or 'Wow my thumbs hurt' 'cos um when you're really into the game you don't notice um the pain."*
11	*"You may think unconsciously about, you sit uncomfortable in the seat or you need to drink or go to the toilet, but a lot of stuff is going on outside, your exact location is kind of gone y'know, you can sit and play a game and look up ten hours later and realise that there's no light on in the room at all and er you didn't even notice it."*

3.3.4.3. Less Likely to Respond to Surroundings

If a player is less aware of an aspect of their surroundings due to their sense of progression in the game, it follows that the player is also less likely to respond to it. This lack of response is a result of bottom-up processing. For example, irrelevant sounds are not processed semantically (for meaning) therefore the player does not respond to their TV show ending because they did not notice it (Table 34). Similarly, players do not respond to changes in lighting and proprioception (Table 35), or changes in the time (Table 33), because they do not notice them.

However, there are some situations in which the player does notice non-game stimuli. For example, although there are some cases where players are less aware of time passing (Table 33), this is not true of all experiences of time loss. Some gamers described situations in which playing for longer than originally intended was a somewhat conscious decision. When a person felt close to their goal, even though they were aware that they had planned to stop playing by now, they would decide to play "just one more time", see Table 36. Choosing to play "just one more time" is an example of top-down processing. The player notices the time, but chooses not to respond because they do not want to break their sense of progression in the game. At such moments the game is considered more important than reality.

Therefore it is evident that playing for longer than intended can involve both bottom-up and top-down processing. Furthermore, these two types of processing do not appear to be mutually exclusive. In one session of game-play a person can experience a mixture of both (Participant 13).

Table 36.

Examples of Aware of Time Passing.

Participant	Quote
1	*"I'll be like 'only two minutes', just five minutes', just ten minutes man, just one more game'..."*
8	*" 'Just one more level, just one more level' and that's what it feels like, it's like I'll just let myself play one more round, I'll just have one more round and you lose track of time..."*
9	*"It's really relative on whether I feel like I'm making progress, 'let me try it one more time, okay let me try it one more time'..."*
14	*"You might even notice the time go by but you think 'oh I'll give it another half hour' or 'I'll give it another hour' or... I guess you get engrossed in the storyline or.. or what goals you're trying to achieve, or what's happening at the time, or just the game you're playing, it's just trying to strive to do it."*
14	*"I don't think I forget but I might not do things because I just decide not to 'cos I'm playing, I think 'cos like with the time thing you think 'oh I'll give it another half hour' or something, you might think 'oh I was gonna do the hoover' or 'I was gonna go down and wash the dishes' or something, and you think 'oh I won't bother now' or 'I'll do it later'..."*
13	*"Once I thought I'd play just one more game and then it's two hours later and I didn't even realise the time had gone by."*

Similarly, although there are some sounds that do not catch a player's attention (irrelevant sounds) this is not true of all sounds in the environment. Gamers described noticing sounds if they were related to the game context, see Table 37. For example, when running around a field in a first person shooter a person might be aware of "bird sound effects" not coming from the game itself, because they seemed to match the game's visual output (Participant 8). In another example, a gamer describes being aware of someone in the room that comments on their performance in the game and says "You're losing now"; however if the same person said "Does anybody want a cup of tea or something?" they might not notice this (Participant 13).

Gamers also described noticing sounds if they were personally-significant. For example, several gamers described being consciously aware of their name being called or the phone ringing, see Table 38.

However, despite the player being aware of game-relevant and personally-significant sounds, sometimes they are still not responded to. Again these are examples of top-down processing. In such situations it is not the case that the player did not respond to the sounds because they did not notice them. Instead the player has noticed them but has chosen not to respond. In other words, they have chosen not to break their immersion in the game. As one gamer put it "I would personally notice but you just ignore it basically" (Participant 9). At the time of play, the game is simply viewed as more important than reality.

Table 37.

Examples of Aware of Context-Relevant Sounds.

Participant	Quote
8	*"I was really impressed because it had really good bird sound effects and like when it was outside you could hear the birds and then when it started loading up a new map I could still hear the birds and I realised it was because like it was getting late.. er getting early in the morning like morning time and it was actually birds outside the game* <laughter>*"*
13	*"You're immersed into not just the screen but you're immersed into the whole group of people around you who are playing the game, and any other conversations or comments that are about the game your attention is focused on that.. so if somebody was to say something in another room about 'Does anybody want a cup of tea or something?' that would probably be lower down on your attention rather than someone mentioning something about um your y'know what happened, 'You're losing now' y'know, even if they're not playing the game if they're talking about the game, then.. your attention is focused on the activity rather than just the screen I suppose."*

Table 38.

Examples of Aware of Personally-Significant Sounds.

Participant	Quote
9	*"I would personally notice but it's.. you just ignore it basically... you are aware that someone's just screamed your name, or y'know just knocked you at the back of your head and said 'Stop playing' or something, but it.. sometimes it doesn't stop you from playing, it won't literally break your concentration, it will interrupt it partially but not completely."*
2	*"I think when you're not really into a game and someone calls you to do something you're more likely to just leave it alone and it just wouldn't really bother you. But if you're really into the game you get really irritated […] if my mum was like 'Oh could you come and do this?' I used to get like quite annoyed and I'd be like 'Mum, could you just leave it for an hour until I do this'… like 'Aggh' y'know, 'for god's sake leave me alone'..."*

Again sense of progression is important, because it is a sense of progression that motivates the person to keep playing at the expense of relevant stimuli in their environment. Thus one can suggest that when a gamer is having an immersive gaming experience they do not want to divert their attention away from the game because it would break their sense of progression in the game's events.

Overall, when considering the types of sounds that are and are not processed, one can suggest that some kind of attentional filter is at work. Irrelevant distracters are less likely to be noticed than game-relevant or personally-relevant distracters. Furthermore, when a gamer does not respond to a distracter this can be due to either bottom-up or top-down processing, depending on the type of distracter. Irrelevant distracters are not responded to because they are not noticed. Relevant distracters are noticed but sometimes still not responded to, because the gamer chooses to ignore them.

It is possible to propose alternative explanations for why some aspects of the surroundings are noticed while others are not. For example, one could suggest that mum shouting or your friends talking is louder than the TV, so it is more likely to be noticed. Also whereas mum shouting or the phone ringing might stand out because of their sudden onset, the other sounds are more continuous and present throughout game-play (e.g. TV) or their onset is more gradual (e.g. lighting, proprioception).

However, we would argue that relevance still plays a major role. In the case of Participant 8 the bird sounds were likely to have been present for a while, however he only became aware of them when he was running around the field, later becoming surprised when the birds were still chirping as the map loaded. Similarly, in the case of Participant 13 her friends were talking throughout, however only when they referred to her and the game did it catch her attention.

3.4. DISCUSSION

3.4.1. Summary of the Grounded Theory

This study aimed to gain an insight into the nature of the experience of people that play games and become less aware of their surroundings (RWD). The resulting grounded theory suggests that RWD is a reason why people play games. Gamers described wanting to escape into a world of fantasy and away from the stressors of the real world or boredom. However, although a person may desire to escape, this does not necessarily mean that RWD will occur. Therefore the main focus of the grounded theory is the specific experience of RWD itself.

A sense of progression was found to be a key part of RWD. Game progression is what draws a person to keep playing the game and can be thought of in terms of the game narrative, i.e. moving forward in the game. Game progression can also be thought of in terms of the game-play, i.e. overcoming obstacles. When a player feels a sense of control in the game, that they are performing well, and that there are overcoming challenges of an appropriate level for their skills, then they will feel motivated to keep playing. For long periods of game-play the obstacles also need to be increasing in difficulty, as the player also wants to feel that they are progressing in terms of their skills and competence.

Feedback underpins this sense of progression, as it is feedback that allows a player to assess whether they have learnt to use the interface properly. Feedback also allows a player to assess their performance in the game. Immersive game-play involves both positive and negative feedback. Positive feedback motivates the player to keep playing. Negative feedback makes the player's success meaningful. In order to succeed in the game, it is the player's goal to receive more positive feedback than negative feedback.

Extraneous factors such as game novelty, personal motivation and social influence can lead to a person expending more effort in their game-play and enhance the player's immersive experience as a result, leading to greater RWD. However, these factors are not essential for immersion to occur. Furthermore, these factors only influence the player's sense of progression indirectly: it is still the success of the game-person interaction that matters most.

Characteristics of RWD include mental transportation, being less aware of your surroundings, and being less likely to respond to your surroundings. Mental transportation can vary from the player feeling like they are the character, to the player feeling like they have a place in the game world and caring about the outcome of the game. Due to their sense of progression in the game, players are less aware of time, irrelevant sounds, and changes in lighting and proprioception, and do not respond to them as a result (bottom up processing). Players are aware of context-relevant and personally-significant sounds. suggesting that some kind of an attentional filter for relevance is at work. However players choose not to respond to these sounds, because they do not want to break their sense of progression in the game (top down processing). There are also instances when players are aware of time, for example if they happen to glance at the clock; however again they choose not to respond because they do not want to break their sense of progression in the game (top down processing).

3.4.2. Immersion as Self-Motivated Attention

In the gaming literature Lankoski (2007) suggests that the important function of affect in games is to guide decision making and attention. For example, the emotion "happiness" relates to progression towards or completion of a goal; "anger" relates to situations where a goal is blocked or frustrated. The grounded theory presented here expands upon this, as it suggests that RWD is highly dependent on a person's motivational state. If a person feels a sense of progression in the game then they are more likely to want to continue putting effort into playing the game, and are less aware of distracters as a result.

The role of motivation has been recently investigated in the attention literature. Pessoa (2009) suggests that motivation has two main effects on executive control. Firstly, reward will lead to the sharpening of executive functions. Secondly, motivation is proposed to recalibrate the allocation of processing resources available to executive functions, to maximize potential reward. For example, when one is in a motivational state of hunger, food items become more salient and are more likely to direct a person's attention. Similarly, Payne et al. (2007) investigated task switching and suggests that people tend to stay longer in more rewarding tasks.

Our grounded theory of RWD clearly could be said to have a number of parallels with the cognitive theories above: a sense of progression can be viewed as a positive reward, which then leads to a person prioritizing the game over other aspects of their surroundings and paying more attention to the game. However the interactivity of the gaming context means that there are also a number of key differences. Much of the real world is attenuated during game-play due primarily to the gamer's motivation to continue the immersive experience. People do not play a game to get a reward – playing the game *is* the reward. It is the good feeling that a person gets from positive feedback and performing well in the game that motivates them to keep playing. As such, one can describe immersion as "self-motivated attention". There is no tangible reward as a result of immersion; the reward is the immersive experience itself. Considering the wider context of immersion (books, films), one could even go as far as to argue that all immersive experiences are intrinsically motivating. This intrinsic motivation is so high that even when distracters do break through to a person's awareness, such as a person's name being called, the person chooses to ignore it and continue their sense of progression.

As described in Chapter Two, this thesis focuses on two of the most influential theories of SA, Attenuation Theory (Treisman, 1960) and Cognitive Load Theory (Lavie, 1995). Although recently researchers of attention have begun to consider the role of emotion and motivation (e.g. Pessoa, 2009), there are few studies that have considered these factors in relation to Attenuation Theory, Cognitive Load Theory, and the processing of distracters. Also explanations can be conflicting. For example, Oaksford et al. (1996) suggest that positive emotions increase cognitive load in working memory. Moreno (2004) on the other hand suggests that explanatory feedback is more positive for novice learners than corrective feedback because it reduces cognitive load.

Furthermore, the context of games is far more complex than the contexts in which SA is traditionally studied. As well as immersion being an intrinsically motivating experience, it is also a very subjective experience. Two people can play the same game but yet differ in their immersion - one person might feel that their needs are being met, whilst the other person might feel bored or frustrated. Game immersion is also a momentary experience - within one session of game-play a person can experience different levels of progression, environmental information being attenuated to a greater extent when their sense of progression is highest. Therefore one can argue that game immersion is not just an extreme form of SA; the intrinsic nature of game-play and its interactivity means that game immersion operates differently.

Some of the key assumptions from our grounded theory are as follows:

(a) It is not just that the game is more difficult, but how the player assesses their sense of progression in the game, via the feedback they receive.

(b) If the player is getting some positive feedback this indicates that they are making progress the game. Game progression draws the player into caring more about the outcome of the game and they become emotionally involved, leading to RWD.

(c) Our theory explains why two people can play the same game and yet differ in RWD, as they might experience a different sense of progression due to differences in their game performance.

(d) Our theory explains why a person can play the same game and at different points experience different levels of RWD – again it depends on their sense of progression at the particular moment in time.

(e) Our theory can explain for extreme cases in which people play games for hours and hours. Due to their emotional involvement, people choose not to break their sense of progression in the game and so they choose to keep playing the game when their name is called, when they feel tired / hungry.

3.4.3. Selectivity for Relevance in the Processing of Sounds

Regarding the characteristics of RWD, it is evident that the grounded theory has also allowed us to gain a greater understanding of an aspect of immersion about which little was known before. Previous studies had shown that gamers were less aware of time passing (Rau et al., 2006) and less likely to respond to auditory distracters when immersed (Brockmyer et al., 2009). However the grounded theory extends upon previous work, by suggesting that gamers are also less aware of changes in lighting and proprioception. Also gamers are not less aware of sounds in general, but specifically irrelevant sounds. This bares striking similarities with the Auditory SA literature, particularly Treisman (1960)'s Attenuation theory, thus suggesting that some kind of attentional filter for relevance is involved.

It is worth noting that despite game-playing being a multi-sensory context, it was mostly auditory distracters that people talked about in the interviews. At first this appeared to be a somewhat surprising result; however as Broadbent (1971) notes people can not shut out sounds in the same way that they can visual distracters in their environment, i.e. by looking away. Therefore it seems to make sense that primarily sounds featured in our exploration of the extent to which people are unaware of their environment. Furthermore, whereas tactile distracters such as someone tapping you on the shoulder or someone turning off the game will physically interrupt your game-play, auditory distracters are not as intrusive and can go by unnoticed.

3.4.4. Other Comparisons with the Existing Literature

Regarding RWD as a reason for playing, the grounded theory supports previous research in that computer game-play can provide users with a sense of escapism. As well as games being played for stress relief

(Clark, 2006; Colwell, 2007), the grounded theory suggests that people also play games to escape from boredom.

In terms of the specific experience of RWD itself, the grounded theory reveals that a sense of progression is key to RWD in gaming. However, as RWD is an aspect of the immersive experience, one can expand upon this and suggest that a sense of progression is key to immersion. Immersion, as defined by the five components of the IEQ, appears to have some overlap with the themes presented in the grounded theory of RWD: if sense of control (Con), game performance (Ch) and appropriate level of challenge (Ch) are just right then the player will get a sense of progression in the game (CI, EI), RWD occurring as a result. Thus, it is evident that as well as giving an insight into the nature of RWD, the grounded theory also gives us an insight into the nature of the immersive experience as a whole and how the various components of immersion interact.

As well as corresponding with the components of the IEQ, the grounded theory also shares similarities with several existing theories of immersion. For example, Brown and Cairns (2004) emphasise the importance of players getting to grips with the controls and becoming emotionally involved in the game as important features of immersion. The CEGE model (Calvillo et al., forthcoming) also features control and ownership as necessary conditions for a player to have a positive experience while gaming. Thus, it is evident that some of the findings of the grounded theory are similar and thereby supported by the existing immersion literature. In particular, one can suggest that the grounded theory is in line with the idea of a common graded experience of immersion (Brown and Cairns, 2004), as a sense of progression is an important feature of many different types of immersive experiences in gaming. For example, regarding Ermi and Mayra (2005)'s SCI model, gamers can gain a sense of progression in sensory immersion, by exploring the environment and interacting with new objects. One can gain a sense of progression in challenge-based immersion by gaining points and learning new skills. One can also gain a sense of progression in imaginative immersion by moving onto new levels and learning more about the characters.

Several of the game, environment and person factors that were identified as influencing RWD in the literature review presented in Chapter Two can also be thought of in terms of sense of progression. For example, games that have high attentional demands are described as having compelling goals and levels, and plot driven stories (Wood et al., 2007). Game worlds that are believable are those in which the user's actions have a non-trivial impact on the game world (McMahon, 2003). The game "Warcraft 2" is described as being successful because the campaign progresses as the difficulty of the mission increases, accommodating both experts and novices in terms of appropriate challenge (Sweetser & Wyeth, 2005). Also players are described as engaging in strategies to minimize distracters that could draw their attention away from the game, for example playing when you won't be interrupted by other people (Nunez & Blake, 2006). In contrast, the other factors identified in the literature review fit into the category of external factors. Previous experience can make it more likely that a person will perform well and have a sense of progression in the game, however it is not essential. Similarly, social factors such as playing against your friends rather than strangers (Ravaja et al., 2006) can enhance an immersive experience, the player expending more effort in the game-play; however it is the person's interaction with the game that is most important.

Considering immersion in a wider sense, one can suggest that a sense of progression is also key to other immersive experiences. For example, when watching a dramatic movie at the cinema people often do not like to be disturbed because it will break their sense of progression in the narrative. If somebody nearby talks loudly during the movie, other people might tell them to "shush". There are also announcements before the movie starts, telling people to make sure that their mobile phones are turned off during the movie. One can suggest that this is also true of immersion in books, as when a person is reading they do not like to lose their train of thought, often choosing to read somewhere quiet where they know they will not be disturbed. Thus it would appear that the central idea of the grounded theory applies to a variety of different immersive contexts; however whereas a sense of progression in books or films is due solely to the player's connection with the narrative story (Green et al., 2004), in games the sense of progression is more complex as interactive elements are also involved. The player must participate in the game, in order for the game story to be told (Qin et al., 2009). Furthermore, in order to gain a sense of progression the player must perform well in the game, thus feedback underpins the player's sense of progression.

In terms of concepts related to immersion, the grounded theory supports the idea that presence in a VE is not synonymous with game immersion. For example, one can suggest that if a virtual simulation has realistic graphics and sounds then the player might initially feel immersed by the sensory features of the simulation. However, if the person has to perform a tedious task or finds that they have fully explored the VE and have run out of things to do, then they will soon become bored and be aware once again that it is just a simulation. Thus immersion relies on the player's mental absorption in the virtual world, rather than sensory features alone. This mental absorption occurs as a result of a successful game-person interaction and the player's sense of progression in the game.

The grounded theory also supports the idea that flow is not a common experience in gaming. A few gamers described themselves as becoming so absorbed that they felt like they were the character; however the majority of gamers claimed that they were always somewhat aware that they are in a room playing a game, even at the height of their immersion. Thus these findings suggest that flow is unlikely to occur, as flow is said to involve an altered state of mind, being one with the activity (Brockmyer et al., 2009). These findings also suggest that at the highest state of immersion not everybody experiences presence. Therefore, in relation to Brown and Cairns (2004)'s conceptualisation of immersion, one can suggest that although some players might progress from engagement to engrossment and then total immersion, the majority of players only experience engagement and engrossment.

3.4.5. Limitations of Study One

A limitation of Study One is that coding can be viewed as a somewhat subjective analysis, i.e. it is up to the researcher to identify the important concepts and properties present in the data. However, by presenting the main themes of the grounded theory in correspondence with quotes from the participants' transcripts, it is hoped that the reader will be able to see how the grounded theory was developed from the data. This is in accordance with Smith (1996), who emphasised that internal coherence and presentation of evidence are necessary in order for the reader to assess the reliability and validity of the researcher's interpretations. Further validation for the grounded theory comes from our discussion of the grounded theory in relation to the existing immersion literature, in which support was found for several of the main themes (e.g. Brown and Cairns, 2004). Also one can suggest that the central idea of a sense of progression being important for RWD is applicable to immersion in other contexts as well as games.

Another potential criticism of Study One is that we had the SA literature in mind when we began interviewing gamers, so we might have been preconceived to look for similarities with the SA literature when coding the data. This could be perceived as particularly true for the part of our grounded theory that deals with the idea of an attentional filter, in which the transcripts are coded according to relevance rather than loudness, or onset (see Section 3.3.4.3., less likely to respond to surroundings). However, again it must be emphasised that the finding that people talked primarily about sounds was initially a surprising result. Furthermore, it is hoped that our explanation of why relevance appears to play a major role shows the reader that such groupings were derived from the data, rather than from preconceptions of how people process information.

A further potential criticism of Study One is that it is only based on interviews with 13 gamers, which is a small sample set. However for the purposes of our study, in which we aimed to gain an initial insight into the nature of RWD, the sample size felt sufficient as theoretical saturation had been reached. Again it is emphasised that Study One did not intend to produce an exhaustive account of RWD in all types of gaming; the aim was to highlight just some of the important issues involved, allowing us to learn more about an aspect of gaming about which little is currently known.

Studies Two and Three: Awareness of Auditory Distracters Altered as a Result of Playing Games Differing in Feedback and Other Game Features

4.1. INTRODUCTION

The grounded theory has helped us to gain an insight into some of the cognitive processes that occur during RWD in gaming. For the next stage of this research a series of experiments were conducted, using experimental studies from the SA literature as inspiration. Experimental investigation is not a required follow up to a grounded theory; however it was decided that it would be a profitable approach as it would allow further validation of some of the claims of the grounded theory. Furthermore, it would show that RWD is not just something that people talk about, but it does exist and can be measured.

When considering which aspects of the grounded theory were important to validate, it was decided that the following elements were most important: immersion as self-motivated attention and selectivity for the relevance of auditory distracters.

4.1.1. Aspects of the Grounded Theory That We Aimed to Validate

Regarding immersion as self-motivated attention, in particular we aimed to validate the grounded theory claim that manipulating the sense of progression gained via performing well in the game can lead to differences in the players' awareness of distracters. Game progression can be thought of in terms of the game narrative, for example moving onto new levels, learning more about the characters and the game story. Game progression can also be thought of in terms of the game-play, for example winning points, gaining mastery, improving your skills. Consider the game "Space Invaders" for example. The player controls the space ship at the bottom of the screen, and must move it from right to left while shooting aliens at the top of the screen, see Figure 3 for a screen shot. The player gains a sense of progression in terms of the game-play, because they receive feedback for when they successfully shoot an alien and they can see their score improving; thus positive feedback motivates the player to keep playing. The player also gains a sense of progression in terms of the game narrative, because over time the aliens move further down the screen towards the player, making it harder for the player to avoid them; therefore the player feels like they are reaching new stages of the game that are more difficult. As a result of this sense of progression, the player feels more emotionally involved in the game and RWD is likely to occur as a result.

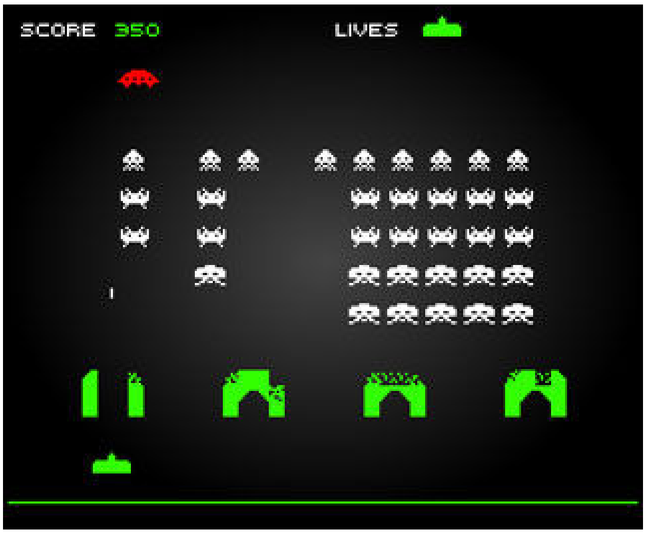

Figure 3. A Screenshot of the Game "Space Invaders".

This suggests that the features of the game are important to RWD, because the game must be designed well to enable the player to gain a sense of progression. If a game does not give sufficient positive feedback, or the controls are so complex that the person can not make sense of how to interact with the game, then the person will not get a sense of progression in terms of the game-play. Also if the game environment does not change over time (coming across new obstacles, obstacles becoming more difficult, new characters to interact with) then the person will not get a sense of progression in terms of the game narrative. This explains why a person might play two games and find that they get a greater sense of progression in one game compared to another.

However a player's sense of progression is not completely reliant on game factors; the player's ability to cope with the challenges of the game also matters. For example, one can imagine a situation in which two people play the same game but yet they differ in their sense of progression because one person performs well and is able to overcome game obstacles (receiving positive feedback, reaching new levels of the game), whereas the other person does not perform well and finds themselves unable to overcome a particular obstacle (no positive feedback, no longer able to reach new levels of the game). Thus this suggests that features of the person (individual differences) are important to RWD also.

As well as a successful interaction between the game and the person, the grounded theory revealed that environmental variables also influence the level of RWD experienced; in particular, the relevance of the distracter. For example, irrelevant distracters, such as someone talking about making a cup of tea, are less likely to be noticed than game-relevant distracters, such as someone talking about the game. Irrelevant distracters are also less likely to be noticed than person-relevant distracters, such as someone calling the player's name. Thus selectivity for relevance in the processing of auditory distracters was another aspect of the grounded theory that we hoped to validate through experimental investigation.

4.1.2. Manipulating Game and Environment Variables

As described in the literature review in Chapter Two, RWD can be influenced by features of the game, features of the environment, and features of the person (individual differences). This thesis begins its experimental validation of the grounded theory by manipulating game and environment variables, see Figure 4.

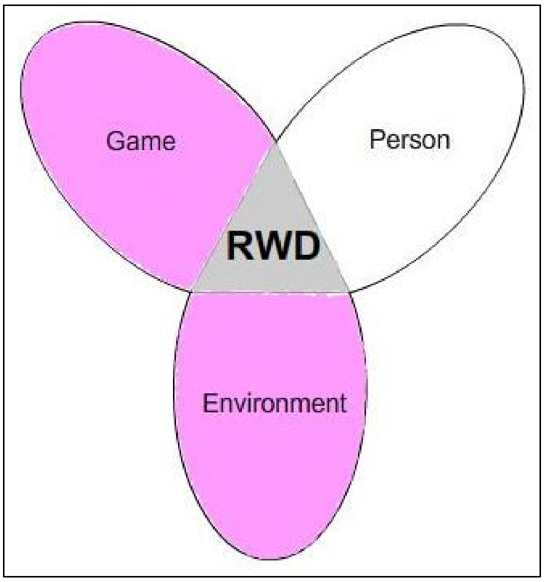

Figure 4. A Figure Depicting that Studies Two and Three Manipulated Game and Environment Variables, Investigating the Effect this had on Real World Dissociation.

Two studies will be described which investigate how awareness of auditory distracters changes with the game immersion experienced. In each study a game that was designed to give users a poor immersion experience was compared with a game that was designed to give users a more immersive experience. The more immersive game in each study had a greater sense of progression because it had feedback and game obstacles changing over time; in contrast the poor immersion game had no feedback and no change in game obstacles over time. In order to make it more likely that the games would differ in immersion, the games also differed in sounds and graphical features. In experimental studies in later chapters only sense of progression is altered between conditions; however for these first two experimental studies, rather than testing the grounded theory claim that sense of progression is important for RWD, the main aim was to see whether awareness of auditory distracters could be used as an objective measure of differences in RWD between conditions differing in immersion. The two studies also investigate the differences between awareness of irrelevant, game-relevant and person-relevant auditory distracters (manipulation of environment variables), in order to test the grounded theory claim that people are less aware of irrelevant distracters than relevant distracters.

Awareness of distracters was measured via a recall test. Auditory distracters were chosen because the interviewed gamers in Study One had talked primarily about relevant and irrelevant distracters that were auditory, e.g. mum calling your name, TV playing in background. Furthermore, Broadbent (1971) explains that an auditory signal can not be shut out in a simple mechanical fashion as can an unwanted visual signal, by looking away; therefore selective listening experiments are more likely to reveal neural processes, rather than mechanical ones.

To study this, two versions of the "Space Trek" game were designed, dubbed "feedback" and "no feedback". Study Two compared recall of auditory distracters for the "no feedback" game and "feedback" game. Study Three compared recall of auditory distracters for the "no feedback" game and a real game that was found online, "Star Fly 3".

The chapter shall be organised as follows: designing the "Space Trek" games; piloting the "Space Trek" games; piloting the auditory distracters; method and findings of Study Two; piloting the game "Star Fly 3"; method and findings of Study Three; followed by a general discussion.

4.2. DESIGNING TWO VERSIONS OF SPACE TREK, DIFFERING IN FEEDBACK AND OTHER GAME FEATURES

The game is called "Space Trek" and was created using Flash Professional 8.0. The aim of the game is to collect as many stars as possible while avoiding the asteroids. Using only two keys to control the rocket (right / left arrows) the game is easy to understand and no prior experience is needed. Furthermore the obstacles are created to be ongoing so that the player needs to stay alert or else they will crash into an asteroid or miss a star.

In order to satisfy the needs of Study Two, two versions of the game were created that were expected to differ in their level of immersion. These games shall be referred to as the "feedback" and "no feedback" versions of "Space Trek" and they differed in terms of feedback, game obstacles changing over time, sound and graphical features. These games shall now be described in more detail.

4.2.1. Space Trek Instructions

In the first screen of the game "Space Trek" the instructions are displayed. For the "feedback" and "no feedback" versions the following messages are displayed, see Table 39. In both games the aim is to collect as many stars as possible while avoiding the asteroids, but in terms of scoring the games differ. By emphasising the score in the "feedback" version of "Space Trek" it was hoped that this instruction would motivate participants to try harder and as a result aid immersion. Participants are told that they will be awarded 100 points for every star they collect and lose 50 points for every asteroid they crash into. By contrast, in the "no feedback" version of "Space Trek" it is explicitly stated that there will be no score so that participants are clear that there will be no outcome for their actions in the game.

In order to start the game participants click the button "Click to Play".

Table 39.

Instructions for the Game "Space Trek", "No Feedback" and "Feedback" Versions.

No Feedback Version	Feedback Version
Use the arrow keys to move the rocket right and left. The aim of the game is to collect as many stars as possible while avoiding the asteroids. You will receive no score in this game, i.e. you will receive 0 points for every star you collect and 0 points for every asteroid you crash into.	Use the arrow keys to move the rocket right and left. The aim of the game is to collect as many stars as possible while avoiding the asteroids. Try to get the highest score possible! You will receive 100 points for every star you collect and lose 50 points for every asteroid you crash into.

4.2.2. Space Trek Game-Play

An example of the screen output for the game can be seen in Figure 5. The game screen can be divided into the following sections: star background, rocket, score, stars, asteroids, line boundary and timer.

Figure 5. A Screenshot of the Game "Space Trek", "No Feedback" Version.

4.2.2.1. *Star Background*

The "feedback" version of "Space Trek" is programmed to play four star background graphics in a loop at a rate of 12 frames per second, thereby creating the visual illusion that the stars are whizzing past as the rocket travels through space. In contrast, the "no feedback" version of "Space Trek" only has one star background present throughout the game, thereby giving the stars a static appearance and no sensation of movement.

4.2.2.2. *Rocket and Scoring*

Players use the left and right arrow keys on the keyboard to move the spaceship along the bottom of the screen, while stars and asteroids fall downwards from the top of the screen. Each key press moves the rocket 15 pixels in the desired direction. Examples of the different rocket states can be seen in Figure 6.

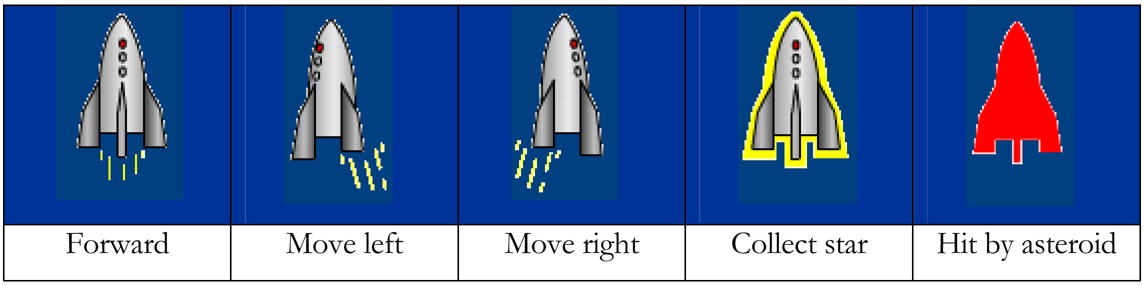

Figure 6. The Five Rocket States for the Game "Space Trek", "Feedback" Version.

In the "feedback" version of "Space Trek", when no keys are pressed the rocket is in the "forward" state, when the left key is pressed the rocket is in the "move left" state and when the right key is pressed the rocket is in the "move right" state. Within each of these states, the game is programmed to play a series of three graphics in a loop, thereby giving the rocket the appearance of blinking windows and fiery ripples propelling it through space, see Appendix 2.

In terms of feedback and scoring, when a star hits the rocket the "collect star" rocket state is shown for 1 frame (see Figure 6), a "whoosh" sound is played and 100 points are added to the score display at the bottom of the screen. When an asteroid hits the rocket the "hit by asteroid" rocket state is shown for 5 frames (see Figure 6), a "bash" sound is played and 50 points are deducted from the score display at the bottom of the screen. Also the player can not move the rocket until the "hit by asteroid" rocket state is over, i.e. the rocket is temporarily stunned.

In contrast, in the "no feedback" version of "Space Trek" the rocket is always in the "forward" state, graphic 1, no matter which keys are pressed or whether the rocket is hit by a star or asteroid. Furthermore, there are no sounds played and when an asteroid hits the rocket it is not temporarily stunned, i.e. there is no effect. Also the score display does not change and displays "N/A" throughout, "N/A" standing for "non-applicable".

4.2.2.3. Stars, Asteroids and Timing

One type of star and three types of asteroid were created. See Figure 7 for their appearance and relative sizes. In the "feedback" version of "Space Trek", the star and all three asteroids are used in the game. Furthermore, for each asteroid a series of five graphics are played in a loop in order to make the asteroids look like they are quaking; and in order to add to the asteroids' appearance of falling, fiery ripples fall from behind; see Appendix 3.

By contrast, in the "no feedback" version of "Space Trek" only the star and asteroid 1, graphic 1 (see Figure 7), are displayed in the game. Therefore there is less variability and the asteroid has a more static appearance while falling.

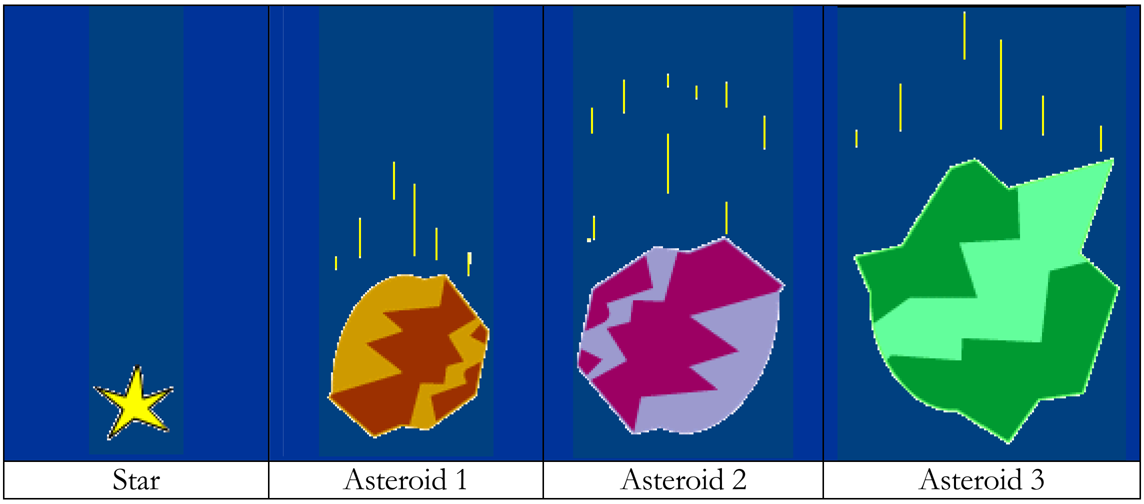

Figure 7. Appearance and Relative Sizes of the Star and Asteroids in the Game "Space Trek".

In terms of timing, stars and asteroids are programmed to appear at a random position along the *x* axis at the top of the screen every 5 seconds 70% of the time and fall at a rate of 15 pixels per frame (frames being shown at a rate of 12 frames per second). 60% of the time an asteroid appears whereas 40% of the time a star appears. If the asteroid hits the rocket a point is added to the "crash" count and the asteroid disappears; if the asteroid hits the line boundary (black line below the rocket, see Figure 5) a point is added to the "crash miss" count and the asteroid disappears. Similarly, if the star hits the rocket a point is added to the "star" count and the star disappears; if the star hits the line boundary a point is added to the "star miss" count and the star disappears.

In the "feedback" version of "Space Trek" the type of asteroid that appears depends on the timer function. The timer is displayed at the top left of the screen and counts down from 600 seconds (10 minutes) how much time is left in the game. As the timer count goes down, the game is programmed to show the bigger asteroids, see Table 40. As a result of the types of asteroid obstacle changing over time, it was hoped that players would gain a sense of progression in the game narrative, adding to their existing sense of progression in the game-play. Also it was thought that players might experience an increased sense of challenge as the size of the obstacle increased, and hence obstacles were slightly more difficult to avoid crashing into.

Table 40.

Percentage of Asteroids and Stars Appearing as Time Progressed in the Game "Space Trek".

Time Left	Chance of appearing
If timeLeft <= 600 and > 480	60% Asteroid 1 40% Star
If timeLeft <= 480 and > 360	30% Asteroid 1, 30% Asteroid 2 40% Star
If timeLeft <= 360 and > 240	60% Asteroid 2 40% Star
If timeLeft <= 240 and > 120	30% Asteroid 2, 30% Asteroid 3 40% Star
If timeLeft <= 120 and > 0	60% Asteroid 3 40% Star

By contrast, in the "no feedback" version of "Space Trek" there was a 60% chance of Asteroid 1 appearing and a 40% chance of a star appearing throughout the game. Therefore there would be less of a sense of progression and no increase in challenge.

Once the timer reached 0, the "game over" screen was displayed.

4.2.3. Space Trek Game Over

In the last screen of the game the instructions "please inform the experimenter that you have finished" are displayed. Also the total "star", "star miss", "crash" and "crash miss" points are displayed at the bottom of the screen. In the "feedback" version of "Space Trek" the player's final score is also displayed in the centre of the screen, whereas in the "no feedback" version of "Space Trek" the message "score: N/A" is displayed.

4.3. PILOTING THE SPACE TREK GAMES

4.3.1. Aim

The aim of the pilot study was to confirm that the two versions of "Space Trek" differing in feedback and other game features would also differ in immersion. It was predicted that the "feedback" version of "Space Trek" would be rated significantly more immersive than the "no feedback" version of "Space Trek", using the IEQ. If successful, the games would be deemed suitable to use in Study Two.

4.3.2. Method

4.3.2.1. Participants

There were 10 participants in total. The majority of participants were university students, recruited through an opportunity sample. In terms of gender, 4 were female (40%) and 6 were male (60%). Ages ranged from 18-44 years, the mean age being 28.9 years (SD = 8.52).

4.3.2.2. Space Trek

The "feedback" and "no feedback" versions of the "Space Trek" game were used, see Section 4.2 for a description of the games.

4.3.2.3. IEQ

To measure immersion the IEQ by Jennett et al. (2008) was used. The IEQ consisted of 31 questions, for which the participant must rate the extent to which they agree or disagree with each item on a 7 point scale. The questions specifically asked participants about how they felt towards the end of the game. As well as a total immersion score, the questionnaire also allows scores for five immersion factors to be computed: cognitive involvement, real world dissociation, emotional involvement, challenge and control. See Appendix 4 to see the IEQ and Appendix 5 to see details of how scores were computed.

As well as the IEQ, a single question measure of immersion was also used: rate how immersed you felt from 1 to 10.

4.3.2.4. Procedure

A repeated measures design was used for the pilot study. Participants played both the "feedback" and "no feedback" versions of "Space Trek" and after each they filled out a questionnaire about their experience. The games were played on a Gateway laptop using Flash Professional 8.0 and lasted 10 minutes each. The order the games were played was counterbalanced across participants to control for order effects.

For both games participants were instructed that the aim of the game was to collect as many stars as possible while avoiding the asteroids. For the "feedback" version of "Space Trek", participants were also instructed that they should try their best to achieve the highest score possible. For the "no feedback" version of "Space Trek", participants were instructed that there would be no score.

After playing each game, the experimenter noted down the game statistics (e.g. number of stars collected, number of asteroids crashed into) and participants were given the IEQ to complete. Once both games had been played and both questionnaires had been filled in, participants were asked if they had any further comments about their experience. Then they were debriefed. They received no payment for their participation.

4.3.3. Results

All statistical analyses were performed using SPSS 11.0. The results are presented in the following order: immersion ratings of each game, immersion factors, then game performance.

4.3.3.1. Immersion Ratings

As can be seen in Table 41, participants rated the "feedback" version of "Space Trek" approximately 50 points more immersive than the "no feedback" version of "Space Trek". A paired samples *t*-test revealed that this difference was significant, $t_{(9)} = -6.015, p<.001$.

Table 41.

Immersion Ratings of the Game "Space Trek", "No Feedback" and "Feedback" Conditions.

	No Feedback		Feedback	
Immersion:	Mean	SD	Mean	SD
- IEQ Immersion Score***	91.70	27.46	142.60	27.72
- Single Question Measure ***	3.50	1.43	6.30	1.64

****p<.001*

The single question measure of immersion supports this finding. As can be seen in Table 41, participants rated the "feedback" version of "Space Trek" three points more immersive than the "no feedback" version of "Space Trek". A paired samples *t*-test revealed that this difference was significant, $t_{(9)} = -5.468$, $p<.001$. Also Pearson correlations revealed that participant responses to the single question and multiple question measures of immersion were highly correlated for both the "no feedback" version of "Space Trek" ($r_{(n=10)} = .904$, $p<.001$) and the "feedback" version of "Space Trek" ($r_{(n=10)} = .870$, $p=.001$), thereby suggesting that the multiple question measure of immersion is reliable and accurately reflecting participants' immersive experiences.

In terms of confounding variables, age was identified as a possible factor that could influence immersion ratings. Students born in or after 1982 are said to have grown up with technology, using computers from an early age (Oblinger, 2004). Therefore it was possible that younger participants would find the "no feedback" version of "Space Trek" less immersive than older participants, as they might have greater expectations of what a good game should be like. It was also possible that younger participants would find the "feedback" version of Space Trek less immersive than older participants, again because of greater expectations. Pearson correlations revealed that there was no significant correlations between age and immersion for both the "no feedback" version of "Space Trek" ($r_{(n=10)} = -.183$, $p=.614$) and the "feedback" version of "Space Trek" ($r_{(n=10)} = -.510$, $p=.132$).

Gender was identified as another possible confounding variable that could influence immersion ratings. Past research suggests that computer games are played more by males than females (Lucas & Sherry, 2004). Therefore it was possible that due to more gaming experience males would have greater expectations of what a good game should be like and rate the "Space Trek" games lower for immersion, compared to females. Independent sample *t*-tests revealed that there were no significant differences between the immersion ratings of males and females for both the "no feedback" version of "Space Trek" ($t_{(8)} = -.537$, $p=.606$) and the "feedback" version of "Space Trek" ($t_{(8)} = .079$, $p=.939$).

4.3.3.2. Immersion Factors

To explore the differences in immersion between the two games further, participant scores for the five immersion factors were computed. As can be seen in Table 42, participants rated the "feedback" version of "Space Trek" higher than the "no feedback" version of "Space Trek" for all five immersion factors. Paired sample *t*-tests (Bonferroni correction, significance level =.01) revealed that the difference between the games was significant for the following immersion factors: cognitive involvement ($t_{(9)} = 5.761$, $p<.001$), real world dissociation ($t_{(9)} = -3.870$, $p<.004$), emotional involvement ($t_{(9)} = -5.8258$, $p=.001$) and control ($t_{(9)} = -6.038$, $p<.001$). However the difference between the games for the immersion factor challenge was not significant ($t_{(9)} = -1.379$, $p=.201$).

Table 42.

Immersion Factor Scores of the Game "Space Trek", "No Feedback" and ""Feedback" Conditions.

Immersion Factors:	No Feedback		Feedback	
	Mean	SD	Mean	SD
- Cognitive Involvement ***	34.40	12.76	53.70	8.80
- Real World Dissociation **	15.20	5.33	23.00	5.73
- Emotional Involvement ***	33.50	10.05	51.80	11.75
- Challenge	19.40	3.37	20.90	1.79
- Control ***	24.90	5.65	32.90	6.67

** $p<.01$; *** $p<.001$

4.3.3.3. Game Performance

The mean percentage of stars collected, stars missed, asteroids avoided and asteroids crashed into, for both the "no feedback" version of "Space Trek" and the "feedback" version of "Space Trek" were computed.

Table 43.

Participant Performance for the Game "Space Trek", "No Feedback" and "Feedback" Conditions.

Game Statistics	No Feedback		Feedback	
	Mean	SD	Mean	SD
- Stars successfully collected	70.16%	10.24	70.42%	11.50
- Stars missed	29.84%	10.24	29.58%	11.50
- Asteroids successfully avoided	96.51%	3.01	96.31%	1.67
- Asteroids crashed into	3.49%	3.01	3.69%	1.67

As can be seen in Table 43, there was little difference between the two game conditions for any of the performance measures. Paired sample *t*-tests revealed that the differences between the game conditions were not significant for both stars collected ($t_{(9)}$ = -.167, p=.871) and asteroids avoided ($t_{(9)}$ = -.306, p=.766).

4.3.4. Discussion

The pilot study was conducted to confirm the two versions of "Space Trek" differing in feedback and other game features would also differ in immersion. As predicted, the "feedback" version of "Space Trek" was rated significantly more immersive than the "no feedback" version of "Space Trek", using the IEQ. A single question measure of immersion supported these findings, suggesting that the IEQ is reliably reflecting participants' immersive experiences. Also in terms of confounding variables, there were no significant effects of age or gender.

Analysing the immersion data further, the results revealed that the "feedback" version of "Space Trek" was rated significantly higher than the "no feedback" version of "Space Trek" for the following immersion factors: cognitive involvement, real world dissociation, emotional involvement and control. However there was no significant difference between the games in terms of challenge. There was also no significant difference in participants' performance in the two games: for both versions of "Space Trek" participants were able to collect approximately 70% of stars and avoid 96% of asteroids. This finding is of interest because it suggests that although participants found both games relatively easy and performed the same in both games, they still found the "feedback" version of "Space Trek" significantly more immersive than the "no feedback" version. This is in line with our grounded theory, in that it is not how well you perform that matters but how you assess your performance through the feedback you perceive. This topic shall be specifically investigated later in the thesis, in Chapter Six.

Another finding of the pilot study, not reported in the results, was that participants had trouble interpreting some of the questions in relation to the game and had to clarify the meaning with the experimenter. For example, due to the timer being present in the game participants queried the meaning of Q5. Also the game naturally ended after ten minutes, participants were not "interrupted" as they had been in the previous experiments in which the questionnaire was used (Q30). Furthermore, although participants were encouraged to try to get the highest score in the "feedback" version of "Space Trek", there were no "win" or "lose" conditions as such (Q26). Therefore several of the questionnaire items were altered as a result of the pilot study, the altered questionnaire to be used in Study Two. Details of these modifications can be seen in Appendix 6 and the modified IEQ can be seen in Appendix 7.

Overall, the "Space Trek" games were deemed suitable for use in Study Two, in which we aim to investigate the extent to which people are aware of auditory distracters during two games differing in game immersion. The next step was to create the required distraction sounds and to check the extent to which they were "distracting".

4.4. PILOTING THE AUDITORY DISTRACTERS

4.4.1. Aim

The aim of the second pilot study was to create 30 distraction sounds and to check the extent to which participants found each sound "distracting" while they played the two versions of "Space Trek". The best 18 distraction sounds would be selected for use in Study Two.

4.4.2. Method

4.4.2.1. Participants

There were 12 participants in total. The majority of participants were university students, recruited through an opportunity sample. In terms of gender, 6 were female (50%) and 6 were male (50%). Ages ranged from 18-25 years, the mean age being 23 years (SD = 1.71).

4.4.2.2. Distraction Sounds

30 distraction sounds were created in total, to be played on a cassette recorder placed at the back of the room, behind where the participant would be sitting. Similar to a situation in which the TV is playing in the background or someone is calling the player's name, distraction sounds were there to encourage the player to draw their attention elsewhere.

In line with the grounded theory, it was predicted that distracters that are context-relevant or personally-significant would be the most distracting. Therefore three categories of distracter were created:

- Relevant to the game;
- Relevant to the person;
- Irrelevant.

Distractions relevant to the game were relevant to asteroids or spaceships, e.g. "I don't see the point of playing games". Distractions relevant to the person were relevant to the situation of being in the testing room, e.g. "I don't see the point of doing experiments". Distractions that were irrelevant were not related to the game or the person, e.g. "I don't see the point of reality shows".

A range of distracters were created across each of these categories: factual, going against the game objective, de-motivating, directional, and object-oriented. In line with the grounded theory, one might predict that the distracters which are most relevant to the task (directional, object-oriented) will be the most distracting. Also one might expect distracters to be more distracting when playing the "no feedback" version of "Space Trek" compared to the "feedback" version of "Space Trek", as players are less motivated to do well in the "no feedback" version.

The distractions were organised into two sets, see Appendix 8. Note that the 15 distraction sounds were re-arranged in a random order before recording. The tone of the person's voice that was used for the recording did differ according to the distracter, for example the way that a question is spoken differs from the way that an exclamation is spoken; however the same tone was used across each of the three main categories (game, person, irrelevant).

Being a mixed measures design, participants would hear one set of distracters while playing the "feedback" version of "Space Trek", and then another set of distracters while playing the "no feedback" version of "Space Trek". Therefore it was necessary for the testing to be counterbalanced in order to combat any order effects, see Table 44. For the pilot study, 12 participants were tested in total. Therefore each of the possible testing conditions occurred 3 times.

Table 44.

Counterbalancing Table for Piloting the Auditory Distracters.

	"Feedback" game first	"No Feedback" game first
Set A Distracters first	"Feedback", Set A Then "No Feedback", Set B	"No Feedback", Set A Then "Feedback", Set B
Set B Distracters first	"Feedback", Set B Then "No Feedback", Set A	"No Feedback", Set B, Then "Feedback", Set A

4.4.2.3. Space Trek

The "feedback" and "no feedback" versions of "Space Trek" were used, see Section 4.2 for a description of the games.

4.4.2.4. Measuring the Extent to Which Sounds Were "Distracting"

The "distractibility" of each distraction sound was measured in two ways. First of all, participants were asked to rate on a scale of 1 to 10 how distracting each sound was during the game, where 1 = not distracting and 10 = very distracting. They were instructed to think of "distraction" in terms of the following:

- Does it catch your attention?
- Does it draw your attention away from the game objective, e.g. causing you to laugh or make a mistake?
- Does it make you want to turn away from the game?

The aim of this first measure was to provide an insight into how distracting the participant found the sound when they first heard it. They simply had to state their rating out loud and the experimenter wrote it down. If they forgot to rate the distraction they were prompted by the experimenter.

The second measure of "distractibility" involved ranking the distractions within each set. After playing each game participants were given 15 small cards, on which each of the distraction sounds that had been played during the game were written in full. Participants were asked to re-arrange the cards in order of how distracting / memorable they were, where 15 = most distracting and 1 = least distracting. After they were happy with their order they simply wrote the order down, each card having a number on it. The aim of this second measure was to provide an insight into how distracting the participant found the sounds in relation to one another.

4.4.2.5. Procedure

A mixed measures design was used for the pilot study. Participants played both the "feedback" and "no feedback" version of "Space Trek" and during each they heard pre-recorded distraction sounds from either Set A or Set B. The order the games and distraction sets were played was counterbalanced across participants to control for order effects.

The games were played on a Gateway laptop using Flash Professional 8.0 and lasted 10 minutes each. For both games participants were instructed that the aim of the game was to collect as many stars as possible while avoiding the asteroids. For the "feedback" version of "Space Trek" participants were also instructed that they should try their best to achieve the highest score possible. For the "no feedback" version of "Space Trek" participants were instructed that there would be no score.

As well as playing the games, participants were instructed that during the game they would hear a number of auditory distractions at various intervals. The auditory distractions were played on a cassette recorder placed at the back of the room, behind where the participant was sitting. While playing the game they were asked to rate the auditory distraction on a scale of 1 to 10 in terms of how distracting it is, where 1 = not distracting and 10 = very distracting. They were instructed to think of "distraction" in terms of the following: Does it catch your attention? Does it draw your attention away from the game objective, e.g. causing you to laugh or make a mistake? Does it make you want to turn away from the game? For example, participants were told that if they were playing a game in which they had to shoot at targets and they heard a loud crashing sound they might find this very startling, causing them to lose concentration, and rate it as a 9. But if they were playing the same game and they heard the sound of a fly buzzing they might not find this distracting at all and rate it as a 1.

The game would be on-going, i.e. there would be no pause for participants to respond. Therefore participants were told that once an auditory distraction had been played it would be followed by a beep, after which they would be expected to say out loud how they rated the distraction. If the participant forget to rate the distraction they were prompted by the experimenter.

After completing each game, the experimenter noted down the game statistics (e.g. number of stars collected, number of asteroids crashed into) and participants were given a ranking task to complete. Participants were shown a list of the distractions for the set they had just heard, and were asked to rank them in order of how distracting / memorable they were, where 15 = most distracting and 1 = least distracting. Numbered cards of each distraction were given to each participant in order to make ranking easier, so that participants could re-arrange the cards spatially into an order on the desk in front of them before writing their ranking order down onto paper.

After playing both games and filling out the questionnaire, participants were asked if they had any further comments about their experience. Then they were debriefed. All participants received chocolates for their participation.

4.5.3. Results

All statistical analyses were performed using SPSS 11.0. The results are presented in the following order: distraction ratings during game-play, distraction rankings after game-play, comparing Set A rankings between the two games, comparing Set B rankings between the two games.

4.5.3.1. Distraction Ratings During Game-Play

In the first measure of the "distractibility" of each distraction sound participants were asked to rate on a scale of 1 to 10 how distracting each sound was during the game, where 1 = not distracting and 10 = very distracting. The aim was to provide an insight into how distracting the participant found the sound when they first heard it.

In terms of overall ratings (not taking into account "no feedback" and "feedback" conditions), distracters in Set A were rated on average by the 12 participants as shown in Appendix 9 Set A. Game and person distracters tended to be rated more distracting than irrelevant distracters. However it is evident there is little range between the ratings, most distracters being rated 2, 3 or 4 out of 10, and so it is difficult to make comparisons in terms of which distracters were best.

Distracters in Set B were rated on average by the 12 participants as shown in Appendix 9 Set B. Again game and person distracters tended to be rated more distracting than irrelevant distracters. However the range of ratings still remains small, at 2-4 out of 10.

During experimental feedback, participants commented that they found it difficult to kept a constant scale of what they meant by 1 to 10 in their heads while playing the game, often just saying a number they considered neutral, such as 2 or 3, in order to respond. Some participants also commented that in comparison to tactile distracters, such as someone pulling them away from the game, auditory distracters would always be rated low as they do not physically stop you from playing the game.

Furthermore, it was interesting to note that participants in the "no feedback" version of "Space Trek" did not need prompting at all to respond, whereas some of the participants in the "feedback" version of "Space Trek" did need prompting from time to time. Unfortunately the exact numbers were not recorded, but this does support the immersion data, suggesting that the "feedback" version was more engaging.

As well as computing overall ratings for distractions in Set A and Set B, the distraction ratings for Set A and Set B were also computed for each game condition. However again all the ratings fell between 2-4, making it difficult to make comparisons in terms of which distracters were best. Therefore this data shall not be presented. Instead we now turn to describing the results of the ranking task, which were found to be much more useful.

4.4.3.2. Distraction Rankings After Game-Play

The second measure of "distractibility" involved ranking the distractions within each set. After playing each game participants were given 15 small cards, on which each of the distraction sounds that had been played during the game were written in full. Participants were asked to re-arrange the cards in order of how distracting / memorable they were, where 15 = most distracting and 1 = least distracting. The aim of this second measure was to provide an insight into how distracting the participant found the sounds in relation to one another.

In terms of overall ratings (not taking into account "no feedback" and "feedback" conditions), Set A was ranked on average by the 12 participants as shown in Appendix 10 Set A. Directional distracters appear to be the most distracting, followed by those referring to the participant's performance in the game. Also note that distracters which were not relevant to the person or the game were rated the least distracting, as predicted.

Set B was ranked by participants on average as shown in Appendix 10 Set B. Object-oriented distracters appear to be the most distracting, followed by those referring to the participant's performance in the game. Again distracters which were not relevant to the person or the game were rated the least distracting, as predicted.

4.4.3.3. Comparing Set A Rankings Between the Two Games

The distraction rankings for Set A and Set B were computed for each game condition, in order to check that the conclusions made from the overall rankings of the game distracters were accurate, i.e. we wanted to check that a similar pattern of rankings would be observed for each game when it is considered individually. Set A was ranked on average by the 6 participants playing the "no feedback" version of "Space Trek" while hearing distraction Set A as shown in Appendix 11 "No feedback". Set A was ranked on average by the 6 participants playing the "feedback" version of "Space Trek" while hearing distraction Set A as shown in Appendix 11 "Feedback".

As can be seen, the order of how distracting the distracters are between the two conditions is very similar. This suggests that the conclusions made earlier from the overall rankings of the distracters (not taking into account "no feedback" and "feedback" conditions) were accurate: directional distracters appear to be the most distracting, followed by those referring to the participant's performance in the game. Irrelevant distracters are rated least distracting

4.4.3.4. Comparing Set B Rankings Between the Two Games

Set B was ranked on average by the 6 participants playing the "no feedback" version of "Space Trek" while hearing distraction Set B as shown in Appendix 12 "No feedback". Set B was ranked on average by the 6 participants playing the "feedback" version of "Space Trek" while hearing distraction Set B as shown in Appendix 12 "Feedback".

Again the orders are similar between the two conditions, supporting the conclusions made earlier from the overall rankings of the distracters (not taking into account "no feedback" and feedback" conditions): object-oriented distracters appear to be the most distracting, followed by those referring to the participant's performance in the game. Also distracters which are not relevant to the person or the game are rated the least distracting.

4.5.4. Discussion

The second pilot study was conducted in order to shortlist from an original list of 30, the best 18 distracters to be used in Study Two. Two measures were used to assess the "distractibility" of distraction items: rating the distracters during game-play and ranking the distracters after game-play. The ranking data was found to be more useful. The ranking data revealed that object-oriented distracters, directional distracters, and those referring to the participant's performance in the game, were the most distracting. This was true both when the ranking data was grouped for the two game conditions, and when the ranking data for each game condition was considered individually.

Based on participant ranking orders, the 9 most distracting items from Set A and the 9 most distracting items from Set B were selected, see Appendix 13. In line with the needs of Study Two, these were a mixture of game-relevant, person-relevant and irrelevant distracters,

As a result of participant feedback (not described in the pilot study), small modifications were made to 13 out of the 18 auditory distractions. These modifications can be seen in Appendix 14. Modifications 1, 2, 4, 5 and 6 were made in order to make the game, person and irrelevant distracters more different from each other. For example, in modification 1, "move the rocket" is mentioned more often, rather than just "right, left, etc." in order to make it more game-relevant. In modification 2, "tap your fingers" is used rather than "move your body" in order to make the distracter more personally-relevant, i.e. the participant is using their fingers to play the game. In modification 4, "I collected hundreds of stars" rather than "I did much better when I played it" is used to emphasise game relevance. In modification 5, "my reaction times were much faster" rather than "I did much better when I took part in it" is used to emphasise person relevance. In modification 6, "I always checkmate the king" is used rather than "I play chess much better than you" in order to emphasise the distracter's irrelevance.

Modifications 3, 7 and 10 were made as a result of some participants finding the irrelevant distracters more personal than intended. For example, in modification 3 "swing the bat" and "hit that ball hard" is used rather than "move the saucepan" and "flip that pancake", because a few participants found this distracter unintentionally funny. In modification 7, "collecting stamps is so boring" is used rather than "cats as pets is so boring" because some participants commented that this caught their attention because they owned a pet cat. In modification 10, "there is a really good newspaper article about water pollution" is used rather than "there is a really good cleaning tip" because some participants expressed a personal interest in cleaning tips, i.e. some commented that they would have liked to have heard some advice to make their household cleaning chores easier.

Modifications 8, 9, 11, 12 and 13 were made to make the distracter items longer so that all distracters would be approximately of an equal length. Modifications 11, 12 and 13 were also made to emphasise the type of distracter. For example, in modification 11, "it's not going to stop after 10 minutes after all" is added to "the game has malfunctioned" in order to emphasise game relevance. In modification 12, "I've cooked you your favourite food" is added to "your lunch is ready" in order to emphasise person relevance. In modification 13, "it must have gone off a long time ago" is added to "the cleaning product is out of date" in order to emphasise irrelevance. The final list of 18 distracters can be seen in Appendix 15.

Overall, the pilot study was deemed successful. With 18 distracters ready to use, we were now prepared to conduct Study Two.

4.5. STUDY TWO: COMPARING RECALL OF AUDITORY DISTRACTERS PRESENT DURING GAME-PLAY OF THE "FEEDBACK" AND "NO FEEDBACK" VERSIONS OF SPACE TREK

4.5.1. Aim

The aim of Study Two was to investigate the extent to which people are aware of auditory distracters during two game conditions differing in feedback and other game features. These conditions were termed the "feedback" condition and the "no feedback" condition.

4.5.2. Hypotheses

In terms of recall:

- Participants in the "feedback" condition will recall fewer auditory distracters than participants in the "no feedback" condition.
- Participants the "feedback" condition will be less aware of irrelevant distracters than the "no feedback" condition; however the "feedback" and "no feedback" conditions will not differ in their awareness of game-relevant and person-relevant distracters.

4.5.3. Method

4.5.3.1. Participants

There were 18 participants in total. The majority of participants were university students, recruited through an opportunity sample. In terms of gender, 14 were female and 4 were male. Ages ranged from 19-30 years, the mean age being 23 years (SD = 2.84).

4.5.3.2. Space Trek

The "feedback" and "no feedback" versions of the game "Space Trek" were used, see Section 4.2 for a description of the games.

4.5.3.3. Distraction Sounds

18 auditory distracters were used for the experiment, see Appendix 15. 6 were game-related, 6 were person-related and 6 were irrelevant. Distraction sounds were played on a cassette recorder placed at the back of the room, behind where the participant would be sitting, and were paced to last for a duration of 10 minutes. All participants heard the same distractions.

4.5.3.4. Free Recall Test

The free recall test consisted of a blank page on which participants were asked to write down as much as they could remember of the auditory distractions. These could then be matched with the appropriate auditory distracter later and the total number of items remembered added up to give the recall score. As well as whole points, half points were given to some items that were partially remembered. For example, if a participant recalled "something about moving the rocket and watching out for asteroids" this would be awarded a half point rather than a whole point, because there was no mention of moving the rocket to the right or left. However it must be noted that if a participant recalled the opposite, just "right, left", this was not awarded any points; this is because it is not clear which distracter is being remembered, e.g. it could refer to "move the rocket" or "tap your fingers" or "swing the bat". See Appendix 16 for a table of how each distraction item was broken down and scored.

4.5.3.5. Procedure

Due to the same 18 distractions being played in both game conditions, an independent measures design was deemed necessary in order to bypass any effects of memory or order, e.g. participants purposively listening to the distractions the second time now that they know they will be tested on recall. Participants played either the "feedback" version or the "no feedback" version of "Space Trek". The games were played on a Gateway laptop using Flash Professional 8.0 and lasted 10 minutes each.

For both games participants were instructed that the aim of the game was to collect as many stars as possible while avoiding the asteroids. For the "feedback" version of "Space Trek" participants were also instructed that they should try their best to achieve the highest score possible. For the "no feedback" version of "Space Trek" participants were instructed that there would be no score.

Participants were also instructed that during game-play they would hear a number of auditory distractions played via a Casio cassette player placed at the back of the room, behind where they would be sitting. However they must not allow these distractions to stop them from their goal in the game, to collect as many stars as possible. Participants were not aware that they would later have to recall these distracters.

Once the participant was ready to begin the game, the experimenter turned on the distraction sound and left the cubicle, so that the experimenter's presence would not disrupt the participant's experience. After the participant had completed the game, the experimenter re-entered the room and presented the participant with the surprise recall test, instructing the participant to write down as much as he / she could remember about the auditory distracters. All participants were debriefed at the end of the experiment and received payment.

4.5.4. Results

All statistical analyses were performed using SPSS 11.0. The results are presented in the following order: first comparing the two conditions for the total number of distracters recalled; then comparing the two conditions for the recall of game, person and irrelevant distracters.

4.5.4.1. Recall of Auditory Distractions

There were 18 auditory distraction items played in total while participants either played the "no feedback" version of "Space Trek" or the "feedback" version of "Space Trek". As can be seen in Table 45, participants in the "feedback" condition recalled fewer distracters (mean = 5 out of 18) than participants in the "no feedback" condition (mean = 7 out of 18). An independent samples *t*-test revealed that this differences was significant, ($t_{(16)}$ = -2.173, p=.045).

Table 45.

Recall of Auditory Distracters for "No Feedback" and "Feedback" Conditions.

	No Feedback		Feedback	
	Mean	SD	Mean	SD
Recall *	6.67	1.20	5.39	1.29

* *p<.05*

4.5.4.2. Recall of Game, Person and Irrelevant Distracters

Out of the 18 distracters, 6 were game-relevant, 6 were person-relevant and 6 were irrelevant. As can be seen in Table 46, participants in the "feedback" condition were better at recalling game distracters (2.67), followed by person distracters (2.28) and then irrelevant distracters (0.44). Participants in the "no feedback" condition were also better at recalling game distracters (3.06), followed by person distracters (1.83) and then irrelevant distracters (1.67). Comparing the game conditions, participants playing the "feedback" version of "Space Trek" recalled on average fewer game distracters (2.67 compared to 3.06), more person distracters (2.28 compared to 1.83), and fewer irrelevant distracters (0.44 compared to 1.67), compared to participants playing the "no feedback" version of "Space Trek". See Figure 8 for a means plot of the recall data.

Table 46.

Recall of Game-Relevant, Person-Relevant and Irrelevant Distracters for "No Feedback" and "Feedback" Conditions.

	No Feedback		Feedback	
Recall:	Mean	SD	Mean	SD
- Game	3.06	0.95	2.67	1.32
- Person	1.83	1.00	2.28	1.35
- Irrelevant *	1.67	1.22	0.44	0.77

* *p<.05*

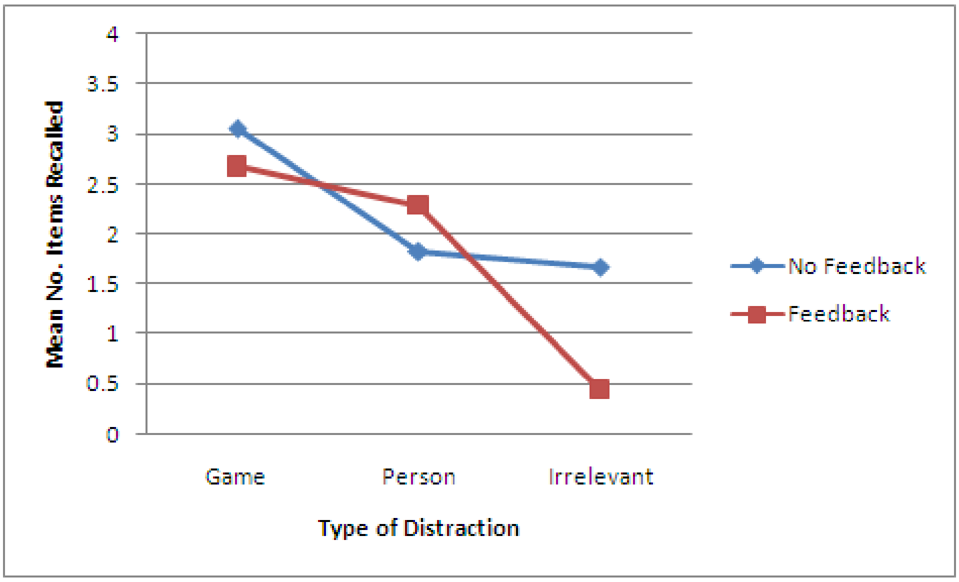

Figure 8. A Means Plot of the Recall of Game-Relevant, Person-Relevant and Irrelevant Distracters, for the "No Feedback" and "Feedback" Conditions.

A mixed measures ANOVA test was conducted on the recall data. The test revealed that there was a main effect of type of distraction, $F_{(2, 32)} = 9.157$, $p=.001$, and a main effect of game condition, $F_{(1, 16)} = 3.165$, $p<.001$. There was no significant interaction between type of distraction and game condition, $F_{(2, 32)} = 1.943$, $p=.160$.

In order to explore the effect of game condition further, independent sample *t*-tests were conducted for each level of distraction. There was a significant difference between the "feedback" and "no feedback" conditions for the recall of irrelevant distracters, $t_{(16)} = -2.536$, $p=.022$. However the difference between the conditions was not significant for the recall of game distracters, $t_{(16)} = -.716$, $p=.484$, or the recall of person distracters, $t_{(16)} = -794$, $p=.439$.

4.5.5. Discussion

Study Two was conducted to investigate the extent to which people are aware of auditory distracters during two games differing in feedback and other game features. The first hypothesis, that participants in the "feedback" condition would recall fewer auditory distracters than participants in the "no feedback" condition was supported. Participants in the "feedback" condition recalled significantly fewer distracter items (mean recall of 4 of 18 items) than participants in the "no feedback" condition (mean recall of 5 out of 18 items). Therefore, this suggests that participants in the "feedback" and "no feedback" conditions both process distracters, but not to the same extent: participants in the "no feedback" condition process distracters to a deeper or more conscious level, and as a result they are able to recall significantly more distracters.

The second hypothesis, that participants in the "feedback" condition would recall fewer irrelevant distracters than participants in the "no feedback" condition, however the "feedback" and "no feedback" conditions would not differ in their recall of game-relevant and person-relevant distracters; was also supported. Participants in the "no feedback" condition recalled significantly more irrelevant distracters than participants in the "feedback" condition (1.67 and 0.44 respectively). In contrast, the differences between the conditions for recall of game-relevant and person-relevant distracters were not significant. This suggests that when a person is immersed they are particularly less aware of irrelevant distracters, due to greater selectivity for relevance.

Overall, it is evident that Study Two has been successful in validating a number of claims from the grounded theory. Comparing two games differing in feedback and other game features, we showed that participants in the "feedback" condition were less aware of distracters than participants in the "no feedback" condition, particularly irrelevant distracters. In line with the grounded theory, we would suggest that the "feedback" condition was more immersive, as shown in the first pilot study, and so participants experienced greater RWD and were able to recall fewer distracters as a result. Greater immersion was also associated with greater selectivity: rather than processing all distracters equally, participants in the "feedback" condition were particularly less likely to process irrelevant distracters to the same extent as game-relevant or person-relevant distracters.

4.5.5.1. Limitations of Study Two

A limitation of Study Two is that the majority of the sample were female (14 females compared to 4 males). Being an opportunity sample, it just happened to be the case that it was mostly female students that volunteered to take part in the experiment. Therefore, one could claim that our results can not be generalised to a male population. However, we would argue that there were no significant gender differences in people's immersive experiences of the two versions of "Space Trek", as shown by the first pilot study, and so we do not expect that gender would have had an effect on recall of distracters either.

Another limitation of Study Two is that although the "feedback" condition recalled significantly fewer distracter items than the "no feedback" condition (mean recalls of 5 and 7 respectively), this is still a relatively small difference. One reason for this could be that although the "feedback" condition is more immersive than the "no feedback" condition, the "feedback" version of "Space Trek" is still not as immersive as a real game. As shown in the first pilot study, participants playing the "feedback" version of "Space Trek" did not rate it as significantly more challenging than the "no feedback" version; they performed extremely well in the game, avoiding over 95% of asteroids and collecting more than 70% of stars. Furthermore the game controls were very simplistic as only two movements were possible, right and left; this could have limited the extent to which a player felt involved in the game. Therefore in Study Three, we replicate the experiment comparing the "no feedback" version of "Space Trek" with a more challenging game.

A further limitation of Study Two is that whereas the "feedback" version had sound effects for when a person collected stars and crashed into asteroids, the "no feedback" version of "Space Trek" had no sound whatsoever. Therefore one could argue that it was easier to process the distracters in the "no feedback" condition due to the absence of any other sounds in the room. We would argue that the "feedback" sounds were only short sound bytes and so we doubt they would have been that obtrusive; however, just in case the presence / absence of game sound is a possible confound, in Study Three we decided to add music to the "no feedback" condition in order to control for this.

In choosing the more challenging game to be used for Study Three, it was important that the game was also space-themed so that the same distracters could be used as in Study Two, with a few minor modifications. The game "Star Fly 3" was chosen because like the "no feedback" version of "Space Trek" it also involves controlling a rocket and avoiding asteroids. In accordance with the grounded theory, we expect that there will be a greater difference in recall than that observed in Study Two, due to the greater difference in immersion experienced by participants playing the two games. In terms of recall of game, person and irrelevant distracters, we expect that participants in the "Star Fly 3" condition will show greater selectivity in terms of relevance than participants in the "no feedback" condition, again due to the differences in game immersion.

A pilot study shall now be described, which gives more details about the game "Star Fly 3" and confirms that "Star Fly 3" and the "no feedback" version of "Space Trek" differ significantly in immersion, using the IEQ. This will then be followed by a description of the method and results of Study Three.

4.6. PILOTING STAR FLY 3

4.6.1. Aim

The aim of the pilot study was to confirm that the game "Star Fly 3" was significantly more immersive than the "no feedback" version of the game "Space Trek". This would allow us to assess whether the game "Star Fly 3" was suitable for Study Three, in which we aimed to replicate Study Two but this time comparing the "no feedback" version of "Space Trek" to a more challenging game.

The game "Star Fly 3" does not have a time limit; instead it ends when the player loses all of their energy. Therefore another aim of the pilot study was to assess the average amount of time that a person spends playing the game. In order for "Star Fly 3" to be suitable for use in Study Three its game-play needs to last for a similar length of time as "Space Trek", approximately 10 minutes.

4.6.2. Method

4.6.2.1. Participants

There were 8 participants in total. The majority of participants were university students, recruited through an opportunity sample. In terms of gender, 5 were female (62.5%) and 3 were male (37.5%). Ages ranged from 23-38 years, the mean age being 28.5 years (SD = 5.78).

4.6.2.2. Space Trek

The "no feedback" version of "Space Trek" was used, the same game as used in Study Two (see Section 4.2). However note that one modification was made to the game: music was added, in order to control for the possible confound of comparing playing a game with no sound whatsoever compared to playing a game with sound. The game music was the sound of a slow ticking clock, chosen to be as dull and repetitive as possible.

4.6.2.3. Star Fly 3

The game Star Fly was found online on the website www.topgameszone.com. The game "Star Fly 3" was chosen because like the "no feedback" version of "Space Trek" it also involves controlling a rocket, avoiding asteroids and collecting stars (plus other available power ups). Therefore if the game was deemed suitable for use in Study Three, it would be possible to use the same space-themed distracters as used in Study Two, with a few minor modifications.

Players were instructed that it is their task to control a small rocket and blast the screen of all asteroids in order to progress to the next level. Hitting asteroids will make the rocket lose energy; collecting power ups will give the rocket more energy. The game finishes when the player loses all of their energy.

Figure 9 shows a screen shot of the game itself. Although "Star Fly 3" shares the same subject matter as "Space Trek", it is evident that in terms of game-play there are a number of differences between the two games. Firstly, the player is not limited to just right and left motions, but is able to fly their rocket around the screen. Going off one side leads to a re-appearance in the opposite adjacent side. By pressing "up" the player can speed up the rocket's flight; by pressing "down" the player can slow the rocket down. Furthermore, the player is able to shoot out from their rocket at the surrounding objects.

The player receives feedback for his or her actions. When they fire at an object a shooting sound is heard. If they are successful in shooting an asteroid a crashing sound is heard as it breaks into several smaller pieces. These pieces must then be shot at again, in order to make the pieces disappear.

Furthermore, sometimes other objects appear on the screen, such as fireballs, which must also be avoided and shot at in a similar manner in order to make them disappear.

Figure 9. A Screenshot of the Game "Star Fly 3".

As well as shooting at the asteroids to destroy them, the player must also be careful to avoid the asteroids because if the asteroids hit them this can lead to them losing their energy, as shown by the energy circle in the bottom left hand corner of Figure 9. Avoiding asteroids can prove to be rather difficult because the asteroids can move around the screen in any direction (i.e. not just from the top of the screen to the bottom of the screen). However there are a number of power-ups that appear on the screen that players can collect on the way in order to maintain their energy. Some of these power ups give the player a better weapon, while others give the player an energy boost. The star shown on the right hand side of Figure 9 is an example of an energy power-up. On collection, a tinkling sound is heard as the effects of the power up take place.

Throughout the game the player can see their progress via their game score which is displayed on the bottom of the screen (see Figure 9). They can also assess their progress by the amount of asteroids that are still left on the screen. With each new level the background image of the planets and space changes and the obstacles and power-ups vary. Upbeat energetic music is played throughout.

The game ends when the player loses all of their energy. On the "game over" screen the player's score is displayed, plus the highest level they reached and a link that they can click to get back to the main menu, where they can restart the game if they choose to do so.

4.6.2.4. IEQ

To measure immersion the modified IEQ was used, see Appendix 7. Details of how the IEQ scores were computed can be seen in Appendix 5.

4.6.2.5. Procedure

A repeated measures design was used for the pilot study. Participants played both the "no feedback" version of "Space Trek" and "Star Fly 3". The order the games were played was counterbalanced across participants to control for order effects. The games were played on a Gateway laptop using Flash Professional 8.0 and lasted approximately 10 minutes each.

For the game "Star Fly 3" participants were instructed that their aim was to clear the screen of all the asteroids and they must see which level they could get to before losing all of their energy. For the "no feedback" version of "Space Trek" participants were instructed that their aim was to collect as many stars as possible while avoiding the asteroids, however there would be no score.

After playing each game, participants were asked to fill out the IEQ. Participants were also asked to note down the time they started playing, the time they finished playing, and their end of game statistics (e.g. their game score).

Once both games had been played and the corresponding questionnaires had been filled in, participants were asked if they had any further comments about their experience. Then they were debriefed. They received no payment for their participation.

4.6.3. Results

4.6.3.1. Immersion Ratings

As can be seen in Table 47, participants rated "Star Fly 3" approximately 70 points more immersive than the "no feedback" version of "Space Trek". A paired samples *t*-test revealed that this difference was significant, $t_{(7)} = -8.517, p<.001$. Therefore this suggests that the games differ in terms of immersion.

The single question measure of immersion supported this finding. As can be seen in Table 47, participants rated "Star Fly 3" approximately 4 points more immersive than the "no feedback" version of "Space Trek" (mean = 1.62). A paired samples *t*-test revealed that this difference was significant, $t_{(7)} = -5.059, p=.001$. Pearson correlations revealed that participant responses to the single question and multiple question measures of immersion were highly correlated for the "no feedback" version of "Space Trek" ($r_{(n=8)} = .914, p=.002$) and also correlated for "Star Fly 3" ($r_{(n=8)} = .761, p=.028$). This suggests that the multiple question measure of immersion is accurately reflecting participants' immersive experiences.

Table 47.

Immersion Ratings of the Game "No Feedback" Version of "Space Trek" and the Game "Star Fly 3".

	No Feedback		Star Fly 3	
Immersion:	Mean	SD	Mean	SD
- IEQ Immersion Score ***	70.00	16.81	146.50	17.74
- Single Question Measure **	1.62	0.74	6.00	1.93

** *$p<.01$*; ****$p<.001$*

In terms of confounding variables, again age and gender were identified as possible factors that could influence immersion ratings (for similar reasons as those described in Section 4.3.3.1). Pearson correlations revealed that there was a significant correlation between age and immersion for the "no feedback" version of "Space Trek", $r_{(n=8)}$ = .825, p=.012. This suggests that the "no feedback" version of "Space Trek" was found to be more immersive by older participants than younger participants. A possible reason for this could be that older participants might have lower expectations of what a good game should be like. In contrast for the more challenging game, "Star Fly 3", there were no significant correlation found for age and immersion, $r_{(n=8)}$ = -.485, p=.223.

In terms of gender effects, independent sample *t*-tests revealed that there were no significant differences between the immersion ratings of males and females for both the "no feedback" version of "Space Trek" ($t_{(6)}$ = -1.795, p=.123) and "Star Fly 3" ($t_{(6)}$ = .736, p=.489).

4.6.3.2. Immersion Factors

Table 48.

Immersion Factor Scores for the Game "No Feedback" Version of "Space Trek" and the Game "Star Fly 3".

	No Feedback		Star Fly 3	
Immersion Factors:	Mean	SD	Mean	SD
- Cognitive Involvement ***	27.63	8.37	54.00	4.28
- Real World Dissociation **	10.63	5.50	27.25	5.31
- Emotional Involvement ***	24.63	5.76	50.88	8.37
- Challenge **	16.00	3.16	22.63	3.25
- Control **	23.88	4.77	35.00	4.00

** *$p<.01$*; ****$p<.001$*

To explore the differences in immersion between the two games further, participant scores for the five immersion factors were computed. As can be seen in Table 48, participants rated "Star Fly 3" higher than the "no feedback" version of "Space Trek" for all five immersion factors. Paired sample *t*-tests

(Bonferroni correction, significance level =.01) revealed that the differences between the games were significant for all five immersion factors: cognitive involvement ($t_{(7)}$ = -9.125, p<.001), real world dissociation ($t_{(7)}$ = -5.752, p=.001), emotional involvement ($t_{(7)}$ = -6.464, p<.001), challenge ($t_{(7)}$ = -4.133, p=.004) and control ($t_{(7)}$ = -4.722, p=.002).

4.6.3.3. Star Fly 3 Game Statistics

The mean play duration, score and level reached was computed for the game "Star Fly 3". As can be seen in Table 49, the time duration for players varied from 5 minutes to 17 minutes, the average being 9 minutes. Also the highest level reached varied from Level 2 to Level 8, the mean being Level 2.

Table 49.

Game Statistics for "Star Fly 3".

	Mean	SD	Range
Play Duration	9.13 mins	4.16	5-17 mins
Level Reached	Level 2	2.03	Level 2-8
Final Score	1192.75	668.26	383-2330

4.6.4. Discussion

The pilot study was conducted to confirm that the game "Star Fly 3" was rated more immersive than the "no feedback" version of "Space Trek". As predicted, "Star Fly 3" was rated significantly more immersive than the "no feedback" version of "Space Trek", using the IEQ. A single question measure of immersion supported these findings, suggesting that the IEQ was reliably reflecting participants' immersive experiences.

Compared to the mean immersion rating of the "feedback" version of "Space Trek" in Pilot Study 1 (142.60), it appears that the game "Star Fly 3" has only been rated slightly higher in Pilot Study 3 (146.50). However it is evident in terms of participant comments that the game was demanding as well as enjoyable. One participant commented "I would have liked to have done better". Another wrote "It was fun, learnt the controls and got better over time".

Furthermore, when analysing the immersion factors the results revealed that "Star Fly 3" was rated significantly more than the "no feedback" version of "Space Trek" for all five immersion factors: cognitive involvement, real world dissociation, emotional involvement, challenge and control. Challenge was the gaming aspect that the "feedback" version of "Space Trek" had been particularly lacking in. Therefore, although the two were not directly compared in this pilot study, one can suggest that "Star Fly 3" is a more immersive game than the "feedback" version of "Space Trek" and thus is suitable for use in Study Three.

In terms of confounding variables there was a significant correlation found between age and immersion for the low immersion game, the low immersion game being rated as more immersive by older participants. However whereas the age range of the pilot study sample was quite broad (23 to 38 years), in the experimental sample of Study Three the age range will be much less varied. Therefore this confound should not be present for the actually experiment.

As well as analysing the immersion data, the game statistics for "Star Fly 3" were also analysed. The results revealed that the game was played for an average of 9 minutes; however there was considerable variation, the time played ranging from 5-17 minutes. Therefore it is evident that for Study Three, in which the ideal game duration would be 10 minutes in order for the experience to be comparable to the 10 minute "Space Trek" game, and also for the 10 minute distraction audio to be played, it may be necessary to ask participants to restart "Star Fly 3" if they finish early. Furthermore at the 10 minute point participants would need to be stopped, rather than letting them continue playing until the end of the game, again to ensure that they play for approximately 10 minutes.

Overall the game "Star Fly 3" was deemed suitable for use in Study Three, in which we plan to replicate Study Two but comparing the "no feedback" version of "Space Trek" to a more challenging game.

4.7. STUDY THREE: COMPARING RECALL OF AUDITORY DISTRACTERS PRESENT DURING GAME-PLAY OF STAR FLY 3 AND THE "NO FEEDBACK" VERSION OF SPACE TREK

4.7.1. Aim

The aim of Study Three was to investigate the extent to which people are aware of auditory distracters during two games differing in feedback and other game features. These conditions were termed the "Star Fly 3" condition and the "no feedback" condition. The method of Study Two was replicated, however this time because we are comparing the "no feedback" version of "Space Trek" with a more challenging game we expect to see a greater difference in recall between the two conditions than that observed in Study Two.

4.7.2. Hypotheses

In terms of recall:

- Participants in the "Star Fly 3" condition will recall fewer auditory distracters than participants in the "no feedback" condition, to a greater extent that that observed in Study Two.

- Participants in the "Star Fly 3" condition will recall fewer irrelevant distracters than the "no feedback" condition, to a greater extent than that observed in Study Two; however the "Star Fly 3" and "no feedback" conditions will not differ in their awareness of game-relevant and person-relevant distracters.

4.7.3. Method

4.7.3.1. Participants

There were 28 participants in total, 13 in the "Space Trek" condition and 15 in the "Star Fly 3" condition. The participants were psychology undergraduates, recruited through an opportunity sample. In terms of gender, 23 were female and 5 were male. Ages ranged from 18-22 years, the mean age being 19 years (SD = 0.1). All participants were paid three pounds for their time.

4.7.3.2. Space Trek and Star Fly 3

The games "Space Trek" ("no feedback" version, created using Flash Professional 8.0.) and "Star Fly 3" (found online on the website www.topgameszone.com) were used to create gaming conditions that differed in terms of immersion. For more details about these games refer back to the pilot study, Section 4.6.

4.7.3.3. Distraction Sounds

18 auditory distracters were used for Study Three. These distracters can be divided into three categories: relevant to the game, relevant to the person, or irrelevant. For Study Three the game "Star Fly 3" was chosen because it involved the same subject matter as the "no feedback" version of "Space Trek", i.e. it also involved controlling a rocket, avoiding asteroids, and collecting power ups. Therefore the same distractions created for Study Two could be used as a basis for Study Three.

All 18 distractions remained the same for the "Space Trek" gaming condition (see Appendix 15). However in order to make the distractions more game or person-relevant a few minor modifications were deemed necessary for the "Star Fly 3" gaming condition. These modifications can be seen in Appendix 17.

Modifications 1 and 2 were made because although power ups in the shape of stars do appear sometimes in "Star Fly 3", they do not appear as often as stars appear in "Space Trek". Therefore by emphasising shooting fireballs rather than collecting stars this should make the distracter more game and person-relevant.

Modifications 3 and 4 were made for a similar reason. In "Star Fly 3" the aim of the game is less about collecting stars and more about clearing the screen of all asteroids Also unlike "Space Trek", "Star Fly 3" does not have a time limit but instead the game ends when the player runs out of energy. Therefore these distracters were changed accordingly.

A list of the 18 distractions used in the "Star Fly 3" condition can be seen in Appendix 18. For each of the conditions, 6 of the distracters were game-related, 6 were person-related and 6 were irrelevant. Apart from these modifications made to 4 of the "Star Fly 3" distractions, efforts were made to make the distraction sounds for the two gaming conditions as alike possible. The distraction sounds were recorded by the same person using the same tone of voice. The distraction sounds were also played at the same volume for both gaming conditions. The distraction sounds were played on a cassette recorder placed at the back of the room, behind where the participant would be sitting, and were paced to last for a duration of 10 minutes.

4.7.3.4. Free Recall Test

The free recall test procedure used was the same as that described in Section 4.5.3.6. See Appendix 16 and 18 for tables of how each distraction item was broken down and scored in the "Space Trek" and "Star Fly 3" conditions.

4.7.3.5. Procedure

Due to similar 18 distractions being played in both game conditions, an independent measures design was deemed necessary in order to bypass any effects of memory or order, e.g. participants purposively listening to the distractions the second time now that they know they will be tested on recall. Participants played either "Star Fly 3" or the "no feedback" version of "Space Trek". Due to a change in testing location, the Gateway laptop was no longer able to pick up a wireless internet connection; therefore, whereas the "no feedback" version of "Space Trek" was played on a Gateway laptop (as in the pilot study), "Star Fly 3" was played on a Dell PC.

For "Star Fly 3" participants were instructed that their aim was to clear the screen of all the asteroids and they must see which level they could get to before losing all of their energy. For the "no feedback" version of "Space Trek" participants were instructed their aim was to collect as many stars as possible while avoiding the asteroids, however there would be no score.

Participants were also instructed that during the game they would hear a number of auditory distractions played via a Casio cassette player, placed at the back of the room behind where they would be sitting. However they must try not to allow these distractions to stop them from their goal in the game, to achieve the highest score possible ("Star Fly 3" condition) or collect as many stars as possible ("Space Trek" condition). Participants were not aware that they would later have to recall these distracters.

Once the participant was ready to begin the game, the experimenter turned on the distraction sound and left the cubicle, so that the experimenter's presence would not disrupt the participant's experience. Each game was played for approximately 10 minutes. For the game "Star Fly 3", participants were instructed to click "play again" if they lost all of their energy before the time was up, and to try to perform better the second time. At the 10 minute mark, game-play was interrupted as the experimenter re-entered the cubicle and the participant was told to stop playing the game. For "Space Trek", at the 10 minute mark game-play was also interrupted as the game was programmed to stop at this time.

On re-entering the cubicle, the experimenter presented the participant with the surprise recall test, instructing the participant to write down as much as he / she could remember about the auditory distracters. All participants were debriefed at the end of the experiment and received three pounds payment.

4.7.4. Results

All statistical analyses were performed using SPSS 11.0. The results are presented in the following order: first comparing the two conditions for the total number of distracters recalled; then comparing the two conditions for the recall of game, person and irrelevant distracters.

4.7.4.1. Recall of Auditory Distractions

There were 18 auditory distraction items played in total while participants played "Star Fly 3" and the "no feedback" version of "Space Trek". As can be seen in Table 50, participants playing "Star Fly 3" recalled fewer distracters (mean = 4 out of 18) than participants playing the low immersion game (mean = 7 out of 18). An independent samples *t*-test revealed that this difference was significant, ($t_{(26)}$ = 4.609, p<.001).

Table 50.

Recall of Auditory Distracters for "No Feedback" and "Star Fly 3" Conditions.

	No Feedback		Star Fly 3	
	Mean	SD	Mean	SD
Recall ***	7.12	2.03	4.13	1.37

****p<.001*

4.7.4.2. Recall of Game, Person and Irrelevant Distracters

Out of the 18 distracters, 6 were game-relevant, 6 were person-relevant and 6 were irrelevant. As can be seen in Table 51, in the "Star Fly 3" condition participants were better at recalling game distracters (1.83), followed by person distracters (1.73) and then irrelevant distracters (0.57). In the "no feedback" condition participants were better at recalling game distracters (3.54), followed by person distracters (2.42) and then irrelevant distracters (1.15). Also comparing the game conditions, participants playing "Star Fly 3" recalled on average fewer game distracters (1.83 compared to 3.54), fewer person distracters (1.73 compared to 2.42), and fewer irrelevant distracters (0.57 compared to 1.15), compared to participants playing the "no feedback" version of "Space Trek". See Figure 10 for a means plot of the recall data.

Table 51.

Recall of Game-Relevant, Person-Relevant and Irrelevant Distracters for "No Feedback" and "Star Fly 3" conditions.

Recall:	No Feedback		Star Fly 3	
	Mean	SD	Mean	SD
- Game ***	3.54	1.07	1.83	1.32
- Person	2.42	1.22	1.73	0.62
- Irrelevant	1.15	1.30	0.57	0.65

****p<.001*

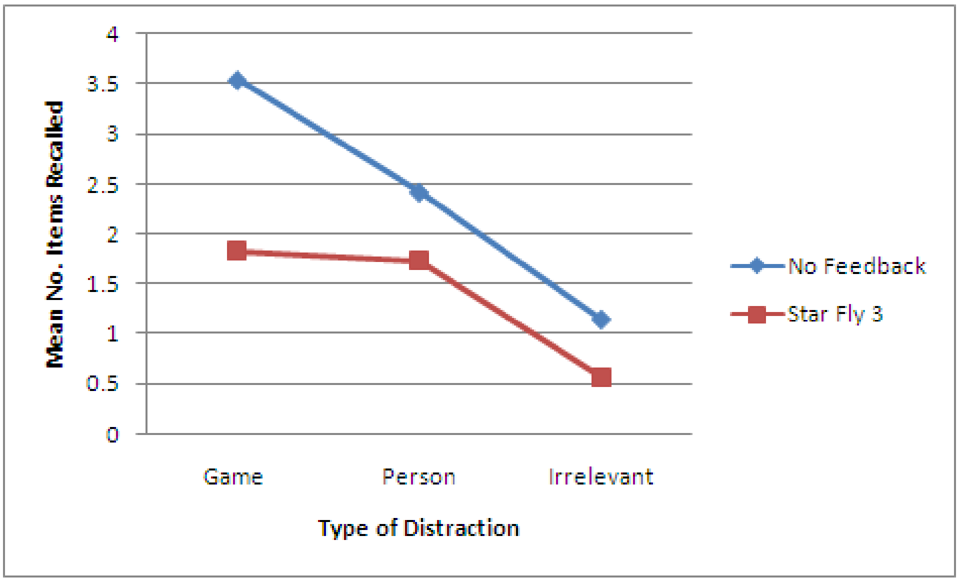

Figure 10. A Means Plot of the Recall of Game-Relevant, Person-Relevant and Irrelevant Distracters for "No Feedback" and "Star Fly 3" conditions.

A mixed measures ANOVA test was conducted on the recall data. The test revealed that there was a main effect of type of distraction, $F_{(2, 52)} = 24.076$, p=.001, and a main effect of game condition, $F_{(1, 26)}$ =

21.240, $p<.001$. The interaction between type of distraction and game condition was close to significance, $F_{(2, 52)} = 2.660$, $p=.056$.

In order to explore the effect of game condition further, independent sample *t*-tests were conducted for each level of distraction. There was a significant difference between "Star Fly 3" and the "no feedback" condition for the recall of game distracters, $t_{(26)} = -4.999$, $p<.001$. However the difference between the game conditions was not significant for the recall of person distracters, $t_{(26)} = -1.920$, $p=.066$, or the recall of irrelevant distracters, $t_{(26)} = -1.546$, $p=.134$.

4.7.5. Discussion

Study Three was conducted to investigate the extent to which people are aware of auditory distracters during two games differing in feedback and other game features. The method of Study Two was replicated, however this time because we are comparing the "no feedback" version of "Space Trek" with a more challenging game, "Star Fly 3", we expect to see a greater difference in recall between the two conditions than that observed in Study Two.

The first hypothesis, that participants in the "Star Fly 3" condition would recall fewer auditory distracters than participants in the "no feedback" condition, to a greater extent than that observed in Study Two, was supported. Participants in the "no feedback" condition were able to recall significantly more distracter items (mean recall of 7 of 18 items) than participants in the "Star Fly 3" game condition (mean recall of 4 out of 18 items); furthermore, this difference in recall between the "no feedback" condition and "Star Fly 3" is greater than the recall difference between the "no feedback" and "feedback" conditions of Study Two (mean recalls of 7 and 5 out of 18 respectively). This suggests that participants in the "Star Fly 3" condition processed distracters to an even shallower / less conscious level compared to the "no feedback" condition (Study Three) than that observed previously between the "feedback" and "no feedback" conditions (Study Two); as a result participants in the "Star Fly 3" recall fewer distracters to a greater significance level.

In line with the grounded theory, we would suggest that the "Star Fly 3" condition was more immersive, as shown in the pilot study, and so participants experienced greater RWD and were able to recall fewer distracters as a result. Furthermore, there was a greater difference in recall in Study Three than that observed in Study Two; in line with the grounded theory, we would suggest that this is due to the greater difference in immersion experienced by participants playing the two games, "Star Fly 3" being particularly more challenging.

The second hypothesis, that participants in the "Star Fly 3" condition would recall fewer irrelevant distracters than the "no feedback" condition, to a greater extent than that observed in Study Two, however the "Star Fly 3" and "no feedback" conditions would not differ in their awareness of game-relevant and person-relevant distracters; was not supported. Participants in the "Star Fly 3" condition did not recall significantly fewer irrelevant distracters than participants in the "no feedback" condition. The difference in recall of person-relevant distracters was also not significant; however, participants in the "Star Fly 3" condition did recall significantly fewer game-relevant distracters than participants in the "no feedback" condition (1.83 and 3.54 respectively). These results differ from our hypothesis and the results of Study Two, as they suggest that the two conditions significantly differ in the processing of game-relevant distracters, not irrelevant distracters.

Furthermore, if one looks at the means plot of Study Three (Figure 10) one can see that the drop from mean recall of game-relevant and person-relevant distracters to mean recall of irrelevant distracter is to a similar extent as that observed in the "no feedback" condition, the main difference being that the actual values are lower for the "Star Fly 3" condition than the "no feedback" condition. This suggests that participants in both the low immersion condition and the "Star Fly 3" condition were selective in processing irrelevant distracters less than relevant distracters to a similar extent.

In summary, it is evident that although the grounded theory was supported in terms of total recall of distracters, it was not supported regarding its predictions for the different types of distracters. Participants in the "Star Fly 3" condition did not show greater selectivity in terms of distracter relevance and did not recall significantly fewer irrelevant distracters than participants in the "no feedback" condition; instead they were found to recall significantly fewer game-relevant distracters than participants in the "no feedback" condition.

4.7.5.1. Limitations of Study Three

Regarding the findings concerning the different types of distracters, there are two important questions to ask. The first is why does the "no feedback" condition in Study Three show a different pattern to the "no feedback" condition in Study Two, recall of irrelevant distracters having a more substantial drop in Study Three?

One difference between Study Two and Study Three is that whereas the "no feedback" condition in Study Two had no sound whatsoever, game music was added to the "no feedback" condition in Study Three; therefore one could suggest that the addition of game sound led to greater selectivity. However we would argue that this seems unlikely. The game music in Study Three was the sound of a slow ticking clock, chosen to be as dull and repetitive as possible; it does not seem likely that such music would require greater processing from participants to such an extent that it affects their awareness of distracters. Furthermore, if we compare the immersion ratings of the "no feedback" condition in the pilot study for Study Two (immersion rating = 91.70) and the "no feedback" condition in the pilot study of Study Three (immersion rating = 70.00), this suggests that the addition of game sound led to a drop in immersion, not an increase.

Another difference between Study Two and Study Three is that the age range of the sample was less varied in Study Three (age range 18-22 years, mean age 19 years, SD = 0.1) compared to Study Two (age range 19-30 years, mean age 23 years, SD = 2.84); therefore one could suggest that younger participants are able to focus more and thus show greater selectivity, even in low immersion conditions. However we would argue that this also seems unlikely: the pilot study for Study Three showed a significant correlation between age and immersion, with older participants rating the "no feedback" game higher in immersion than younger participants, not less so.

Instead, we would suggest that a more compelling possible explanation for the different patterns observed in the "no feedback" conditions of Study Two and Study Three can be found in the make up of the student sample itself. Whereas the sample of Study Three was completely psychology undergraduates, the sample of Study Two was more generic (university students); therefore one could suggest that the Psychology students of Study Three might have been more subject to demand characteristics than other university students, due to their knowledge of the domain. Whereas other university students might not have thought much about the aim of the experiment before taking part, Psychology students might have been more suspicious when they found out that distracters were to be played into the room during game-play. Furthermore, Psychology students might have been more likely to guess the prediction that relevant distracters would be easier to recall than irrelevant distracters, and so they acted accordingly, i.e. they paid more attention to relevant distracters / wrote down more relevant distracters.

A further difference between Study Two and Study Three is that Study Three involved a bigger sample size (28 participants in Study Three, compared to 18 participants in Study Two). Therefore it could also be the case that our initial understanding of the data in Study Two was mistaken, i.e. there is always selectivity for relevance in both immersive and non-immersive conditions, one just needs a big enough sample to show the effect.

The second question to ask regarding the findings concerning the different types of distracters is why does the "Star Fly 3" condition not show greater selectivity for relevance than the "no feedback" condition? As well as having feedback and a sense of progression, "Star Fly 3" differs from the "no feedback" condition in a number of other ways: the game controls allow for more rocket movements, the player is able to shoot at surrounding objects, extra fire balls and power ups appear at random points in the game, energetic and upbeat game music is played throughout, it is also possible to die in the game.

The results from the pilot studies support the idea that "Star Fly 3" was considerably more immersive. Whereas the "feedback" condition was rated approximately 50 points more immersive than the "no feedback" condition in the pilot study for Study Two (immersion ratings of 142.60 and 91.70 respectively), the "Star Fly 3" condition was rated approximately 70 points more immersive than the "no feedback" condition in the pilot study for Study Three (immersion ratings of 146.50 and 70.00 respectively); this suggests that participants in the latter pilot study experienced a greater difference in immersion when playing the games "Star Fly 3" and the "no feedback" version of "Space Trek" than participants in the first pilot study, whom played the "feedback" and "no feedback" games. Furthermore, whereas the "feedback" condition was only rated significantly more immersive than the "no feedback" condition for only four immersion factors (excluding challenge), the "Star Fly 3" condition was rated significantly more immersive for all five immersion factors. Therefore again we pose the question, due to this greater immersion why does the "Star Fly 3" condition not show greater selectivity?

One possible explanation is that the relationship between immersion and selectivity for relevance is S-shaped rather than linear. For example, it could be the case that when a game is slightly immersive at first distracters that are irrelevant are filtered out (as in Study Two). However as the game becomes more immersive (and more challenging, as in Study Three), game and person distracters are filtered out also, making such selectivity less evident. See Figure 11 for an illustration of this possible S-shaped relationship between immersion and selectivity for relevance.

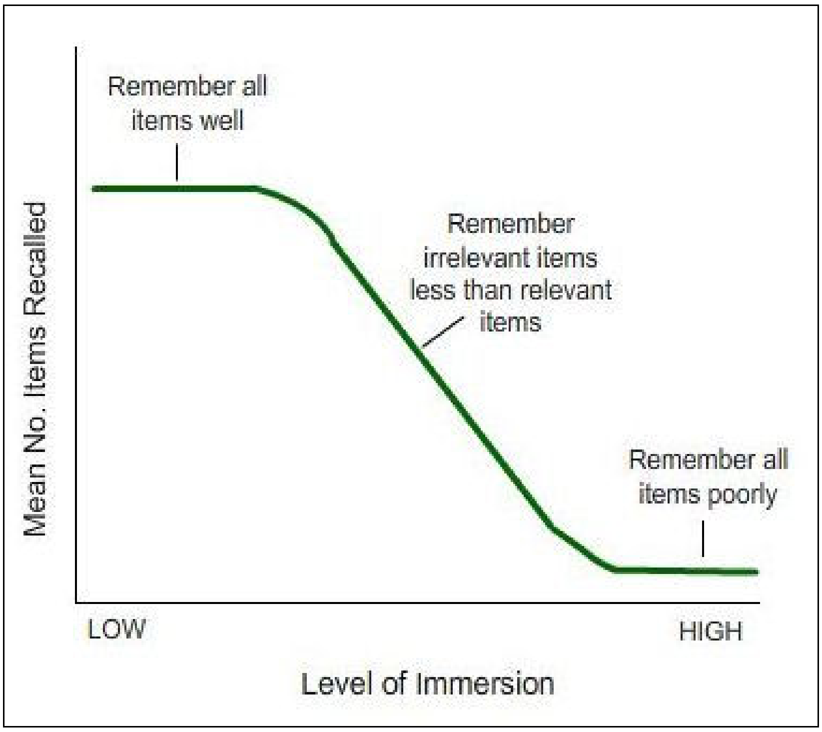

Figure 11. An Illustration of the Possible S-shaped Relationship Between Immersion and Selectivity for Relevance.

In support of such an interpretation, participants recalled more game distracters in the "feedback" condition of Study Two (recall = 2.67) than the "Star Fly 3" condition of Study Three (recall = 1.83). Participants also recalled more person distracters in the "feedback" condition of Study Two (recall = 2.28) than the "Star Fly 3" condition of Study Three (recall = 1.83). In contrast the recall of irrelevant distracters was similar for Study Two (recall = 0.44) and Study Three (recall = 0.57).

Alternatively, another possible explanation for the lack of greater selectivity in the "Star Fly 3" condition is that it could be due to the experimental method itself. Despite the distractions in the "no feedback" condition and the "Star Fly 3" condition being designed to be similar, it is still possible that some of the distracters were not equally "distracting". For example, after Study Three was conducted it was realised that the irrelevant distracter "turn, turn, flip" was actually quite relevant in the "Star Fly 3" condition, as participants are using the controls to turn the rocket in the direction they want to fly in. Also, rather than just "moving" the rocket to the right and the left, in the "Star Fly 3" condition the person's experience is one more of "flying" the rocket to the right and the left. Therefore one can argue that the distracters were more suited for the "no feedback" condition than the "Star Fly 3" condition.

As a final note, not related to the findings regarding the types of distracters but Study Three as a whole, we wish to acknowledge that the majority of participants in the sample were female (23 females, 5 males). Therefore like Study Two, one might question whether our results can be generalised to a male population. In response, again we would argue that there were no significant gender differences in people's immersive experiences of the "no feedback" version of "Space Trek" and "Star Fly 3" in the pilot study, therefore it seems unlikely that gender would have had an effect on recall of distracters either.

4.8. GENERAL DISCUSSION

4.8.1. Summary of the Experimental Findings

To recap, in this chapter two studies were described that investigated how awareness of auditory distracters changes with the level of game immersion experienced. These studies aimed to provide evidence for the following claims:

- Gaming conditions that differ in immersion, as a result of differences in feedback and other game features, will also differ in terms of RWD, as measured by recall of auditory distracters.
- When a player is immersed in a game not all aspects of the surroundings are processed in the same way: irrelevant distracters are less likely to be noticed than game-relevant or person-relevant distracters.

The first claim was supported by the studies. Participants recalled fewer distracters in the "feedback" condition compared to the "no feedback condition" (Study Two), and participants recalled even fewer distracters in the "Star Fly 3" condition compared to the "no feedback" condition (Study Three). Pilot studies conducted beforehand had shown that the "feedback" and "no feedback" games, and the "Star Fly 3" and "no feedback" games, differed significantly in terms of the immersion experienced, as measured by the IEQ.

However the second claim was only partially supported. Participants in the "feedback" condition showed greater selectivity and recalled significantly fewer irrelevant distracters compared to participants in the "no feedback" condition (Study Two); however participants in the "Star Fly 3" condition did not show greater selectivity and recall significantly fewer irrelevant distracters than participants in the "no feedback" condition (Study Three). A number of reasons have been put forward regarding why the second claim was not supported in Study Three. These include sampling issues, the suitability of the distracter sounds for the "Star Fly 3" condition, and also the possibility that the relationship between immersion and selectivity for relevance is an S-shaped curve rather than linear.

4.8.2. Comparisons with the Existing Literature

In relation to the existing immersion literature, an important contribution of the studies is that they demonstrate that RWD is not just something that people talk about, but it does exist and can be measured. Despite the use of distracter recall to measure a person's awareness of their surroundings being common to the SA literature, as of yet this has not been used in the game immersion domain. Therefore one could claim that we have also introduced a new way of measuring game immersion to the research field, distracter recall being a more objective measure than questionnaire measures.

Of course, the games played in real life are much more complex. Even the "more challenging" "Star Fly 3" game is simplistic compared to many of the games currently on the market; it is still only a retro shooting game after all. However for the purposes of our studies, in which we aimed to show that differences in RWD could be measured objectively via recall of auditory distracters, the games served their purpose. It is evident that just by adding feedback, a sense of progression, sound and better graphics to a game which is otherwise identical, a person becomes significantly less aware of their surroundings (Study Two). In fact, some might even say that the "no feedback" game is not even a game; this comment supports our claim that a sense of progression and feedback are essential parts of gaming.

A limitation of Studies Two and Three however is that one can suggest that there is an alternative explanation to the experimental findings other than our grounded theory. It is possible that the differences in recall were due to differences in perceptual load, which would result in fewer cognitive resources being available to process the distracters, rather than differences in sense of progression. For example, in Study Two the "feedback" and "no feedback" version of "Space Trek" not only differed in terms of feedback and a sense of progression, but in terms of perceptual features of the task, the "feedback" version containing more visual effects and sound effects. Similarly in Study Three, "Star Fly 3" and the "feedback" version of the "Space Trek" also differed in perceptual features as well as task difficulty. For example, "Star Fly 3" was visually more complex, a greater range of rocket movements were available, there were levels and it was possible to die in the game. Therefore, in order to provide stronger support for our grounded theory notion that immersion is self-motivated attention, it will be important for us to control these factors in subsequent experiments.

Studies Four and Five: Awareness of Distraction Altered as a Result of Player's Game Performance

5.1. INTRODUCTION

The experimental studies in the previous chapter showed gaming conditions that differ in immersion (as a result of differences in feedback and other game features) will also differ in terms of RWD, as measured by recall of auditory distracters. The findings support our grounded theory claim somewhat, as the game conditions did differ in their sense of progression; however they also differed in terms of other game features that were unrelated to game progression, such as one game having better graphics. Therefore, in order to validate the grounded theory claim that a sense of progression is an important part of game immersion, we now turn to conducting experiments in which the conditions differ in terms of sense of progression only.

5.1.1. Manipulating Person Variables

As well as a player's sense of progression being influenced by game factors, individual differences can also influence the sense of progression experienced. For example, it is easy to imagine the scenario where two people play the same game but whereas one person might find it highly immersive the other person does not. This could be due to a number of factors, for example a player might find a game too difficult or they might be unable to get to grips with the controls. Thus our grounded theory predicts that the better a player performs in a game, the greater sense of progression they will experience. As a result of this sense of progression the gaming experience will be more immersive, RWD being an aspect of this experience.

Previous research on individual differences in game performance suggests that people can often be divided into two categories, experts and novices. Experts tend to perform well and are strategic in how they approach obstacles; in contrast, novices are less strategic and struggle more in the game (Maglio et al., 2007). However, whereas past research focuses on people that have played a particular game a lot compared to people that have played the same game very little, in the current studies we will be comparing people that differ in their performance of a game which they are playing for the first time. Previous experience of the genre of the game is likely to play a role; however one would be hesitant to call any of the participants that perform well "experts", as they are unlikely to perform as well another person that has been playing the particular game more regularly. Therefore the labels "high performers" and "low performers" are used instead.

Another important aspect of the current studies is that it was suspected that a greater variation in previous gaming experience might lead to a greater variation in gaming performance. For the studies presented in the previous chapter, Studies Two and Three, previous gaming experience was not measured; however informal discussions between the experimenter and the participants suggest that none of the participants played games a great deal, all participants were either casual gamers or considered themselves complete novices. Therefore in Studies Four and Five, when advertising for participants the need for people that play games a lot, as well as people that do not play games often, was emphasised.

In this chapter two studies will be described in total. Both of the studies investigate how awareness of distraction changes with the player's sense of game progression. Sense of progression was manipulated via person variables (see Figure 12), comparing people that perform well in a game (sense of progression) to people that perform poorly in a game (no sense of progression).

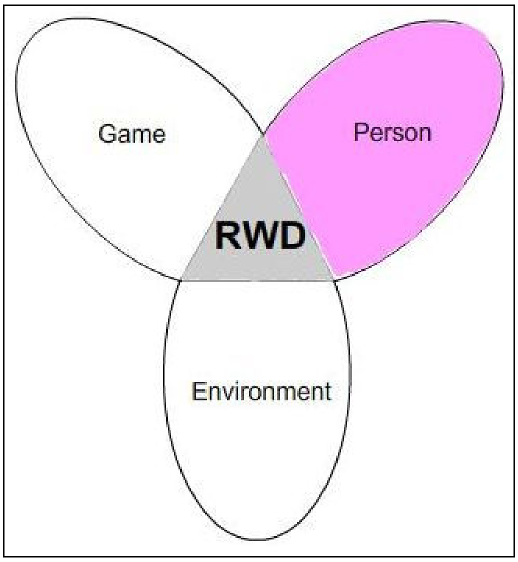

Figure 12. A Figure Depicting that Studies Four and Five Manipulated Person Variables, Investigating the Effect this had on Real World Dissociation.

For both studies, whether the participant was a "high performer" or a "low performer" was determined post hoc, after testing. However the studies differed in terms of the criteria used to define a "high performer" and a "low performer".

Overall the chapter shall be organised as follows: method and findings of Study Four; piloting the game "Rescue the Band", method and findings of Study Five; followed by a general discussion.

5.2. STUDY FOUR: COMPARING RECALL OF AUDITORY DISTRACTERS PRESENT DURING GAME-PLAY OF STAR FLY 3 FOR "HIGH PERFORMERS" AND "LOW PERFORMERS"

5.2.1. Aim

The aim of Study Four was to investigate the extent to which people are aware of auditory distracters during a challenging game, comparing people that perform well in the game and people that perform poorly in the game. The method of the "Star Fly 3" condition in Study Three was replicated; but this time recruiting participants of a broader range of gaming backgrounds, in the hope that this would lead to a greater variance in the game performance observed. Based on a game score / level cut-off point that was decided post hoc, participants were categorised into two groups for analysis: the "high performers" group and the "low performers" group.

5.2.2. Hypotheses

In terms of immersion:

- The "high performers" group will rate the game "Star Fly 3" as more immersive than the "low performers" group.

In terms of recall:

- The "high performers" group will recall fewer auditory distracters than the "low performers" group.
- The "high performers" group will recall fewer "irrelevant" auditory distracters than the "low performers" group; however the "high performers" group will not recall fewer "game-relevant" or "person-relevant" distracters than the "low performance" group.

5.2.3. Method

5.2.3.1. Participants

There were 18 participants in total. The participants were university students, recruited through an opportunity sample. The ages of the 18 participants ranged from 19-46 years, the mean age being 26 years (SD = 7.48). In terms of gender, 8 were female and 10 were male. All participants were paid four pounds for their time.

5.2.3.2. Star Fly 3

The game "Star Fly 3" involved controlling a rocket, avoiding asteroids and collecting power ups. It was played on a Dell PC. It is the same game as used in Study Three (found online on the website www.topgameszone.com). For more details about the game refer back to Section 4.6.

5.2.3.3. Distraction Sounds

The same 18 distractions that were used in the "Star Fly 3" condition of Study Three were used for Study Four (see Appendix 18). These distracters can be divided into three categories: relevant to the game, relevant to the person, or irrelevant. However two minor modifications were made, as a result of reflecting on Study Three and the suitability of the distracters. These modifications can be seen in Appendix 20.

Modification 1 was made because rather than just "moving" the rocket to the right and the left, in "Star Fly 3" the person's experience is one more of "flying" the rocket to the right and the left. In other words, there is more freedom in movement when controlling the rocket in "Star Fly 3" than that available in the game "Space Trek", the game for which the auditory distracters were originally designed for. Therefore this modification should make the distracter more game-relevant to "Star Fly 3".

Modification 2 was made because after Study Four was conducted it was realised that the irrelevant distracter "turn, turn, flip" was actually quite relevant in the "Star Fly 3" condition, as participants are using the controls to turn the rocket in the direction they want to fly in. Therefore it was changed to "slide, slide, flip", in order to make it less game-relevant.

A list of the final 18 distractions used in Study Four can be seen in Appendix 21. 6 of the distracters were game-related, 6 were person-related and 6 were irrelevant. Distraction sounds were played on a cassette recorder placed at the back of the room, behind where the participant would be sitting, and were paced to last for a duration of 10 minutes. All participants heard the same distractions.

5.2.3.4. IEQ

To measure immersion the modified IEQ was used, see Appendix 7. Details of how the IEQ scores were computed can be seen in Appendix 5.

5.2.3.5. Free Recall Test

The free recall test procedure used was the same as that described in Section 4.5.3.6. See Appendix 22 for a table of how each distraction item was broken down and scored.

5.2.3.6. Procedure

The design of Study Four was a pseudo independent measures design, as participants could only be classed as either "high performers" or "low performers" after game-play. A suitable cut-off point for "high performers" and "low performers" was decided once the data was collected based on score and level reached, so that the researcher could get an accurate view of performance in the sample as a whole.

The game "Star Fly 3" was played on a Dell PC. Participants were instructed that their aim was to clear the screen of all the asteroids and that they must see which level they could get to before losing all of their energy.

Participants were also instructed that during the game they would hear a number of auditory distractions played via a Casio cassette player, placed at the back of the room behind where they would be sitting. However they must try not to allow these distractions to stop them from their goal in the game, to achieve the highest score possible. Participants were not aware that they would later have to recall these distracters.

Once the participant was ready to begin the game, the experimenter explained that they would be leaving the cubicle so that their presence would not disrupt the participant's experience. However, in order to get an idea of how well the participant did in the game, the participant would be asked three questions on the experimenter's return: how many times did they restart the game, what was the highest level they had reached during game-play, and what was the highest score they had achieved. By informing the participant of this beforehand, this allowed the participant to take a mental note of these details while playing.

On leaving the cubicle the experimenter turned on the distraction sound. Each participant played the game "Star Fly 3" for approximately 10 minutes. Participants were instructed to click "play again" if they lost all of their energy before the time was up, and to try to perform better the second time. At the 10 minute mark, their game-play was interrupted as the experimenter re-entered the cubicle and they were told to stop playing the game.

On re-entering the cubicle the experimenter noted down the participant's number of restarts, highest level and highest score. Then the experimenter gave the participant the IEQ, which asked them to rate their experience of the game. The experimenter also presented the participant with the surprise recall test, instructing the participant to write down as much as he / she could remember about the auditory distracters.

All participants were debriefed at the end of the experiment and received four pounds payment.

5.2.4. Results

All statistical analyses were performed using SPSS 11.0. The results are presented in the following order: first the analysis of the game performance data, which allowed us to group participants into "high performers" and "low performers", then the IEQ data (immersion ratings, immersion factors); then the recall data (total number of distracters recalled; recall of game, person and irrelevant distracters).

5.2.4.1. Game Performance: Classifying High Performers and Low Performers

After collecting the data and viewing the range of scores it was decided that a high score of 900 would be the cut-off point to classify people as "high performers" and "low performers." Participants that scored below 900 only reached level 2 or 3. In contrast, participants that scored above 900 reached level 4-9, the mean being level 5. Therefore one would expect that the latter participants would have felt a greater sense of progression. See Table 52 for a summary of the game performance data for the "high performers" group and the "low performers" groups.

Table 52.

"Star Fly 3" Game Performance Data for the "Low Performers" Group and "High Performers" Group.

	Low Performers (n = 7)			High Performers (n = 11)		
	Range	Mean	SD	Range	Mean	SD
No. restarts	1-3	1.86	0.69	0-3	1.00	0.89
Highest level	2-3	2.86	0.38	4-9	5.00	1.67
Highest score	300-850	645.71	222.47	940-2645	1455.55	513.48

The "low performers" group consisted of 7 of the 18 participants. Their ages ranged from 19-46 years, the mean age being 28 years (SD = 8.98). In terms of gender, 6 were female and 1 was male.

The "high performers" group consisted of 11 of the 18 participants. Their ages ranged from 19-40 years, the mean age being 24 years (SD = 6.39). In terms of gender, 2 were female and 9 were male.

Using these groupings, we then turned to analysing the immersion and recall data.

5.2.4.2. Immersion Ratings

As can be seen in Table 53, the "high performers" group rated "Star Fly 3" approximately 9 points more immersive than the "low performers" group. However an independent samples *t*-test revealed that this difference was not significant, $t_{(16)}$ = -.995, p=.334.

Table 53.

Immersion Ratings of the Game "Star Fly 3" for the "Low Performers" Group and "High Performers" Group.

	Low Performers		High Performers	
Immersion:	Mean	SD	Mean	SD
- IEQ Immersion Score	141.14	22.62	151.82	21.92
- Single Question Measure	6.43	1.51	7.09	1.70

For the single question measure of immersion the "high performers" group also rated the game as more immersive than the "low performers" group. However again this difference was not significant, $t_{(16)}$ = -.839, p=.414.

Pearson correlations revealed that participant responses to the single question and multiple question measures of immersion were highly correlated for the "high performers" group ($r_{(n=11)}$ = .934, p<.001); however they were not significantly correlated for the "low performers" group ($r_{(n=7)}$ = .597, p=.028). This suggests that the multiple question measure of immersion is accurately reflecting participants' immersive experiences for the "high performers" group moreso than the "low performers" group.

In terms of confounding variables, again age and gender were identified as possible factors that could influence immersion ratings (for similar reasons as those described in Section 4.3.3.1). Pearson correlations revealed that there was no significant correlations between age and immersion for both the "low performers" group ($r_{(n=7)}$ = .317, p=.489) and the "high performers" group ($r_{(n=11)}$ = -.143, p=.674). Also an independent samples *t*-test revealed that there was no significant difference between the immersion ratings of males and females ($t_{(16)}$ = .263, p=.796).

5.2.4.3. Immersion Factors

To explore the differences in immersion between the two games further, participant scores for the five immersion factors were computed. As can be seen in Table 54, the "high performers" group rated the game slightly higher than the "low performers" group for the immersion factors RWD, challenge and control. However there was little difference between the two groups for cognitive involvement and emotional involvement.

Table 54.

Immersion Factor Scores of the Game "Star Fly 3" for the "Low Performers" Group and "High Performers" Group.

Immersion Factors:	Low Performers		High Performers	
	Mean	SD	Mean	SD
- Cognitive Involvement	53.43	6.16	53.91	9.31
- Real World Dissociation	22.14	7.24	28.64	4.88
- Emotional Involvement	56.14	10.19	57.73	9.37
- Challenge	18.43	3.69	20.18	2.44
- Control	29.71	6.18	33.27	5.69

Independent sample *t*-tests (Bonferonni correction, significance level =.01) revealed that the differences between the groups were not significant for any of the five immersion factors: cognitive involvement ($t_{(16)}$ = -.120, p=.906), real world dissociation ($t_{(16)}$ = -2.284, p=.036), emotional involvement ($t_{(16)}$ = -.338, p=.740), challenge ($t_{(16)}$ = -1.220, p=.240) and control ($t_{(16)}$ = -1.251, p=.229).

5.2.4.4. Recall of Auditory Distractions

There were 18 auditory distracters played in total. As can be seen in Table 55, there is little difference between the recall of "high performers" and "low performers". An independent samples *t*-test revealed that this difference was not significant, $t_{(16)}$ = .756, p=.756.

Table 55.

Recall of Auditory Distracters for the "Low Performers" Group and "High Performers" Group.

	Low Performers		High Performers	
	Mean	SD	Mean	SD
Recall	3.86	1.70	3.64	1.27

5.2.4.5. Recall of Game, Person and Irrelevant Distracters

Out of the 18 distracters, 6 were game-relevant, 6 were person-relevant and 6 were irrelevant. As can be seen in Table 56, the "high performers" group was better at recalling game distracters (1.73), followed by person distracters (1.64) and then irrelevant distracters (0.27). The "low performers" group was better at recalling person distracters (2.21), followed by game distracters (1.29) and then irrelevant distracters (0.36). Also comparing the two groups, the "high performers" group recalled on average more game distracters (1.73 compared to 1.29), fewer person distracters (1.64 compared to 2.21), and fewer irrelevant distracters (0.27 compared to 0.36), compared to the "low performers" group. See Figure 13 for a means plot of the recall data.

Table 56.

Recall of Game-Relevant, Person-Relevant and Irrelevant Distracters for the "Low Performers" Group and "High Performers" Group.

Recall:	Low Performers		High Performers	
	Mean	SD	Mean	SD
- Game	1.29	0.64	1.73	0.90
- Person	2.21	0.95	1.64	0.71
- Irrelevant	0.36	0.56	0.27	0.52

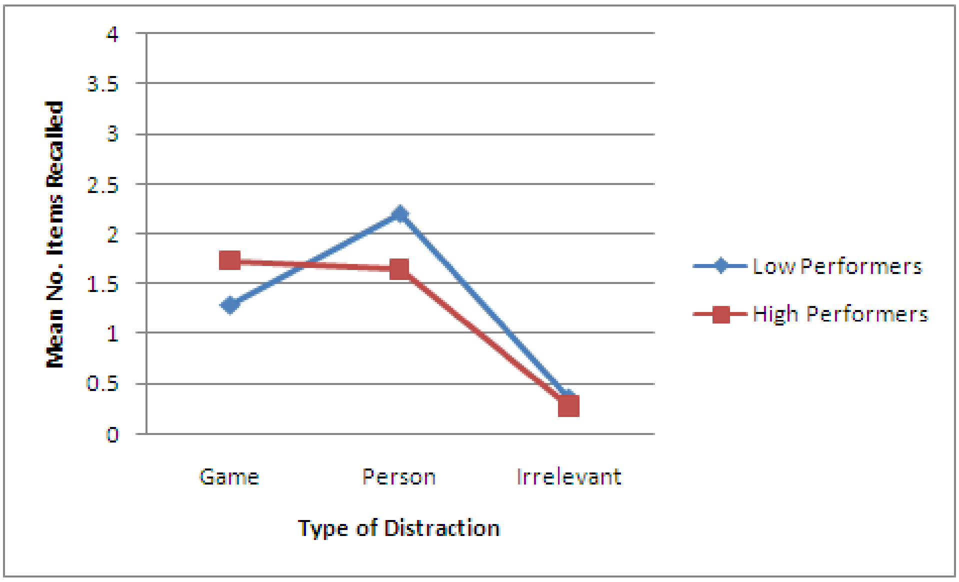

Figure 13. A Means Plot of the Recall of Game-Relevant, Person-Relevant and Irrelevant Distracters for the "Low Performers" Group and "High Performers" Group.

A mixed measures ANOVA test was conducted on the recall data. The test revealed that there was no main effect of type of distraction, $F_{(2, 24)}$ = 17.236, p=.001, and no main effect of participant group, $F_{(1,}$

$_{12)}$ = .601, $p<.453$. There was also no significant interaction between type of distraction and game condition, $F_{(2, 24)} = .970, p=.393$.

Independent sample *t*-tests conducted for each level of distraction confirmed that there was no main effect of participant group. The difference between the "high performers" group and the "low performers" group was not significant for the recall of game distracters, $t_{(16)} = 1.121, p=.279$, the recall of person distracters, $t_{(16)} = -1.477, p=.159$, or the recall of irrelevant distracters, $t_{(16)} = -.328, p=.747$.

5.2.5. Discussion

Study Four was conducted to investigate the extent to which people are aware of auditory distracters during a challenging game, comparing people that perform well in the game (the "high performers" group) and people that perform poorly in the game (the "low performers" group). Participants were classified as "high performers" and "low performers" depending on their score in the game, 900 points being the cut-off point that was decided post hoc.

The immersion hypothesis, that the "high performers" group would rate the game as more immersive than the "low performers" group, was not supported. Although the "high performers" group did rate the game "Star Fly 3" higher for immersion than the "low performers" group, with means ratings of 151.82 and 141.14 respectively, this difference was not significant. There were also no significant differences in immersion factors between the two groups: the "high performers" group did not experience significantly more cognitive involvement, real world dissociation, emotional involvement, challenge or control compared to the "low performers" group.

Both of the awareness hypotheses were also not supported. The "high performers" group did not recall significantly fewer auditory distracters than the "low performers" group: each group had a mean recall of 4 out of 18 items. Furthermore, the "high performers" group did not show a greater selectivity for relevance: they did not recall significantly fewer irrelevant distracters than the "low performers" group.

As an aside, if one compares these results to Study Three, it is interesting to note that the "Star Fly 3" condition of Study Three also had a mean recall of 4 out of 18 items; the pattern of data in the means plots for recall of game, person and irrelevant distracters is also similar (see Section 4.7). This suggests that the recall measure is reliable, "Star Fly 3" receiving similar recall results in two separate studies. Furthermore, whereas in the pilot study for Study Three the "Star Fly 3" game received a mean immersion rating of 146.50 (see Section 4.6); in Study Four the "high performers" group gave the game a higher rating, with a mean immersion rating of 151.82, whereas the "low performers" group gave the game a lower rating, with a mean immersion rating of 141.14. Again this suggests that the measures used were reliable: although the differences in immersion ratings between the performance groups were not significant, they were in the direction expected compared to the original study.

In summary, it appears that the grounded theory was not supported. Despite their differences in game performance, the "high performers" group did not find the game significantly more immersive than the "low performers" group. The "high performers" group were also not less aware of distracters" and did not show greater selectivity for relevance than the "low performers" group.

5.2.5.1. Limitations of Study Four

One possible explanation for the hypotheses not being supported could be the small size of the sample (7 "low performers", 11 "high performers"). If the difference between the groups was a small effect, i.e. one that is real but is difficult to detect, then one might have needed a bigger sample size in order for the small effect to be detected as significant. To investigate whether small effect size was a possible cause, Cohen's d was computed for the mean immersion scores ($d = 0.339$) and mean recall scores ($d = 0.104$). For the immersion data, as d is higher than 0.2 this indicates that there was a small effect. In other words, this indicates that there was a small significant difference in the immersion ratings of the "high performers" group and "low performers" group. For the recall data on the other hand, as d is 0.1, this indicates that the difference in recall scores between the "high performers" group and "low performers" group was at the level of natural variation.

Regarding our grounded theory, one would expect that if there was a small effect between the groups for immersion then there would be a small effect for recall also. Therefore one could interpret these results as evidence against the grounded theory, i.e. the results show that performing well in a game is related to increased immersion ratings, but not related to lower recall.

However, in this thesis we take another viewpoint. We argue that rather than the grounded theory being wrong, the lack of significance could be due to the way in which "high performers" and "low performers" were classified. Although the "low performers" group did not get through the levels as quickly as the "high performers" group, they all reached level 2 / 3. Therefore one could suggest that the "low performers" group did not experience lower levels of RWD because they were still able to get a sense of progression in the game. Like the "high performers" group, the "low performers" group were also overcoming game obstacles in their game-play and getting positive feedback for their performance.

If such an interpretation is correct, it is clear that the classification of "high performers" and "low performers" in Study Four was too simplistic. As outlined in the grounded theory, it is not just the case of people performing less well that leads to a person being more aware of their real world environment (low RWD), but people performing less well to such an extent that they are unable to get a sense of progression. For Study Five, in order to classify participants more in line with the grounded theory, a more difficult game was used. The game "Rescue the Band" was chosen because it appeared that participants could be grouped into those that were unable to follow the blue van, thereby getting little positive feedback and little sense of progression, and those that were able to follow the blue van, thereby getting some positive feedback and a greater sense of progression.

Also in Study Five a new measure of awareness of distracters was used: reaction time to a visual distracter. This scenario was thought to be analogous to a Windows pop up that appears on the outskirts of a game telling the user to check their computer for viruses (see Figure 14 for an example screen shot of this scenario). The pop up only disappears when is it clicked. However, if a person is immersed in playing a game one might expect that they might not notice the pop up straight away and would be slower to react to it.

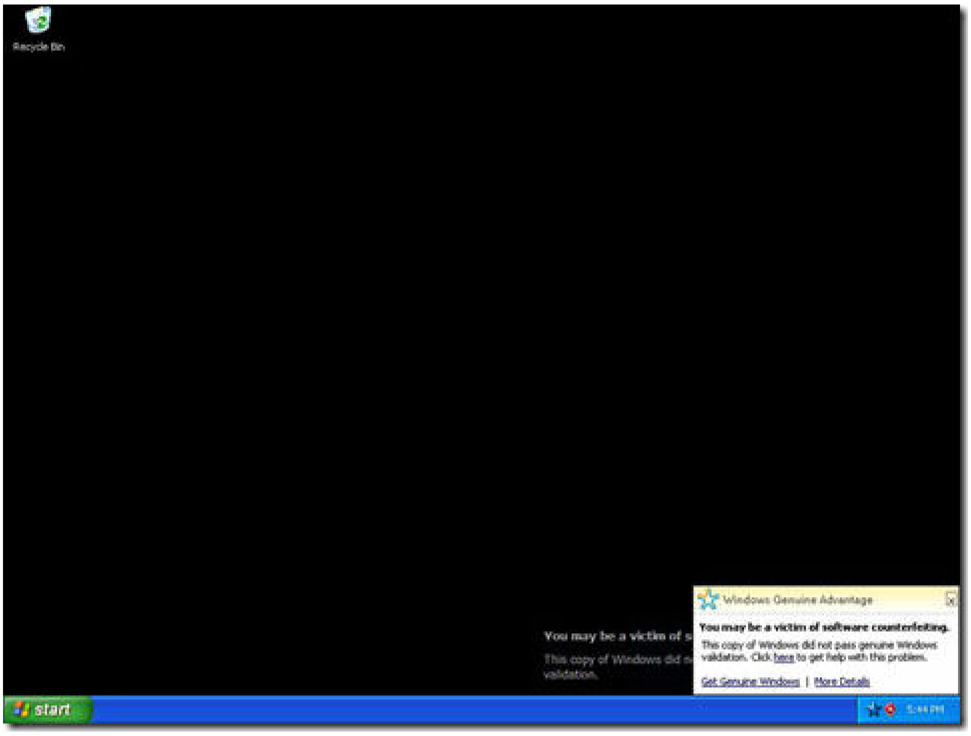

Figure 14. A Screenshot of a Windows Pop-Up that Sometimes Appears at the Bottom of the Screen, Informing the User of Viruses.

Participants were classed as either "high performers" or "low performers" post hoc, based on the experimenter's observations of their ability to cope with the demands of the game. Whereas the experimenter's presence might have been distracting in the presence of auditory distracters, e.g. the participant might think it is the experimenter speaking, it was thought that the experimenter's presence would not be distracting in the current context as no auditory distracters were involved.

A pilot study shall now be described, which gives more details about the game "Rescue the Band" and confirms that people's experiences of game immersion varied, depending on whether they were able to cope with the demands of the game. The pilot study also allowed us to determine an appropriate time for the visual distracter to appear and to confirm that the experimenter's presence would not be distracting during game-play. The description of the pilot study will then be followed by a description of the method and results of Study Five.

5.3. PILOTING RESCUE THE BAND

5.3.1. Aim

The aim of the pilot study was to confirm that people's experiences of game immersion varied, depending on whether they were able to cope with the demands of the game "Rescue the Band". This would allow us to assess whether the game "Rescue the Band" was suitable for Study Five, in which we aimed to investigate the extent to which participants are aware of a visual distracter, comparing people that performed well in the game ("high performers") and people that performed poorly in the game to such an extent that they were unable to gain a sense of progression ("low performers").

Another aim of the pilot study was to determine the average time that participants played "Rescue the Band" before they reached game over. This would allow us to determine an ideal time for when the visual distracter should appear in Study Five, and it would also allow us to determine whether it would be necessary to tell participants to replay the game when they reached game over.

A further aim was to confirm that the experimenter's presence would not be distracting during game-play.

5.3.2. Method

5.3.2.1. Participants

There were 9 participants in total. The majority of participants were university students, recruited through an opportunity sample. In terms of gender, 6 were female (66%) and 3 were male (33%). Ages ranged from 23-29 years, the mean age being 25 years (SD = 2.29).

5.3.2.2. Rescue the Band

In contrast to Study Four, which used a 2D space-themed game, it was thought that a driving game involving a first person perspective and a virtual environment might be more difficult, leading to a wider range of immersive experiences. The game "Rescue the Band" was found online on the website www.animixgames.com. The game was chosen in particular because it was rated the most popular driving game on the website. Furthermore, during a test run it appeared to be a game in which participants could be grouped into those that were unable to cope with the demands of the game and unable to keep up with the blue van (no positive feedback, little sense of progression) and those that were able to cope with the demands of the game and able to keep up with the blue van (positive feedback, greater sense of progression). The background music provided by the band OK GO was another advantage, because their music is upbeat and seemed like it would add to the atmosphere and the immersiveness of the game.

In the initial screen of the game players were instructed that the band OK GO had been kidnapped and that it was their job to catch the kidnappers. They must do this by chasing the blue van and ramming into the back of it with their car. As well as explaining the objective of the game, the instruction screen also explained the controls at the bottom of the screen. The arrow keys of the keyboard are used to make the car move forward, left, right and break. The space key is used to put the car into turbo.

Another feature of the instruction screen is that the name of the OK Go song being played is displayed at the bottom, as well as white outlines of the four members of the OK GO band (bottom left) and the player's score (bottom right). These features are also present on the game screen. Players must click "go" when they have finished reading the instructions and are ready to begin the game.

Figure 15 shows a screenshot of the game itself. The player is controlling the red car (middle of the screen), and must ram it into the back of the blue van with the words "HELP!" written on the window (left of the screen). The player must keep doing this until the "THEM" red energy bar decreases to 0. When this happens, one of the kidnapped band members will be released.

Figure 15. A Screenshot of the Game "Rescue the Band".

Although the blue van starts off relatively close to the player's car it will soon zoom off ahead, and so the player must drive through the traffic to catch up, dodging the various other vehicles on the road. If the player hits any of the other vehicles, the "YOU" red energy bar will decrease. Sometimes there are also spanners on the road. If the player drives over one of the spanners some of the energy in the "YOU" red energy bar is restored.

OK GO music plays throughout the game, creating an upbeat atmosphere. The voices of the band members can also be heard during the game, saying phrases such as "We'll never make it to the gig on time!", "Hurry up we gotta show to play!", "Get going!" When the player crashes into another car voices can be heard saying "Ouch!" or "Ow ow ow!" When the player crashes into a taxi an angry horn sound is played, "Beep beep!" When the player crashes into a police car, a voice can be heard saying "Watch out copper!" When the player drives over a spanner a "Ding ding!" sound is heard.

There are two ways in which the player can lose the game. If the "YOU" red energy bar reaches 0, the game will be over. If the player does not retrieve the kidnapped band member within a set time limit, this also results in the game being over. The timer can be seen on the top right of the game screen, Figure 15.

If an OK GO band member is successfully rescued, one of the white outlines of the four band members in the bottom of the screen is filled in white, to signify the successful rescue. The player's score is also displayed, on the bottom right of the screen. The player is then instructed that they must rescue the next band member, and they must click "go" to proceed. The next level follows the same format as before: players must chase the blue van and ram into it until the "THEM" red energy bar decreases to 0. They must do this within the time limit and also without losing all of their energy in the "YOU" red energy bar.

If the player reaches game over, the player is instructed that they have failed in their mission and again the player's score is displayed in the bottom right of the screen. If the player chooses to play again, they can click "play again".

5.3.2.3. Game Statistics

A form was created for the experimenter to fill in as the participant played the game. On this form the experimenter recorded the time that the participant started playing the game, the time that they reached the next level / reached game over, and their score. This format was repeated on the form several times, to allow for the participant possibly replaying the game. There was also space on this form for the experimenter to make notes on the participant's performance, whether the participant was able to keep up with the blue van, whether the participant was pleased while playing the game or frustrated, and any comments the participant made during game-play.

5.3.2.4. IEQ

To measure immersion the modified IEQ was used, see Appendix 7. Details of how the IEQ scores were computed can be seen in Appendix 5.

5.3.2.5. Procedure

The game "Rescue the Band" was played on a Gateway laptop. Participants were instructed that their aim was to rescue the band member of OK GO, by chasing the kidnapper's blue van down the highway and ramming their car into the back of it. They would be playing the game for a 20 minute period and must try to progress through as many levels as possible. Participants were further instructed that if they reached "game over" before the time limit was up, they can click "replay" and try again. While the participant played the game, the experimenter sat behind them and filled in a form regarding the participant's game statistics and made notes on the participant's performance.

At the 20 minute mark the experimenter interrupted the participant's game-play and instructed them to fill in the IEQ and whether they had any further comments about their experience. Then they were debriefed. They received no payment for their participation.

5.3.3. Results

All statistical analyses were performed using SPSS 11.0. The results shall be presented in the following order: "Rescue the Band" game statistics, immersion ratings, and then an exploration of how game performance corresponds with immersion ratings.

5.3.3.1. Rescue the Band Game Statistics

The mean play duration of level 1, the mean highest level and score reached in the 20 minutes of game-play, and the mean number of times participant's replayed the game in the 20 minutes of game-play, were computed for the game "Rescue the Band"; see Table 57.

As can be seen in Table 57, the time duration for players to reach gamer over varied from 2-18 minutes, the average being 11.44 minutes. The time duration for players to complete / fail level 1 varied from 2 minutes to 20 minutes, the average being 7.67 minutes. During the 20 minutes of game-play, the highest level reached varied from Level 1 to Level 4, the mean being Level 2. On average participants reached game over and had time to click replay and begin starting the game again from Level 1 once (although not necessarily completing the second game before the 20 minutes were up).

Table 57.

Game Statistics for "Rescue the Band".

Game Statistics	Mean	SD	Range
Play Duration before 1st Game Over	11.44 mins	5.03	2-18 mins
Play Duration of Level 1	7.67 mins	5.07	2-15 mins
Highest Level Reached in the 20 mins	Level 2.11	1.05	Level 1-4
Highest Score Reached in the 20 mins	18608.89	4869.87	12605-28285
Number of Replays in the 20 mins	1 replay	0.5	0-2 replays

The number of participants that passed / failed Level 1 was also tallied, see Table 58. Out of the 9 participants, 5 participants completed Level 1 the first time they played it (rescued the band member) and 4 participants did not successfully complete Level (reached game over, did not rescue the band member). During the 20 minutes of game-play, only 3 of these 4 participants did not rescue a band member at least once, i.e. they never got beyond Level 1.

Table 58.

Number of Participants that Passed / Failed Level 1 of the Game "Rescue the Band".

	Successfully completed Level 1 first time of playing it		Successfully completed Level 1 at least once during the 20 mins	
	Frequency	Percentage	Frequency	Percentage
Yes, rescued band member	5	55.6%	6	66.7%
No, did not rescue band	4	44.4%	3	33.3%

The experimenter's observations reveal that the main reason why these 3 participants were unable to complete Level 1 was that they lost track of the blue van early on in the game. As a result they ended up driving along the highway aimlessly with no target in sight until the time limit was up. One of the participants started to fiddle with the sound of the game as they grew bored. The other two participants complained to the experimenter towards the end of the 20 minutes, saying "Can I stop now? I can't see the blue van anywhere, this game is too hard!"

In contrast, the participant that was not able to complete Level 1 the first time they played it but did complete it when they replayed the game had appeared engaged while playing the game for the first time, even though they ended up losing Level 1. This is because they had come close to rescuing a band member. This participant had faltered because they had crashed into too many of the surrounding cars, not because they had lost track of the blue van. Therefore even though they lost Level 1 the first time they played the game, they had still been able to ram into the back of the blue vans a few times and lower the kidnapper's energy bar, getting some positive feedback. Hence the second time they played they were able to learn from their mistakes, driving more carefully along the highway, and successfully complete Level 1 the second time round.

5.3.3.2. Immersion Ratings

As can be seen in Table 59, the IEQ ratings varied from 121-207, the mean immersion rating being 157.11. Participant responses for the single question measure of immersion also varied, some participants rating the game as high as 9 out of 10 while other participants rating it as low as 3 out of 10, the mean rating being 7 out of 10.

Table 59.

Immersion Ratings of the Game "Rescue the Band".

Immersion:	Mean	SD	Range
- Multiple Question Measure	157.11	26.24	121-207
- Single Question Measure	6.44	1.94	3-9

A Pearson correlation revealed that participant responses to the single question and multiple question measures of immersion were highly correlated ($r_{(n=9)}$ = .886, p<.001). This suggests that the multiple question measure of immersion is accurately reflecting participants' immersive experiences.

In terms of possible confounding variables that could influence immersion ratings, another Pearson correlation revealed that there was no significant correlation between age and immersion ($r_{(n=9)}$ = -.249, p=.517). Also an independent samples *t*-test revealed that there was no significant difference between the immersion ratings of males and females ($t_{(9)}$ = .417, p=.689).

5.3.3.3. Immersion Ratings and Game Performance

In order to explore whether the variation in immersion ratings were corresponding with the variation in participant performance, next we decided to look at individual participant's immersion scores, see Table 60. Comparing the 6 participants that were able to complete Level 1 at least once during the 20 minutes of game-play (P1, P2, P5, P6, P8, P0) and the 3 participants that were not (P3, P4, P7), it is evident that the latter rated the game with some of the lowest scores for both the multiple question measure of immersion and the single question measure of immersion.

To explore the differences between the two games further, participant scores for the five immersion factors were also computed, see Table 61. Looking at the data we can see that the three participants that were unable to complete Level 1 at least once during game-play rated the game lower for cognitive involvement (two of the lowest scores), real world dissociation (second and third lowest scores) and control (two of the lowest scores).

Being an exploratory pilot study, statistical tests were not conducted to compare the two groups. Furthermore, with group sizes of 3 and 4 it would have been a very small sample for comparison.

Table 60.

Individual Immersion Ratings of the Game "Rescue the Band " for All Pilot Study Participants.

	Successfully completed Level 1 at least once during the 20 mins	Multiple Question Measure of Immersion	Single Question Measure of Immersion
P1	Yes	142.00 *	7
P2	Yes	182.00	8
P3	No	157.00	6 *
P4	No	136.00 *	4 *
P5	Yes	142.00 *	6 *
P6	Yes	156.00	7
P7	No	121.00 *	3 *
P8	Yes	171.00	8
P9	Yes	207.00	9

** = 1 of the 4 lowest immersion scores*

Table 61.

Individual Immersion Factor Scores of the Game "Rescue the Band" for All Pilot Study Participants.

	Cognitive Involvement	Real World Dissociation	Emotional Involvement	Challenge	Control
P1	62.00	15.00 *	62.00	24.00	32.00 *
P2	63.00	35.00	69.00	25.00	46.00
P3	54.00 *	26.00 *	60.00	22.00 *	41.00
P4	42.00 *	21.00 *	58.00 *	25.00	33.00 *
P5	44.00 *	29.00	52.00 *	19.00 *	33.00 *
P6	54.00	34.00	48.00 *	16.00 *	39.00
P7	43.00 *	24.00 *	46.00 *	26.00	27.00 *
P8	61.00	28.00	68.00	21.00 *	36.00
P9	67.00	38.00	77.00	28.00	48.00

** = 1 of the 4 lowest immersion scores*

5.3.4. Discussion

The pilot study was conducted to confirm that people's experiences of game immersion varied, depending on whether they were able to cope with the demands of the game "Rescue the Band". Looking at participant's individual immersion ratings, comparing the 5 participants that were able to complete Level 1 at least once during the 20 minutes of game-play and the 3 participants that were not, it is evident that the latter rated the game with some of the lowest scores for both the multiple question measure of immersion and the single question measure of immersion. Also looking at participants' individual scores for the immersion factors, it is evident that the three participants that were unable to complete Level 1 at least once during game-play, compared to the other participants, rated the game particularly low for cognitive involvement, real world dissociation and control. This suggests that a person's performance in the game is related to the level of immersion that they experience, as measured by the IEQ.

Furthermore, it is evident that it is not whether you complete or lose Level 1 that matters; it is whether or not you are able to track the blue van that is important. One participant was not able to complete Level 1 the first time they played it but they had still appeared engaged because they had come close to rescuing a band member, gaining some positive feedback. When this participant played the game the second time round they were able to learn from their mistakes and did complete Level 1. In line with the grounded theory, this suggests that a person is immersed when they are doing well in a game, but also when they come close to doing well. In contrast, the three participants that did not complete Level 1 at least once during the 20 minutes of game-play appeared bored throughout: they lost track of the blue van early on in the game and never came close to rescuing a band member, thereby gaining no positive feedback for their actions and no sense of progression.

These pilot study findings re-enforce the conclusions of Study Four, in that a classification of "high performers" and "low performers" in terms of scores or level reached is too simplistic. As outlined in the grounded theory, it is not just the case of people performing less well, but people performing less well to such an extent that they are unable to get a sense of progression. The observations of the experimenter will therefore be important in Study Five, in order to group participants into those that were unable to follow the blue van, thereby getting little positive feedback and little sense of progression, and those that were able to follow the blue van, thereby getting some positive feedback and a greater sense of progression.

Being an exploratory pilot study, statistical tests were not conducted on the immersion data to compare the two sub groups of gamers. Therefore in Study Six immersion data will be collected again, in order to confirm that the "high performers" (people that performed well in the game, able to track the blue van) and "low performers" (people that performed poorly in the game to such an extent that they were unable to gain a sense of progression, unable to track the blue van) significantly differ in their immersive experiences.

As an aside, it is interesting to note that the game "Rescue the Band" was rated a mean immersion rating of 157.11. This is higher than the mean immersion ratings of all of the games we have piloted so far: the "feedback" game was rated a mean of 142.50, see Section 4.3; the "Star Fly 3" game was rated a mean of 146.50, see Section 4.3. Part of the reason why on average "Rescue the Band" was rated the highest could be that the game is more complex, involving a first person perspective and a VE.

Furthermore note the IEQ appears to be reliably reflecting participants' immersive experiences. A high correlation was found between the IEQ and a single question measure of immersion. Also in terms of confounding variables, there were no significant effects of age or gender.

Another aim of the pilot study was to determine the average time that participants played "Rescue the Band" before they reached game over, in order to decide an ideal time for the visual distracter to appear in Study Five. Due to the variation of participants' performance, some participants reaching Level 4 the first time they played the game, others unable to get past Level 1, we decided that rather than basing the timing of the distracter on play duration until game over we would specifically look at the play duration of Level 1. This way it would be more likely that the distracter is appearing when the participant is playing the game for the first time, rather than re-playing the game. The results revealed that the average play duration for Level 1 was 7.67 minutes. Therefore it was decided that 5 minutes would be an ideal time for the visual distracter to appear, as it was likely that the participant would still be in the middle of playing Level 1. Furthermore, we hoped that by this point it would be clear to the experimenter observing the participant' game-play whether the participant was close to rescuing the band member or not at all when the distracter appears.

Just in case some participants in Study Five reached game over before 5 minutes, i.e. they crashed into too many of the surrounding cars in Level 1, it was decided that in Study Five the participants would be told to re-play the game if they lost and keep playing until instructed to stop. However a key aspect of the experimental procedure is that participants would not be told when they would be instructed to stop, or how this instruction would be displayed to them. Therefore when the visual distracter appears, a small "pop up" at the bottom of the screen telling them "the experiment is over" and you must "click here", this should come as a surprise and be unexpected.

A further aim of the pilot study was to confirm that the experimenter's presence, sitting behind the participant and making notes about whether or not they are able to track the blue van, would not be distracting for the participant during game-play. The pilot study revealed that the experimenter's presence was not distracting for the majority of participants, who just got on with playing the game. Two of the participants that performed badly in the game did turn to the experimenter to complain "Can I stop now?" towards the end of the 20 minutes of game-play. However, seeing as the game-play time for the experimental study would not be for as long as 20 minutes, game-play in Study Six being a maximum of 10 minutes, the presence of the experimenter was therefore deemed okay for Study Five.

5.4. STUDY FIVE: COMPARING REACTION TIMES TO A VISUAL DISTRACTER PRESENT DURING GAME-PLAY OF RESCUE THE BAND FOR "HIGH PERFORMERS" AND "LOW PERFORMERS"

5.4.1. Aim

The aim of Study Five was to investigate the extent to which people are aware of a visual distracter during a challenging game, comparing people that perform well in the game, and people that perform poorly in the game (to the extent that they do not have a sense of progression). Participants were recruited from a broad range of gaming backgrounds, in the hope that this would lead to a greater variance in the game performance observed. Based on the experimenter's observations of the participants' performance in the game "Rescue the Band", participants were categorised into two groups for analysis: the "high performers" group and the "low performers" group.

5.4.2. Hypotheses

In terms of immersion:

- The "high performers" groups will rate the game "Rescue the Band" as more immersive than the "low performers" group.

In terms of reaction times:

- The "high performers" group will have a slower reaction time to the visual distracter, being slower to click it than the "low performers" group.

5.4.3. Method

5.4.3.1. Participants

There were 40 participants tested in total; however 4 participants were excluded from the sample (the reasons for this will be described in the results section), therefore the analysis is based on the results of 36 participants. The majority of participants were university students, recruited through an opportunity sample. In terms of gender, 30 were female and 6 were male. Ages ranged from 19-30 years, the mean age being 20.9 years (SD = 2.40).

5.4.3.2. Rescue the Band

The game "Rescue the Band" was used, for more details about the game see Section 5.3.

5.4.3.3. Visual Distracter

The idea behind the visual distracter was that it would be analogous to a Windows pop up that appears on the outskirts of a game, telling you to check your computer for viruses. However for this particular pop up we wanted to make sure that the participant's clicked it when they noticed it. Therefore we made it an instruction relevant to the game, "End of Experiment – Click Here".

The visual distracter was created using Visual Basic 6.0. The visual distracter screen was displayed next to the game screen, on the right-hand side, see Figure 16. At first the visual distracter consisted of text in a large font (font size 15) in the centre of the visual distracter screen that read "Click to Start". When the button was clicked the text and the button disappeared, and the timer was started.

Figure 16. Screenshot of the Game "Rescue the Band", with the Visual Distracter Displayed on the Right of the Screen.

After 5 minutes, text re-appeared on the visual distracter screen, this time in a small font (font size 5) at the bottom of the screen; as shown in Figure 16. This new text read "End of Experiment – Click Here". Over time this text gradually increased in size, to make it more noticeable. After 1 minute it was increased to font size 10. After another minutes it was increased to font size 15.

When the button was clicked the text and the button disappeared, and the timer was stopped. The reaction time measure is from when the second button first appeared (the 5 minute mark) to when the second button was clicked. This was recorded by the Visual Basic program. The size of the distracter text when the button was clicked was also recorded, size 1 = font size 5, size 2 = font size 10, size 3 = font size 15.

5.4.3.4. IEQ

To measure immersion the modified IEQ was used, see Appendix 7. Details of how the IEQ scores were computed can be seen in Appendix 5.

5.4.3.5. Procedure

The design of Study Five was a pseudo independent measures design, as participants could only be classed as either "high performers" or "low performers" after game-play. This classification was based on the experimenter's observations of whether or not the participant was able to track the van and rescue a band member / come close to rescuing a band member.

The game "Rescue the Band" was played on a Dell PC. Participants were instructed that their aim was to rescue the band member of OK GO, by chasing the kidnapper's blue van down the high way and ramming their car into the back of it. They were further instructed that at some point they would be told when to stop playing; however they were not told how these instructions would be given. If they reached "game over" before this point, they were told to click "replay" and play the game again. Participants were informed that the experimenter would be sitting behind them and making notes throughout.

The game was to be played on a split screen, with the game displayed on the left half of the screen and the Visual Basic program on which the visual distracter would be shown displayed on the right half of the screen. When the participant was ready to play the game, they were told to click the button on the visual distracter screen with text that said "Click to Start", and then immediately click the game screen and start playing. After five minutes a button re-appeared on the visual distracter screen, with text that said "End of Experiment – Click Here". The time it took for the participant to click the button from when it first appeared was the reaction time measure. If the participant still had not clicked the button after 10 minutes of game-play, the experimenter interrupted them and told them to click the button and stop playing.

The experimenter then gave the participant the IEQ, which asked them to rate their experience of the game. All participants were debriefed at the end of the experiment. They received no payment.

5.4.4. Results

All statistical analyses were performed using SPSS 11.0. The results shall be presented in the following order: first the experimenter's observations of the participants' game performance, which allowed us to group participants into "high performers" and "low performers"; then the IEQ data (immersion ratings, immersion factors); and finally the reaction time data.

5.4.4.1. Game Performance: Classifying High Performers and Low Performers

Classifications of participants as "high performers" and "low performers" were originally to be based on the experimenter's observations of whether or not the participant was able to track the van and rescue a band member / come close to rescuing a band member. However, on observing participants it was evident that a further detail to this classification was needed: whether or not the participant was able to track the van and rescue a band member / come close to rescuing a band member *at the moment* when the distracter appeared. For example, as shall soon be described, two participants did well in rescuing a band member within the first couple of minutes appeared, however at the time the distracter appeared they were observed to be frustrated and had lost track of the van, no longer close to rescuing a band member.

There were 40 participants tested in total, however 4 participants were excluded from the sample. One participant was excluded because they guessed the motive of the experiment and said that they purposefully paid attention to the distracter screen. Three participants were excluded because the distracter happened to appear at the same time as the level ended and they were waiting for the next level to load; for the purposes of this experiment, we only wanted to include data from participants that were in the middle of game-play when the distracter appeared. Therefore the analysis is based on the results of 36 participants.

The "low performers" group consisted of 14 of the 36 participants. Their ages ranged from 19-30 years, the mean age being 21 years (SD = 3.09). In terms of gender, 13 were female and 1 was male. Participants in the "low performers" group were observed to be unable to track the van, often losing track of it and driving along the highway aimlessly, feeling lost. They did not appear able to cope with the demands of the game. The majority of the participants were not close to rescuing a band member when the visual distracter appeared at the 5 minute mark. Two of the participants in this category did rescue a band member very quickly early on, however they were still classed as "low performers" because on starting Level 2 they lost track of the blue van and grew frustrated, displaying similar behaviours to the other "low performers" when the visual distracter appeared on the screen. The comments written by participants in the "low performers" group after the game appear to support these observations. For example, several participants described the game as "too hard" and said that they felt "frustrated" that they kept losing track of the car they were supposed to be chasing.

The "high performers" group consisted of 22 of the 36 participants. Their ages ranged from 19-26 years, the mean age being 21 years (SD = 1.89). In terms of gender, 17 were female and 5 were male. Participants in the "high performers" group were observed to be able to keep track of the van, hitting it and either rescuing a band member, or coming close to rescuing a band member at the time when the visual distracter appeared at the 5 minute mark. They appeared to be able to cope with the demands of the game. The comments written by participants in the "low performers" group after the game appear to support these observations. For example, one participant wrote that they were "focused on the game, totally oblivious to presence of another person in the room at times". Another participant wrote that the game was "quite fun, I didn't notice it was the end of the experiment."

The game statistics also support these groupings, see Table 62. As can be seen in the table, whereas the "high performers" reached level 2 of the game on average (rescued a band member), the majority of "low performers" stayed on level 1 (did not rescue a band member). Also the average highest score achieved by the "high performers" group was 6774.29 points higher than the average score achieved by the "low performers" group.

Table 62.

"Rescue the Band" Game Performance Data for the "Low Performers" Group and "High Performers" Group.

	Low Performers (n = 14)			High Performers (n = 22)		
	Range	Mean	SD	Range	Mean	SD
Highest level	1-2	1.14	0.36	1-3	2.00	0.756
Highest score	90-8375	3360.71	2175.02	1795-17710	10135.00	4174.24

Compared to the pilot study, it was evident that participants progressed through the levels quicker in Study Five, perhaps due to the use of a different computer with faster processing power. For example, some participants were very quickly able to rescue the first band member and were onto Level 2 when the visual distracter first appeared at the 5 minute mark. However it must be noted that the opposite was not observed, e.g. when the distracter appeared none of the participants had lost Level 1 within this time and were replaying the game. Therefore the results of Study Five reflect immersion ratings and reaction times when playing the game for the first time for all participants.

5.4.4.2. Immersion Ratings

As can be seen in Table 63, the "high performers" group rated the game approximately 28 points more immersive than the "low performers" group. An independent samples *t*-test revealed this difference was significant, $t_{(34)} = 2.619$, $p=.013$.

Table 63.

Immersion Ratings of the Game "Rescue the Band" for the "Low Performers" Group and "High Performers" Group.

	Low Performers		High Performers	
Immersion:	Mean	SD	Mean	SD
- IEQ Immersion Score *	129.57	20.83	148.23	20.85
- Single Question Measure *	6.00	1.67	7.32	1.43

** p<.05; ** p<.01; ***p<.001*

The single question measure of immersion supported this finding. As can be seen in Table 63, the "high performers" group rated the game 1.32 points more immersive than the "low performers" group. An independent samples *t*-test revealed that this difference was significant, $t_{(34)} = 2.533$, $p=.016$. Also Pearson correlations revealed that participant responses to the single question and multiple question measures of immersion were positively correlated for the "high performers" ($r_{(n=22)} = .745$, $p<.001$); however the correlation was not significant for the "low performers" group ($r_{(n=14)} = .462$, $p=.097$). Therefore, this suggests that the multiple question measure of immersion is reflecting participants' immersive experiences for the "high performers" group moreso than the "low performers" group.

In terms of confounding variables, again age and gender were identified as possible factors that could influence immersion ratings (for similar reasons as those described in Section 4.3.3.1). Pearson correlations revealed that there was no significant correlation between age and immersion for both the "low performers" group ($r_{(n=14)} = .125$, $p=.671$) and the "high performers" group ($r_{(n=22)} = -.126$, $p=.577$).

In terms of gender differences the gender ratio of the sample was very unbalanced, with 30 females and only 6 males, and so it was decided that it would not be suitable to test for significant differences.

5.4.4.3. Immersion Factors

To explore the differences in immersion between the two games further, participant scores for the five immersion factors were computed. As can be seen in Table 64, the "high performers" group rated the game higher than the "low performers" group for the immersion factors cognitive involvement, real world dissociation, emotional involvement and control. However there was little difference between the two groups for challenge.

Table 64.

Immersion Factor Scores of the Game "Rescue the Band" for the "Low Performers" Group and "High Performers" Group.

Immersion Factors:	Low Performers		High Performers	
	Mean	SD	Mean	SD
- Cognitive Involvement **	45.29	7.77	52.64	6.04
- Real World Dissociation **	25.71	6.64	33.77	6.96
- Emotional Involvement	52.44	9.25	55.00	10.12
- Challenge	19.64	3.52	19.59	3.15
- Control	30.29	4.76	34.82	5.70

*** $p<.01$; *** $p<.001$*

Independent sample *t*-tests (Bonferroni correction, significance level =.01) revealed that the differences between the groups were significant for two of the immersion factors: cognitive involvement ($t_{(34)}$ = 3.184, p=.003) and real world dissociation ($t_{(34)}$ = 3.446, p=.002). However the differences between the groups were not significant for emotional involvement ($t_{(34)}$ = .767, p=.448), challenge ($t_{(34)}$ = -.046, p=.964) and control ($t_{(34)}$ = 2.472, p=.019).

5.4.4.4. Reaction Time to Visual Distracter

The reaction time measure is the number of seconds from when the second button on the visual distracter screen that said "End of Experiment – Click Here" first appeared at the 5 minute mark to when the second button was clicked. As can be seen in Table 65, the "high performers" group were slower to react to the visual distracter by an average of 54 seconds compared to the "low performers" group. Due to the big difference in standard deviations the non-parametric Mann Whitney test was used instead of an independent samples *t*-test. The test revealed that the difference between the groups for the reaction times was significant (U = 49.000, p<.001).

Table 65.

Reaction Time to Visual Distracter (in Seconds) for the "Low Performers" Group and "High Performers" Group.

	Low Performers (n = 14)			High Performers (n = 22)		
	Range	Mean	SD	Range	Mean	SD
Mean Reaction Time	5.76-197.04	46.83	60.54	6.59-600.00	200.72	161.12
Mean Size of Distracter	1-3	1.43	0.76	1-3	2.41	0.80

The size of the distracter when it was clicked was also recorded. There were 3 sizes in total (size 1 = font size 5, size 2 = font size 10, size 3 = font size 15), the distracter text increasing in size every 60 seconds to make it more noticeable. As can be seen in Table 65, whereas on average the "low performers" group clicked the visual distracter when it was at its smallest size, size 1; the "high performers" group on average clicked the visual distracter when it was slightly bigger, at size 2. A Mann Whitney test revealed that this difference was significant ($U = 64.000$, p=.003).

5.4.5. Discussion

Study Five was conducted to investigate the extent to which people are aware of a visual distracter during a challenging game, comparing people that perform well in the game (the "high performers" group) and people that perform poorly in the game to the extent that they do not have a sense of progression (the "low performers" group). Participants were classified as "high performers" and "low performers" post hoc depending on the experimenter's observation of their performance and whether or not they were gaining a sense of progression (tracking the van, close to rescuing the band member) at the particular moment when the visual distracter appeared.

The immersion hypothesis, that the "high performers" group would rate the game as more immersive, was supported. The "high performers" group rated the game a mean immersion rating of 148.23, which was significantly higher than the mean immersion rating of the "low performers" (mean = 129.57). The single question measure of immersion supported this finding, the "high performers" group rating the game a mean rating of 7 out of 10, which was significantly higher than the "low performers" group, whom gave the game a mean rating of 6 out of 10. In terms of confounding variables, there were no significant correlations between age and immersion.

Analysing the immersion data further, the results revealed that the "high performers" group rated the game significantly higher than the "low performers" group for two of the immersion factors: cognitive involvement and real world dissociation. This suggests that the "high performers" group found that the game absorbed their attention more and were less aware of their surroundings than the "low performers" group. However they did not find the game significantly more challenging, more emotionally involving and did not feel a greater sense of control.

The awareness hypothesis, that the "high performers" group would be slower to react to the visual distracter than the "low performers" group was also supported. The reaction time of "high performers" group was 200.72 seconds (over 2 minutes), which was significantly slower than the reaction time of the "low performers" group, 46.83 second (under 1 minute). Therefore this suggests that participants in the "low performers" group were more aware of information outside of the game, i.e. outside of the visual field of the game. As a result they were able to notice the visual distracter and react to it quicker than the "high performers".

Furthermore, whereas on average the "low performers" group clicked the visual distracter when it was at its smallest size, size 1; the "high performers" group on average clicked the visual distracter when it was slightly bigger, at size 2. Again this suggests that the "low performers" group were more aware of information outside of the game; the "high performers" group only noticing the distracter when the font was bigger and more noticeable.

Overall, it is evident that Study Five has been successful in validating a number of claims from the grounded theory. Comparing two groups of participants playing the same game, it showed that the "high performers" group found the game more immersive" and were less aware of a visual distracter than the "low performers" group. In line with the grounded theory, one can suggest that because participants in the "high performers" group were doing well in the game and were able to feel a sense of progression they became more immersed in the game-play, experienced greater RWD and were slower to react to the visual distracter as a result. In contrast, because the participants in the "low performers" group were unable to get past a certain point in the game they felt frustrated and were not able to get this same sense of progression. As a result they were less immersed in the game-play, experienced less RWD and were quicker to react to the visual distracter.

Another important outcome of the study is that it became clear that game performance is not a stable factor in game-play, and as a result neither is the level of immersion. For example, two participants did well in rescuing a band member within the first couple of minutes, however at the time the distracter appeared they were observed to be frustrated and had lost track of the van, no longer being close to rescuing a band member. These participants were classed as "low performers"; however if the distracter had appeared during those first couple of minutes when they were doing well they would have been classed as "high performers". Similarly, three participants were excluded from the study because the distracter happened to appear at the same time as the level ended and they were waiting for the next level to load; such participants of course noticed the distracter straight away, because they were not in the middle of game-play when the distracter appeared. These observations emphasise the momentary nature of game immersion and RWD: during one session of game-play a person can vary in how immersed they are in the game's events, depending on their current performance and sense of progression; thus how quickly a person notices a visual distracter depends on whether or not they are gaining a sense of progression (tracking the van, close to rescuing the band member) *at the moment* when the distracter appears.

Another finding of Study Five to highlight is that although the two groups differed significantly in overall immersion rating, when it came to the immersion factors the two groups only differed significantly for two factors: cognitive involvement and real world dissociation. One can suggest that a possible reason why the groups did not differ significantly for the immersion factor challenge is that both groups experienced the same level of challenge, the difference being that the "high performers" were able to cope with this challenge while the "low performers" could not. Similarly for the immersion factor control, a possible reason that both groups experienced non-significant levels of lack of control could be due to the fast paced nature of the game; again the difference between the groups being that whereas the "high performers" were able to cope with this lack of control and still track the blue van, the "low performers" were not. Also one can suggest that for the immersion factor "emotional involvement" perhaps both groups were emotionally involved in the game-play but in different ways, the "high performers" experiencing high suspense and more positive emotions while the "low performers" experiencing high frustration and more negative emotions.

5.4.5.1. Limitations of Study Five

Regarding the limitations of Study Five, Pearson correlations between the single question measure of immersion and the multiple question measure of immersion revealed that the multiple question measure of immersion was reflecting participants' immersive experiences for the "high performers" group moreso than the "low performers" group. It is not clear why this would be; however comments made by participants after the experiment seem to support the idea that the "low performers" group found the game less immersive, and so we feel that we can be confident in our conclusions. Perhaps the "low performers" were just reluctant to rate the game a low score out of 10? If such is the case, then this would support the necessity to ask multiple questions about a person's experience, so that participants feel less conscious about rating a game with a low score.

Another possible confound of Study Five is that the experimenter being present in the room making notes could have possibly had an impact on the participant. However, as suggested by the pilot study (see Section 5.3) and as shown by the immersion ratings of Study Six and participant comments (e.g. "I was focused on the game, totally oblivious to the presence of another person in the room at times") we would argue that participants found it easy to focus on the game and did not find the experimenter distracting, especially as they were only playing the game for a short amount of time. Furthermore, one can argue that because the experimenter did not know how the participant would perform in the game it was impossible for him / her to give the participant cues of how to behave.

A further limitation of Study Five is that the classifications of "high performers" and "low performers" were based on the subjective observations of one experimenter, thus one could question the reliability of the results. In response to this we can simply stress that the experimenter was professional in writing notes according to the participant's game performance, and not altering these notes according to how quick the person clicked the distracter. However in future research we acknowledge that it would be better if we recorded the game screen and got multiple experimenters to rate the participant's game performance. Alternatively, the experimenter could watch the screen recording and count the number of times the participant hit the blue van, as a more objective measure for classification.

As a final note, it is important to acknowledge that the majority of participants in the sample were female (30 females, 6 males). Therefore like Study Two and Three, one might question whether our results can be generalised to a male population. In response again we would argue that there was no significant gender difference found in participants' immersion ratings of the game in the pilot study, therefore it seems unlikely that gender would have had an effect on reaction times.

5.5. GENERAL DISCUSSION

5.5.1. Summary of the Experimental Findings

To recap, in this chapter two studies were described that investigated how awareness of auditory distracters changes with the level of game performance experienced. These studies aimed to validate the following grounded theory claim:

- Sense of progression plays an important role in game immersion. Performing well in a game is important to this sense of progression because if the player views themselves as doing well in the game, receiving positive feedback, they will care more about the outcome and become more immersed in the game-play. Being less aware of your surroundings (RWD) is an aspect of this immersive experience.

Thus it was predicted that the better a person performs in a game, the greater immersion they will experience and the more RWD they will experience.

The grounded theory claim was not supported at first: the "high performers" group did not recall significantly more distracters than the "low performers" group (Study Four). However it was suspected that this was due to the classification of "high performers" and "low performers": although the "low performers" did not score as highly as the "high performers", they were still able to gain a sense of progression as they reached level 2 / 3. Therefore, in line with our grounded theory, in Study Five "low performers" were re-defined as "participants that performed badly to such an extent that they were unable to gain a sense of progression". During the analysis of the results of Study Five this was defined further, to read "participants that performed badly to such an extent that they were unable to gain a sense of progression at that particular moment in time". With this new classification in use, the grounded theory claim was supported: participants in the "high performers" group were slower to respond to a visual distracter than participants in the "low performers" group (Study Five).

Considering the experimental findings in the context of our grounded theory as a whole it seems likely that, if a sense of progression is measured by observations of performance only, there could be occasions when a sense of progression is not always associated with greater game immersion and RWD. For example, the game "Rescue the Band" was quite challenging: in order to gain a sense of progression the player had to constantly keep their eyes on the screen and drive well to keep up with the blue van and dodge the other cars on the high way. In contrast, one could imagine another situation where the game is too easy, in which case the player might be performing well and progressing in the game but their concentration is not as intent. In line with our grounded theory, we would propose that in the latter scenario the player is not highly immersed despite the sense of progression, because the challenge of the game is too low. As a result of such low immersion, a person playing an easy game might be more aware of distracters than a person that is experiencing a sense of progression while being challenged; although perhaps not as aware of distracters as a person that is experiencing no sense of progression at all. See Figure 17 for an illustration of this possible U-shaped relationship between game difficulty and RWD.

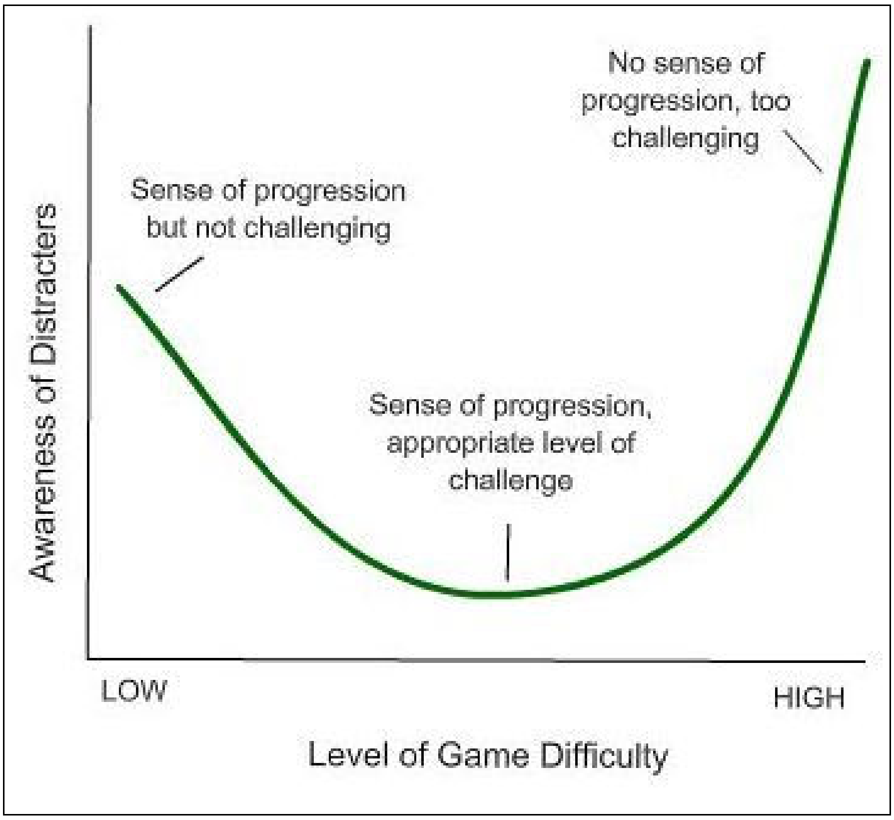

Figure 17. An Illustration of the Possible U-shaped Relationship Between Game Difficulty and Real World Dissociation.

As can be seen in Figure 17, we are proposing that the curve representing awareness of distracters stemming between a game of appropriate difficulty and an easy game is not as steep as the curve stemming between a game of appropriate difficulty and a game that is too difficult. Support for this comes from Study One (Section 3.3.2.3.), in which the interviewed gamers describe how a person could still play a game that is easy, but they are unlikely to play it for as long as they would a game that is of the appropriate challenge level, i.e. they are "playing just to play". In contrast, a person that is playing a game that is too difficult will just grow frustrated and stop playing. Further research would be needed to confirm the details of this theory, however it is noteworthy that the grounded theory in conjunction with the experimental data from Study Five is allowing us to hypothesise about such relationships.

5.5.2. Comparisons with the Existing Literature

In relation to the existing immersion literature, an important contribution of these studies is that they demonstrate that RWD is not just something that people talk about, but it does exist and can be measured. It also introduces another way of measuring game immersion to the immersion literature. In the previous chapter recall of auditory distracters was shown to be a successful method. Now in Study Five reaction time to a visual distracter is also shown to be successful.

Another contribution of these studies is that whereas past research focuses on people that have played a particular game a lot compared to people that have played the same game very little (experts versus novices), Studies Four and Five compared people that differ in their performance of a game which they are playing for the first time. As of yet, there has been little research conducted investigating this aspect of gaming.

Furthermore, these studies illustrate the momentary nature of game immersion and RWD. For example, during one session of game-play a person can vary in how immersed they are in the game's events, depending on their current performance and sense of progression. This is one reason why carrying out experimental studies in gaming research can often be so tricky, as found in Study Four: such a momentary experience requires a more precise measurement of how immersed a person is at that particular moment in time. Study Five demonstrated one way in which this can be achieved, through experimental observation. One can also propose the use of screen recording in future research, for more objective analyses.

Regarding the grounded theory notion that immersion is self-motivated attention, the design of Studies Four and Five makes them more suited for testing this as participants played the same game – thus one could assume that the players' processing demands were the same, and any differences in immersion were due to differences in performance. However a limitation of these studies is that this assumption is not necessarily the case. For example, one could argue that in Study Five because the "high performers" group progressed further in the game than the "low performers" group, hitting the blue van more often, they experienced the visual effects and sounds that occurred with this, moved onto different levels, thus experiencing greater perceptual load. By contrast, the "low performers" group were unable to progress that far in the game and so were unable to experience these perceptual features of the game; instead they just wandered around the highway aimlessly. Therefore, in order to provide stronger support for our grounded theory notion that immersion is self-motivated attention, for the next study it will be important that we have greater control over the perceptual features of the game that participants experience.

Study Six: A Dissociation Between Real World Dissociation in Gaming and Cognitive Load Theory

6.1. INTRODUCTION

The grounded theory presented in Study One proposed that a sense of progression plays an important role in game immersion. Feedback is important to this sense of progression because it allows a player to assess their performance. If the player views themselves as doing well in the game, receiving positive feedback, they will care more about the outcome, becoming more immersed in the game-play. A sense of progression in the game narrative is also important for immersion: the player needs to feel like they are reaching new stages of the game. Being less aware of your surroundings (RWD) is an aspect of this immersive experience.

To validate the grounded theory, two experiments were conducted that manipulated feedback and sense of progression ("no feedback" versus "feedback" / "Star Fly 3"; Study Two and Three). Also two experiments were conducted that investigated differences between people that perform well and people that perform poorly ("high performers" versus "low performers"; Study Four and Five). These experiments supported various aspects of the grounded theory, such as the importance of a sense of progression. However what these experiments did not provide was support for our claim that immersion is self-motivated attention, as the results of the experiments could be explained by differences in perceptual load as well as the grounded theory.

This chapter will describe a study that is designed to demonstrate that RWD in gaming is not just a result of differences in perceptual load.

6.1.1. Testing Conditions Equal in Load

Study Six investigates how awareness of auditory distracters changes with the level of performance perceived by the player. In gaming, when a person is less aware of distracters it is not just because the game is more difficult, but it is due to how the person assesses their performance in the game via the feedback they receive. If a person perceives themselves as doing well, this allows them to gain a sense of progression and become emotionally involved, caring about the outcome. In contrast, cognitive load tasks such as visual search tasks (Lavie, 1995) do not have feedback. Therefore, as there is no formal way of assessing whether you are performing well, one can propose that emotional involvement is not an important factor for such tasks, they only involve cognitive involvement.

In order to manipulate the level of performance perceived by the player, the game "Space Trek", "feedback" version, was modified to include an extra component that either rigged the game so that the player received a high score ("high performance" version) or rigged the game so that the player received a low score ("low performance" version).

In Cognitive Load Theory the level of cognitive load experienced is affected by two factors: (a) perceptual features of the task; and (b) task difficulty (Lavie, 1995). A key aspect of Study Six is that the two conditions are designed to be equal in cognitive load:

- Perceptual features of the task are equal, both the "high performance" and "low performance" versions of "Rigged Space Trek" use virtually the same visuals and sound effects.
- Task difficulty is equal, both the "high performance" and "low performance" versions of "Rigged Space Trek" involve moving the rocket right and left in order to collect stars and avoid asteroids.

However, although the two games do not differ in cognitive load, it is predicted that the conditions will differ in immersion due to the level of performance perceived by the player. In the "high performance" condition, when the extra component has the function of dramatically increasing the player's score this will increase the player's perception of doing well in the game, thereby adding to their immersion and making them less aware of distracters. However in the "low performance" condition, when the same extra component has the function of dramatically decreasing the player's score, even though the person knows they had no control over this component of the game, this will decrease the player's perception of doing well in the game, thereby decreasing their immersion and making them less aware of distracters.

Like the previous auditory experiments that have been conducted (Study Two, Study Three, Study Four), awareness of distracters was measured via a recall test. An advantage of modifying the existing experiment, rather than creating new stimuli, was that there was already data to suggest that the game and the distracters worked together in the way that was needed (see Chapter Four); therefore a pilot study was not deemed necessary and one could go straight to conducting the experiment.

As well as differences between the conditions in terms of overall recall, in line with the grounded theory it was also predicted that the "high performance" condition would show greater selectivity and recall fewer irrelevant distracters than the "low performance" condition.

The chapter shall be organised as follows: method and findings of Study Six; followed by a general discussion.

6.2. STUDY SIX: COMPARING RECALL OF AUDITORY DISTRACTERS PRESENT DURING GAME-PLAY OF TWO RIGGED VERSIONS OF SPACE TREK, "HIGH PERFORMANCE" AND "LOW PERFORMANCE"

6.2.1. Aim

The aim of Study Six was to investigate the extent to which people are aware of auditory distracters during a game rigged so that the participant performs well, compared to a game rigged so that the participant performs poorly. The method of our existing auditory experiment was replicated (Study Two, "Space Trek" "feedback" condition); however this time the game was modified to include an extra component, a laser that hits the rocket and functions to either dramatically increase your score or dramatically decrease your score. The conditions were termed the "high performance" condition and the "low performance" condition.

6.2.2. Hypotheses

In terms of immersion:

- Participants in the "high performance" condition will rate it as more immersive than participants in the "low performance" condition.

In terms of recall:

- Participants in the "high performance" condition will recall fewer auditory distracters than participants in the "low performance" condition.
- Participants in the "high performance" condition will recall fewer "irrelevant" auditory distracters than participants in the "low performance" condition; however participants in the "high performance" condition will not recall fewer "game-relevant" or "person-relevant" distracters than participants in the "low performance" condition.

6.2.3. Method

6.2.3.1. Participants

There were 41 participants tested in total, 23 in the "high performance" condition and 18 in the "low performance" condition. The majority of participants were university students, recruited through an opportunity sample. The ages of the 41 participants ranged from 18-43 years, the mean age being 23.6 years (SD = 4.92). In terms of gender, 31 were female and 10 were male. All participants were paid three pounds for their time.

6.2.3.2. Rigged Space Trek

The rigged "Space Trek" game (dubbed "Rigged Space Trek") was adapted from the "feedback" version of "Space Trek", the game used in Study Two. Like the original version of the game, in "Rigged Space Trek" the player controls a rocket, which they can move right and left, and the aim is to collect as many stars as possible while avoiding the asteroids. The player gains 100 points for every star they collect and loses 50 points for every asteroid they crash into. Over time the asteroids change in their appearance (different shapes, different colours) and increase in size. The game lasts for a total of 10 minutes. For further information about the original version of the game, refer back to Section 4.2.

However, in contrast to the original game, "Rigged Space Trek" includes an extra component: a laser that hits the rocket. This laser serves the function of rigging the game. Two versions of the game were created. In the "high performance" version of "Rigged Space Trek" the laser has the effect of adding 2000 points to the participant's score, thereby rigging the game so that the participant perceives themselves as performing well. In the "low performance" version of "Rigged Space Trek" the laser has the effect of deducting 2000 points from the participant's score, thereby rigging the game so that the participant perceives themselves as performing badly, their score so low that it is in negative figures.

In terms of its appearance the laser was red, with a white border that appeared and disappeared on alternate frames, thereby making the laser look like it was glowing. While the laser was moving a "hum" sound was played. In terms of timing, the laser was programmed to appear along the y axis once approximately every 27 seconds and move from the left to the right of the screen at a rate of 15 pixels per frame (frames being shown at a rate of 12 frames per second). Therefore during the 10 minute game the laser appeared on the screen 22 times in total. See Figure 18 for a screen shot of the game featuring the laser.

Figure 18. A Screenshot of the Game "Rigged Space Trek", "Low Performance" Version.

In terms of feedback, when the laser hit the rocket the feedback differed in appearance and sound depending on the version of "Rigged Space Trek". These differences were to signify whether being hit by laser was positive for the player's score or negative. See Figure 19 to see how the appearance of the "hit by laser" rocket state differed in the two games.

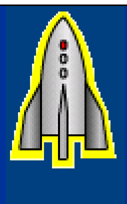	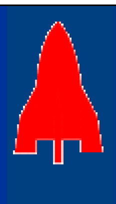
Hit by laser in "high performance" game	Hit by laser in "low performance" game

Figure 19. "Hit by Laser" Rocket States for the "High Performance" and "Low Performance" Versions of the Game "Rigged Space Trek".

In the "high performance" version, when a laser hits the rocket the rocket is shown to have a yellow border for 1 frame (see Figure 19), a "whoosh" sound is played and 2000 points are added to the score displayed at the bottom of the screen. This feedback is similar to that received by the player when they collect a star, i.e. when a person collects a star the rocket is shown to have a yellow border for 1 frame, a "whoosh" sound is played and 100 points are added to the score. Therefore this should suggest to the player that the laser is a sign of positive feedback and that they are performing well in the game.

By contrast, in the "low performance" version, when a laser hits the rocket the rocket is shown to turn red for 1 frame (see Figure 19), a "bash" sound is played and 2000 points are deducted from the score displayed at the bottom of the screen. This feedback is similar to that received by the participant when they are hit by an asteroid, i.e. when a person is hit by an asteroid the rocket is shown to turn red for 3 frames, during which time the rocket cannot be moved, a "bash" sound is played and 50 points are added to the score. Therefore this should suggest to the player that the laser is a sign of negative feedback and that they are performing badly in the game.

As well as the addition of the laser, another feature of "Rigged Space Trek" is that the font of the score at the bottom of the screen is bigger compared to the original "feedback" game (see Section 4.2. for a screen shot of the original). This modification was made in order to make the score more visible to the player, so that they would be more likely to notice the state of their score and whether they appear to be improving / doing worse over time.

Regarding cognitive load, although the nature of the laser feedback differs in the "high performance" and "low performance" versions of "Rigged Space Trek", in terms of the number of times the rocket was hit by the laser and the duration of this feedback the games were the same. Therefore we suggest that in terms of processing perceptual features of the games, the cognitive load of the "high performance" and "low performance" versions of "Rigged Space Trek" is virtually identical.

Both versions of "Rigged Space Trek" were programmed using Flash 8.0 and played on a Gateway laptop.

6.2.3.3. Distraction Sounds

The same 18 distractions that were used in the "feedback" condition of Study Two were used in Study Six, see Appendix 16. These distracters can be divided into three categories: game-relevant (6 distracter items), person-relevant (6 distracter items) and irrelevant (6 distracter items). Distraction sounds were played on a cassette recorder placed at the back of the room, behind where the participant would be sitting, and were paced to last for a duration of 10 minutes. All participants heard the same distractions.

6.2.3.4. IEQ

To measure immersion the modified IEQ was used, see Appendix 7. Details of how the IEQ scores were computed can be seen in Appendix 5.

6.2.3.5. Free Recall Test

The free recall test procedure used was the same as that described in Section 4.5.3.6. See Appendix 17 for a table of how each distraction item was broken down and scored.

6.2.3.6. Procedure

Due to the same 18 distractions being played in both game conditions, an independent measures design was deemed necessary in order to bypass any effects of memory or order, e.g. participants purposively listening to the distractions the second time now that they know they will be tested on recall. Participants played either the "high performance" version or the "low performance" version of the "Rigged Space Trek" game. The games were played on a Gateway laptop using Flash Professional 8.0 and lasted 10 minutes each.

For both games participants were instructed that the aim of the game was to collect as many stars as possible while avoiding the asteroids, and that they should try their best to achieve the highest score possible. Participants were also instructed that a laser would appear at certain points in the game and that this laser is unavoidable, it will definitely hit you. For the "high performance" version of "Rigged Space Trek" the laser served the function of adding 2000 points to the participant's score. For the "low performance" version of "Rigged Space Trek" the laser served the function of deducting 2000 points from the participant's score.

Participants were further instructed that during game-play they would hear a number of auditory distractions played via a Casio cassette player placed at the back of the room, behind where they would be sitting. However they must not allow these distractions to stop them from their goal in the game, to collect as many stars as possible. Participants were not aware that they would later have to recall these distracters.

Once the participant was ready to begin the game, the experimenter turned on the distraction sound and left the cubicle, so that the experimenter's presence would not disrupt the participant's experience. After the participant had completed the game, the experimenter re-entered the room. The experimenter noted down the game statistics (e.g. number of stars collected, number of asteroids crashed into) and gave the participant the IEQ, which asked them to rate their experience of the game. The experimenter also presented the participant with the surprise recall test, instructing the participant to write down as much as he / she could remember about the auditory distracters. All participants were debriefed at the end of the experiment and received three pounds payment.

6.2.4. Results

All statistical analyses were performed using SPSS 11.0. The results are presented in the following order: first IEQ data (immersion ratings, immersion factors); then the recall data (total number of distracters recalled; recall of game, person and irrelevant distracters).

6.2.4.1. Immersion Ratings

As can be seen in Table 66, participants rated the "high performance" game approximately 17 points more immersive than the "low performance" game. An independent samples *t*-test revealed that this difference was significant, $t_{(39)} = -2.255, p=.030$.

Table 66.

Immersion Ratings of the Game "Rigged Space Trek", "Low Performance" and "High Performance" Conditions.

	Low Performance		High Performance	
Immersion:	Mean	SD	Mean	SD
- IEQ Score *	139.83	20.53	156.61	27.15
- Single Question Measure	6.96	2.25	7.00	1.72

* *p<.05*

The single question measure of immersion did not support this finding. As can be seen in Table 66, participants rated the "high performance" game less than 1 point more immersive than the "low performance" game. An independent samples *t*-test revealed that this difference was not significant, $t_{(39)} = -.068, p=.946$.

Comments made by participants after the experiment however do seem to support the multiple question measure in suggesting that the immersive experiences of the two conditions differed. For example, participants in the "low performance" condition described it as "very annoying" and "de-motivating" because when the laser came you could not do anything to stop it. In contrast, participants in the "high performance" condition did not even comment on the laser, instead they referred to other aspects of the game such as how much they enjoyed the graphics.

In terms of confounding variables, again age and gender were identified as possible factors that could influence immersion ratings (for similar reasons as those described in Section 4.3.3.1). Pearson correlations revealed that there were no significant correlations between age and immersion for both the "low performance" group ($r_{(n=18)} = -.046, p=.855$) and the "high performance" group ($r_{(n=23)} = .168, p=.443$).

In terms of gender differences the gender ratio of the sample was very unbalanced, with 31 females and only 10 males, and so it was decided that it would not be suitable to test for significant differences.

6.2.4.2. Immersion Factors

To explore the differences in immersion between the two games further, participant scores for the five immersion factors were computed. As can be seen in Table 67, participants rated the "high performance" version of "Rigged Space Trek" higher than the "low performance" version for all five immersion factors. Independent sample *t*-tests (Bonferroni correction, significance level =.01) revealed that the differences between the games were not significant for four of the immersion factors: cognitive involvement ($t_{(39)}$ = -2.430, p<.020), emotional involvement ($t_{(39)}$ = -2.171, p=.029), real world dissociation ($t_{(39)}$ = -.958, p=.344) and challenge ($t_{(39)}$ = -.407, p=.0686).

Table 67.

Immersion Factor Scores of the Game "Rigged Space Trek", "Low Performance" and "High Performance" Conditions.

	Low Performance		High Performance	
Immersion Factors:	Mean	SD	Mean	SD
- Cognitive Involvement	50.78	7.25	56.22	6.92
- Real World Dissociation	22.83	7.46	25.00	6.88
- Emotional Involvement	52.78	9.19	59.83	10.67
- Challenge	18.78	3.92	19.22	2.67
- Control **	32.92	6.23	41.11	14.79

** *p<.01*

Due to the big difference in standard deviations between the conditions for the immersion factor control, the non-parametric Mann Whitney test was used instead of an independent samples *t*-test. The test revealed that the difference between the games for the immersion factor control was significant (*U* = 106.500, p=.008).

6.2.4.3. Game Performance

The "high performance" version of "Rigged Space Trek" was rigged so that participants would perceive themselves as performing well. The mean score achieved by participants in the "high performance" condition was 68664 points (SD = 5687.86). In contrast, the "low performance" version of "Rigged Space Trek" was rigged so that participants would perceive themselves as performing badly. The mean score achieved by participants in the "low performance" condition was -18904 points.

In order to compare actual game performance, the mean percentage of stars collected, stars missed, asteroids avoided, and asteroids crash into, were computed for both the "low performance" and "high performance" versions of "Rigged Space Trek". As can be seen in Table 68, there was little difference between the two game conditions for any of the performance measures. Independent sample *t*-tests revealed that the differences between the game conditions were not significant for both stars collected ($t_{(39)}$ = .546, *p*=.588) and asteroids avoided ($t_{(39)}$ = .755, *p*=.455).

Table 68.

Participant Performance for the Game "Rigged Space Trek", "Low Performance" and "High Performance" Conditions.

Game Statistics	Low Performance		High Performance	
	Mean	SD	Mean	SD
- Stars successfully collected	63.17%	11.54	61.11%	12.57
- Stars missed	36.83%	11.54	36.83%	12.57
- Asteroids successfully avoided	95.17%	2.05	95.66%	2.04
- Asteroids crashed into	4.83%	2.05	4.34%	2.04

6.2.4.4. Recall of Auditory Distracters

There were 18 auditory distraction items played in total while participants either played the "low performance" version or "high performance" version of "Rigged Space Trek". As can be seen in Table 69, participants playing the "high performance" version of "Rigged Space Trek" recalled fewer distracters (mean = 4 out of 18) than participants playing the "low performance" version (mean = 6 out of 18). An independent samples *t*-test revealed that this differences was significant, ($t_{(39)}$ = 4.186, *p*=.001).

Table 69.

Recall of Auditory Distracters for "Low Performance" and "High Performance" Conditions.

	Low Performance		High Performance	
	Mean	SD	Mean	SD
Recall ***	5.54	1.53	3.78	1.05

****p<.001*

6.2.4.5. Recall of Game, Person and Irrelevant Distracters

Out of the 18 distracters, 6 were game-relevant, 6 were person-relevant and 6 were irrelevant. As can be seen in Table 70, participants in the "high performance" condition were better at recalling game distracters (2.08), followed by person distracters (1.31) and then irrelevant distracters (0.42). Participants in the "low performance" condition were also better at recalling game distracters (2.61), followed by person distracters (1.80) and then irrelevant distracters (1.15). Comparing the game conditions, participants playing the "high performance" version of "Rigged Space Trek" recalled on average fewer game distracters (2.08 compared to 2.61), fewer person distracters (1.31 compared to 1.80), and fewer irrelevant distracters (0.42 compared to 1.15), compared to participants playing the "low performance" version of "Rigged Space Trek". See Figure 20 for a means plot of the recall data.

Table 70.

Recall of Game-Relevant, Person-Relevant and Irrelevant Distracters for "Low Performance" and "High Performance" Conditions.

Recall:	Low Performance		High Performance	
	Mean	SD	Mean	SD
- Game	2.61	1.08	2.08	0.81
- Person	1.80	0.91	1.31	0.84
- Irrelevant **	1.15	1.02	0.42	0.49

* *p*<.05; ** *p*<.01; ****p*<.001

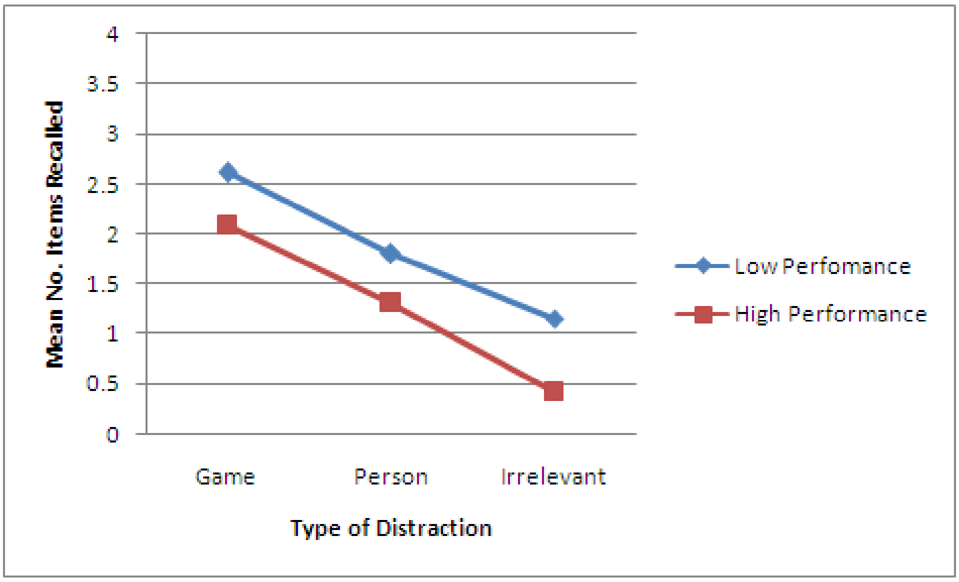

Figure 20. A Means Plot of the Recall of Game-Relevant, Person-Relevant and Irrelevant Distracters for "Low Performance" and "High Performance" Conditions.

A mixed measures ANOVA test was conducted on the recall data. The test revealed that there was a main effect of type of distraction, $F_{(2, 78)} = 26.686$, $p<.001$, and a main effect of game condition, $F_{(1, 39)} = 45.753$, $p<.001$. The interaction between type of distraction and game condition was not significant, $F_{(2, 78)} = .184$, $p=.832$.

Independent sample *t*-tests were conducted for each level of distraction. There was a significant difference between the "high performance" and "low performance" conditions for the recall of irrelevant distracters, $t_{(39)} = 2.817, p=.008$. However the difference between the conditions was not significant for the recall of game distracters, $t_{(39)} = 1.723, p=.093$, or the recall of person distracters, $t_{(39)} = 1.794, p=.081$.

6.2.5. Discussion

Study Six was conducted to investigate the extent to which people are aware of auditory distracters during a game rigged so that the participant perceives themselves as performing well ("high performance" condition), compared to a game rigged so that the participant perceives themselves as performing poorly ("low performance" condition).

The immersion hypothesis, that participants in the "high performance" condition would rate it as more immersive than participants in the "low performance" condition, was supported. The "high performance" condition was given a mean immersion rating of 156.61, which was significantly higher than the mean immersion rating of the "low performance" condition (mean = 139.83). Furthermore, the "high performance" condition was rated significantly higher than the "low performance" condition for the immersion factor control, suggesting that the "high performance" condition felt more in control of the game than the "low performance" condition.

The awareness hypothesis, that participants in the "high performance" condition would recall fewer auditory distracters than participants in the "low performance" condition was supported. Participants in the "high performance" condition recalled significantly fewer distracter items (mean recall of 4 of 18 items) than participants in the "low performance" condition (mean recall of 6 out of 18 items). Therefore, this suggests that participants in the "high performance" and "low performance" conditions both process distracters, but not to the same extent: participants in the "low performance" condition process distracters to a deeper or more conscious level, and as a result they are able to recall significantly more distracters.

The second awareness hypothesis, that the "high performance" condition would be less aware of irrelevant distracters than the "low performance" condition; however the "high performance" and "low performance" conditions would not differ in their awareness of game-relevant and person-relevant distracters; was also supported. Participants in the "low performance" condition recalled significantly more irrelevant distracters than participants in the "high performance" condition (1.15 and 0.42 respectively). In contrast, the differences between the conditions for recall of game-relevant and person-relevant distracters were not significant. Therefore, this suggests that when a person is immersed they are particularly less aware of irrelevant distracters, due to greater selectivity for relevance.

As an aside, if one compares these results to Study Two, it is interesting to note that the "feedback" condition of Study Two had a mean recall of 5 out of 18 items (see Section 4.5). Therefore it would appear that the addition of the laser to the game in Study Six has led to lower recall for the high performance" condition (mean recall = 4 of 18 items) and higher recall for the "low performance" condition (mean = 6 out of 18 items). This suggests that the recall measure is reliable, as recall is in the direction expected compared to the original study. Furthermore, whereas in the pilot study for Study Two the "feedback" game received a mean immersion rating of 142.60 (see Section 4.3); in Study Six the "high performance" condition gave the game a higher rating, with a mean immersion rating of 156.61; whereas the "low performers" group gave the game a lower rating, with a mean immersion rating of 139.83. Again this suggests that the measures used were reliable, the immersion ratings being in the direction expected compared to the original study.

Overall, it is evident that Study Six has been successful in validating a number of claims from the grounded theory. Comparing two games rigged so that the participants either perceived themselves as performing well or performing poorly, the study showed that participants in the "high performance" condition found the game more immersive and were less aware of distracters than participants in the "low performance" condition, particularly irrelevant distracters. In line with the grounded theory one can suggest that, because participants perceived themselves as performing well in the "high performance" condition they gained a greater sense of progression and became more immersed in the game, RWD being an aspect of this immersive experience; thus participants were able to recall fewer distracters as a result. Greater immersion was also associated with greater selectivity for relevance: participants in the "high performance" condition recalled significantly fewer irrelevant distracters than participants in the "low performance" condition, whereas differences in the recall of game-relevant and person-relevant distracters were not significant.

It is important to note that performance of participants in the two conditions did not actually differ. Game statistics reveal that both the "high performance" condition and the "low performance" condition successfully collected over 60% of stars and successfully avoided over 95% of asteroids. Immersion data also show that participants did not rate the "low performance" condition significantly higher for challenge. Thus we emphasise again that it was only the perception of performance that differed, due to the extra component of the laser in the game that could not be controlled and would add or subtract points from the person's score. In line with our grounded theory, this illustrates the importance of feedback in that it is not how well you perform that matters but how you assess your performance through the feedback you perceive. A similar result was found in the pilot study of Study Two: although participants in the "feedback" and "no feedback" conditions both collected approximately 70% of stars and avoided 96% of asteroids, the "feedback" condition was rated significantly more immersive (see Section 4.3).

A further implication of Study Six is that it shows a dissociation between cognitive load and immersion, something that the previous experimental studies were not able to. A key aspect of Study Six is that the two conditions were designed to be equal in cognitive load:

- Perceptual features of the task were equal, both the "high performance" and "low performance" versions of "Rigged Space Trek" used virtually the same visuals and sound effects.
- Task difficulty was equal, both the "high performance" and "low performance" versions of "Rigged Space Trek" involved moving the rocket right and left in order to collect stars and avoid asteroids.

Therefore, as the two performance conditions were virtually identical in terms of perceptual features and task difficulty, one can suggest that the differences in RWD observed can not be explained by cognitive load and were due to differences in motivation only. This provides strong support for our grounded theory notion that immersion is self-motivated attention.

6.2.5.1. Limitations of Study Six

In terms of the limitations of Study Six, it is evident that in contrast with all of the previous experimental studies, the single question measure of immersion did not support the findings of the IEQ. It is not clear why this might be, however comments made by participants after the experiment seem to support the idea that the immersive experiences of the two conditions differed, and so we feel that we can be confident in our conclusions.

Another limitation of Study Six is that the "high performance" condition and the "low performance" condition did not differ significantly in terms of the immersion factor RWD (mean ratings of 25.00 and 22.82 respectively). It was somewhat expected that the other immersion factors (excluding control) would not significantly differ, due to the similarity of the two versions of the "Rigged Space Trek" game; however considering that a significant difference was found in recall scores, it would have added strength to our use of the IEQ if we had found a significant difference in RWD also. Rather than taking this finding as a negative result for our study however, we suggest that perhaps participants are not always aware of the extent to which they are unaware of their surroundings, e.g. if you did not notice something, how can you know that you missed it? As our recall measure demonstrates there were significant differences in RWD between the conditions, with the "high performance" condition recalling significantly more distracters than the "low performance" condition. Thus, we conclude the recall measure was more accurate.

A further limitation of Study Six is that the majority of the sample were female (31 females compared to 10 males). Being an opportunity sample, it just happened to be the case that it was mostly female students that volunteered to take part in the experiment. Therefore like pervious studies one might question whether our results can be generalised to a male population. In response, we would argue that there was no significant gender difference found for people's immersive experiences in the pilot study described in Section 4.3., which tested the original "feedback" version of "Space Trek". As "Rigged Space

Trek" is a modification of this game, it therefore seems unlikely that gender would have had much of an effect on participants' immersion ratings in Study Six.

6.2.5.2. Possible Criticisms of the Study Regarding Cognitive Load

A possible criticism of Study Six is that the two games did differ slightly in terms of the nature of the laser feedback: the feedback for the laser hitting the rocket in the "high performance" game was the rocket getting a yellow border and a "whoosh" sound being played; whereas the feedback for the laser hitting the rocket for the "low performance" game was the rocket turning red and a "bash" being played. However we would argue that in terms of the number of times the rocket was hit by the laser and the duration of this feedback the games were the same. Therefore we would argue that unless one was to go as far as to argue that the colour red had more cognitive load than the colour yellow (which seems unlikely), or one sound has more cognitive load than another (which again seems unlikely); in terms of processing perceptual features of the games, the cognitive load of the two games is virtually identical.

Another possible criticism of the study is that rather than task difficulty referring to the controls of the game, it could refer to how difficult it was to gain points. The "low performance" game would therefore be viewed as requiring more cognitive load than the "high performance" game, as it was more difficult to score well. However under such an interpretation, the results are still not as they would be expected under Cognitive Load Theory, as the "low performance" condition (higher load) was significantly more aware of distracters than the "high performance" condition (lower load). Therefore again one can suggest that the differences in RWD not be explained by cognitive load and were due to differences in motivation only.

C h a p t e r 7

Discussion

7.1. INTRODUCTION

In each chapter a discussion section offered some interpretations of results, conclusions drawn and considered methodological limitations. The aim of this chapter is not to repeat what has already been written, but to consider to what extent the aims of the research (as identified in Chapter One) have been met. These aims were to explore the relationship between immersion and SA, by gaining an insight into RWD and answering the following questions:

1. What factors affect RWD?
2. To what extent is a person "less aware" of their surroundings?
3. Can RWD be measured objectively?

By answering these questions and positioning game immersion in relation to SA, it was hoped that this would allow us to answer the over-arching question of this thesis: 'Is immersion just another form of SA?'

The findings of the research shall now be summarised, answering each of the three questions in turn. This will then be followed by a discussion of the contribution this research has made to the field of HCI and suggestions for future research.

7.2. THE RESEARCH FINDINGS

7.2.1. What Factors Affect RWD?

The grounded theory of Study One revealed that a sense of progression is key to immersion, RWD being one aspect of the immersive experience. Game progression can be thought of in terms of the game narrative: the player is moving onto new levels, learning more about the characters and the game story. Game progression can also be thought of in terms of the game-play: the player is winning points and gaining mastery, they want to see if they can carry on improving their skills.

The grounded theory identified three factors associated with the game-person interaction that were important for a player to feel a sense of progression: a sense of control, game performance, and an appropriate level of challenge. Feedback was found to underpin this sense of progression as it is feedback that allows a player to assess whether they have learnt to use the interface properly and to assess their performance in the game. Positive feedback is essential to immersive game-play as this is what motivates the player to keep playing. Some negative feedback is also necessary as this is what makes the player's success meaningful, signifying that the game tasks are difficult and require skill to complete. This is a key difference between our grounded theory of RWD and the existing SA literature: whereas feedback plays a major role in games due to their interactivity, SA tasks do not involve feedback.

Three extraneous factors were also identified as influencing RWD in gaming: game novelty, personal motivation and social influence. However, although these factors might lead to a player to expend more effort in their game-play, they do not guarantee that the player will experience a sense of progression and so they are not essential for immersion to occur. Therefore it is still the success of the game-person interaction that matters most.

The role of motivation has been recently investigated in the attention literature (e.g. Pessoa, 2009). However we argue that the interactivity of the gaming context means that there are a number of key differences. Firstly, there is no tangible reward as a result of immersion; the reward is the immersive experience itself. Secondly, a person's sense of progression is a very subjective experience (two people can play the same game but have different experiences of progression) and also a momentary experience (within one session of game-play a person can experience different levels of progression). Therefore we argue that game immersion is not just an extreme form of SA; the intrinsic nature of game-play and its interactivity means that game immersion operates differently. The grounded theory suggests that immersion is a result of self-motivated attention which is enhanced through feedback from the game; environmental information being attenuated to a greater extent when a person's sense of progression is highest.

7.2.2. To What Extent is a Person Less Aware of their Surroundings?

The interview findings of Study One revealed that due to their sense of progression in the game, players were less aware of time, changes in lighting (daylight turning to nightfall and vice versa) and changes in proprioception (fingers sore from button-pressing). Interestingly players also described themselves as being less aware of sounds - but some sounds more than others. Irrelevant distracters, such as the TV playing in the background, were less likely to be noticed than relevant distracters, such as someone calling your name (personally-relevant) or a sound related to the game but not coming from the game (game-relevant). Thus we suggest that some kind an attention filter is at work for the processing of sounds during game-play: when a person is having a successful interaction with the game there is greater selectivity for relevance.

These findings concerning the processing of sounds share striking similarities with findings from the Auditory SA literature, particularly Treisman (1960)'s Attenuation Theory. However an important difference is that whereas a successful interaction is essential for immersion to occur, gaming being a voluntary activity, so the game needs to motivate the person to keep playing; selective listening tasks are not interactive, you attend because you are told to do so and you do not get feedback for your actions. Our grounded theory suggests that it is this ability of games to motivate players, via the feedback they receive and their sense of progression through the game world, that makes games immersive and leads to such selectivity when processing distracters.

Another key finding from Study One was that as well as being less aware of the environment due to processing capabilities, there were also times when gamers consciously choose to ignore the environment. In other words, there are times when they choose to stay immersed in the game world. This suggests that a mixture of bottom-up and top-down processing is involved in RWD. Irrelevant distracters are not responded to because they are not noticed (bottom-up). Relevant distracters are noticed, however sometimes they are still not responded to, because the gamer chooses not to respond to them (top-down); at that moment in time, the game is simply viewed as more important than reality. Similarly, when it comes to losing track of time Study One found that sometimes people do not notice time passing (bottom-up); at other times people do notice that they have played for longer than they intended but they choose to ignore this and play "just one more time" (top-down). These findings suggest that gamers are more aware of their surroundings than one might think: as well as getting carried away with game-play there are also times when gamers purposively choose to stay immersed. Again it is the ability of the game to motivate the person to keep playing that influences this decision. If the game is not going well, then the person will choose to stop playing and respond to the distracter instead.

Thus if we refer back to the scenario described in Chapter One (Section 1.3.), we can now propose an answer. When your daughter is playing video-games and you call her to dinner but she fails to respond, do you assume she heard and ignored you? Or was your daughter so immersed in the game that she really was telling the truth when she said she did not hear you? Our response would be that the auditory items that do get through the attenuation filter and are heard by the gamer are those that are personal in some way; so based on our findings, if you used your daughter's name when you called her, and she did not respond, the one might suggest that she chose to ignore you in order to keep her sense of immersion.

Before moving onto the next section, it is important to note that we are by no means suggesting that these are the only aspects of a person's surroundings that one is less aware of during game-play. The intention of Study One was not to produce an exhaustive account of RWD in all types of gaming, but just gain an insight into some of the characteristics of RWD and the processes involved.

7.2.3. Is it Possible to Measure RWD?

Using selective listening experiments as inspiration, the experimental scenario we designed involved 18 auditory distracters being played into the testing room while participants played a game. The distracters were a mixture of game-relevant, person-relevant and irrelevant. Afterwards the participants were given a surprise recall test, in which they were asked to list as many of the distracters that they could remember as possible. In line with the grounded theory of Study One, it was predicted that games that involved a sense of progression would lead to greater immersion, and therefore fewer recall of distracters. Three experimental studies were found to support this claim. In Study Two participants in the "feedback" condition recalled significantly fewer auditory distracters (mean = 6 distracters) than participants in the "no feedback" condition (mean = 7 distracters). In Study Three participants in the Star Fly 3 condition (a game more challenging than the "feedback" game) recalled significantly fewer distracters (mean = 5 distracters) than participants in the "no feedback" condition (mean = 7 distracters); furthermore this difference was greater than the difference observed in Study Two. In Study Six, participants in the rigged "high performance" condition (mean = 4 distracters) recalled significantly fewer distracters than participants in the rigged "low performance" condition (mean = 6 distracters).

Two of these experimental studies were also found to support the idea of selectivity for relevance in the processing of auditory distracters. In Study Two, participants in the "feedback" condition recalled significantly fewer irrelevant distracters than participants in the "no feedback" condition; there were no significant differences between the conditions for game-relevant and person-relevant distracters. Similarly, in Study Six participants in the rigged "high performance" condition recalled significantly fewer irrelevant distracters than participants in the rigged "low performance" condition; there were no significant differences between the conditions for game-relevant and person-relevant distracters.

A second experimental scenario was designed where RWD could be measured via reaction time. Five minutes after participants started to play a game surprise text appeared at the bottom right of the screen, instructing the participant to click here the experiment is now over; the participant's reaction time to click this button from when it first appeared was then measured. The idea behind the design was that it would be analogous to a Windows pop up that suddenly appears on the outskirts of a game telling you to check your computer for viruses, etc. In line with the grounded theory of Study One, it was predicted that people that are performing well in a game and are feeling a sense of progression at that moment in the time would be slower to react to the visual distracter. Study Five was found to support this claim: the "high performers" group was slower to react to the visual distracter (mean = 201 seconds) compared to the "low performers" group (mean = 41 seconds).

Therefore these findings suggest that RWD is not just something that people talk about, but it does exist and can be measured. The use of these measures served to validate several aspects of our grounded theory. Furthermore, they also served to validate the existing IEQ (Jennett et al., 2008) which was often used in conjunction with the recall / reaction time measures: the conditions that were rated most immersive using the questionnaire were also found to have less recall / slower reaction times.

Considering the experimental findings in relation to our over-arching question 'Is immersion just another form of SA?' it is necessary to go into more depth about the conclusions of each the experiments.

Studies Two and Three showed that gaming conditions with a sense of progression in terms of game-play (positive and negative feedback) and the game narrative (obstacles more difficult over time, moving onto new levels) were rated more immersive and led to the recall of fewer auditory distracters, compared to conditions with no feedback. However the more immersive conditions in Study Two and Three also differed in terms of features not associated with game progression, such as better graphics. Therefore one could argue that the differences were due to differences in perceptual load (similar to existing SA theories) rather than differences in the players' sense of progression.

Studies Four and Five were better suited for supporting the grounded theory, as they involved participants playing the same game rather than different games. Study Four was not successful in showing that the "high performers" group was more immersed and recalled fewer distracters than participants than the "low performers" group; however it was suspected that this was due to the lack of detail in our definition of low performance. In Study Five we clarified "low performers" as participants that were not making progress and receiving no positive feedback at the moment when the distracter appeared. As predicted, the "high performers" group was slower to react to a visual distracter than the "low performers" group. However it was still possible to explain the results according to differences in perceptual load, as the "high performers" would have moved onto new levels, experiencing visual effects and sounds associated with this.

Study Six was designed to demonstrate that RWD in gaming is not just a result of differences in perceptual load. Study Six involved comparing two conditions in which the games were identical, apart from an additional feature of the game that either served to dramatically increase or dramatically decrease the participant's score. As predicted, the rigged "high performance" condition recalled fewer auditory distracters than the rigged "low performance" condition. Furthermore, a key aspect of the design of Study Six was that the actual performance of the participants did not differ, just their perceptions of their performance, influenced by the feedback they received. Therefore, as the two performance conditions conditions were virtually identical in terms of perceptual features and task difficulty, one can suggest that the differences in RWD observed can not be explained by cognitive load and were due to difference in motivation only. This provides strong support for our grounded theory notion that immersion self-motivated attention.

Together the evidence suggests that immersion cannot be accounted for solely by selective attention: much of the real world is attenuated during game-play due primarily to the gamer's motivation to continue the immersive experience.

7.3. CONTRIBUTION TO HCI

7.3.1. Theoretical Insights into the Nature of RWD and Immersion

This research has contributed to HCI by giving a number of theoretical insights into the nature of RWD, an aspect of game immersion about which little was known before. The grounded theory introduces the idea that a number of attentional processes are involved in RWD: selectivity for relevance, bottom-up and top-down processing. The grounded theory also allows us to gain an insight into how immersion relates to SA. We propose that immersion is not just an extreme form of SA; the intrinsic nature of game-play and its interactivity means that game immersion operates differently. In particular, we emphasise the important role that motivation plays in immersion, feedback underpinning a person's sense of progression and their motivation to keep playing the game.

An emphasis on the importance of the feedback in gaming is not new for the gaming literature, several researchers have already emphasised the importance of the feedback loop in gaming. For example, Polaine (2005) defines "game interaction" as a feedback loop between the person and the game: the player makes a change to the device presented to them (usually to elements on a screen) which in turn changes the player's behaviour, creating yet another change in the device's reaction, and so on. Polaine (2005) explains that this form of action, reaction and interaction is a fundamental aspect of game-playing. Similarly, Friedman (1995) also emphasises the importance of the feedback loop in gaming. However, it is new to discuss feedback in relation to RWD and to validate claims of the importance of feedback with experimental studies.

As well as insights into the nature of RWD, this research also shows considerable support for Brown and Cairns (2004)'s conceptualisation of immersion. In line with Brown and Cairns (2004), the grounded theory supports the idea that there is a common graded experience of immersion, as a sense of progression is an important feature for many different game genres. Consequently, it also supports the use of the IEQ as a common metric to measure the immersive experiences of a wide range of games.

The grounded theory also revealed that although some gamers did get immersed to the extent that they felt like they were the character, the majority of gamers claimed that they were always somewhat aware that they were in a room playing a game. Therefore this supports the idea that Flow is not a common experience in gaming (Brockmyer et al., 2009) and that at the highest state of immersion not everybody experiences presence (Arsenault, 2005). This also provides further support for Brown and Cairns (2004)'s conceptualisation of immersion, engagement and engrossment being much more common than extreme experiences in which a person feels completely absorbed in an activity.

7.3.2. New Objective Measures for Assessing Game Immersion

An additional strength of this research is that as well as developing a grounded theory, experimental studies were conducted to further validate the theory, testing the hypotheses of the theory. Thus there is empirical evidence to support our claims. This research shows that RWD is not just something that people talk about, but it does exist and can be measured.

In immersion research only a handful of studies have used objective measures to assess the extent to which a person is less aware of distracters during game immersion. These objective measures included time estimation (Rau et al., 2006) and behavioural responses to an auditory distracter (Brockmyer et al., 2009). The current research used recall of auditory distracters and reaction times to a visual distracter to show a relationship between a sense of progression (via feedback) and being less aware of your surroundings. This is new for immersion research as such measures have not been used before. The IEQ was used in conjunction with these objective measures, to provide further support that the conditions did differ in immersion as expected.

A limitation of using experimental methodologies is that the gaming scenario is less ecologically valid. For example, rather than playing in the comfortable setting of one's own home, gamers are asked to play a game in a testing cubicle. However, one can argue that if researchers conduct a mixture of qualitative and quantitative studies, as in this research, one is able to get the best of both worlds: rich qualitative data for exploring people's experiences as well as objective quantitative data for testing hypotheses.

7.3.3. An Example of Multisensory Selective Attention in a Context Similar to Real Life

As well as contributing to the immersion literature, this research also contributes to the SA literature. In support of the Attenuation Theory (Treisman, 1960), the research findings suggest that when playing an immersive game a player is less aware of irrelevant distracters than relevant distracters. Therefore this suggests that a similar attentional filter is at work in gaming as that described to be at work in Auditory SA tasks.

Similar to SA research, these findings also show that by manipulating features that are known to influence game immersion, such as a person's sense of progression, one is able to affect how much people attend to other aspects of their environment. Indeed the use of the objective measures of recall and reaction times to measure one's processing of distracters were inspired by our literature review in which the immersion literature was compared to the SA literature. This further supports the idea that the concepts of SA and RWD share similarities.

However, the current research also differs from SA research. SA studies are usually not ecologically valid, investigating simple tasks that are uni-modal such as selective listening tasks (e.g. Cherry, 1953), and visual attention tasks such as Stroop effects (e.g. Stroop, 1935) and Flanker effects (e.g. Eriksen & Hoffman, 1973). In contrast, this research investigates a complex phenomenon similar to real life. Gaming is an example of a domain in which a person's vision, audition and tactile senses are all directed towards one stimulus, the game, ignoring other stimuli in the room. Therefore, this research contributes to the growing multi-sensory SA literature (e.g. Spence, 2002).

In particular, our theory of RWD in gaming is an example of how SA processes work in an interactive task domain that involves feedback. Whereas people do not choose to do boring attention tasks for a long period of time unless paid, e.g. monitoring a security camera in case of intruders, people do choose to play games. In this research it has been suggested that feedback plays an important role in this, because it allows for self-assessment and influences a person's motivation to keep playing the game. Therefore one can suggest that game immersion operates differently to SA as it is typically conceptualized; immersion being much more complex due to such interactivity.

Study Six in particular shows a dissociation between game immersion and cognitive load. This adds strength to our claim that differences in immersion are not a result of increased sensory features of task demands, but purely due to motivation. For the next step of this research, in order to understand more about the ways in which immersion and attention differ, it would be useful to investigate other dissociations between the two concepts, e.g. situations that involved high attention but low immersion.

7.3.4. Possible Applications for Enhancing / Limiting Immersion in Gaming and Other Contexts

In Chapter One it was proposed that the current research could have possible practical applications in the following gaming contexts: stress relief, educational games, and limiting excessive game-play. Each of these issues shall now be considered in turn. Practical applications for contexts other than gaming shall also be proposed.

7.3.4.1. Stress Relief

Several researchers suggest that stress relief is a reason why people play computer games (Clark, 2006; Colwell, 2007). It has also been suggested that visuospatial games could be used to reduce the impact of traumatic events, preventing the development of PTSD (Holmes et al., 2009). Expanding upon this, the current research suggests that it is a person's sense of progression in the game that is most important: as a result of their focus on the game world, this allows players to get their minds off any problems that they have in the real world. Therefore, if a player wants to enhance immersion while gaming one can suggest that they try to limit relevant distracters in their environment that could threaten to disrupt their sense of progression, e.g. play when they are least likely to be disturbed by siblings, turn off their phone. Players should also play a game of a suitable challenge level for their abilities, so that it is not too difficult to progress. In order for the game to be considered "worthy of the player's time" it should also not be too easy to progress, as the player needs to feel challenged and stimulated.

As well as gaming, this research supports the idea that leisure activities in general provide a mechanism for coping with tension and stressful events (Trenberth & Dewe, 2002). One can suggest that a sense of progression is also key for other immersive experiences, such as reading in books, watching films, and playing physical games (sports, cards). The person's sense of progression in the activity (progression in narrative, progression in game-play) allows the person to focus on something else other than the stressors in their life. Again one can enhance immersion in such contexts by increasing this sense of progression, for example keeping the plot of a film moving at a suitable speed in order to gauge people's interests, playing sports against teams of a similar skill level to your own so that team members are unsure whether they will win and feel like more in suspense.

7.3.4.2. Educational Games

Several researchers suggest that computer games involve high levels of concentration which could be beneficial for teaching students in schools (Prensky, 2003; Rosas et al., 2003; Tuzun et al., 2009; Bioulac et al., 2008). It has also been suggested that such a highly motivating context could be utilized by therapists in order to teach clients new coping strategies (Parsons et al., 2004; Silver & Oakes, 2001; Sharry et al., 2003). Expanding upon this, based on the current research one can suggest that it is a person's sense of progression that is key to this motivation. The idea of playing a game might attract students at first, the same as a VR system might be immersive at first because it is new and exciting; however in order to engage the participant's focus and concentration for a long period of time so that they do not become bored the student must feel that they are learning new things about the environment, improving their score, moving onto new levels. Therefore one can suggest that in order for a game to be successful in learning contexts there must be an appropriate level of challenge: although a good game needs a level of ease when a person starts to play, over time the game should become more difficult so that the user needs to learn more skills in order to succeed, keeping their sense of achievement and sense of progression at a satisfactory level.

Furthermore, if games are to be used in contexts such as education and therapy, one can suggest that it is important that the teacher or therapist is nearby, so that they can offer assistance if the student / client is unable to get past a point in the game and progress. Similarly, in therapeutic sessions Goh et al. (2008) suggests that it is also important for the therapist to be nearby so that they can explain how the activities in the game relate to real life coping skills.

7.3.4.3. Limiting Excessive Game-Play

There are also situations in which researchers may want to limit a person's immersion. For example, it has been suggested that children spending increasing amounts of time playing games and not being physically active could be linked to the rise in childhood obesity (IT News, 2007). It has also been suggested that gaming can be "addictive". Computer game addiction is not currently recognised as an official disorder, however there is evidence to suggest that players who spend excessive amounts of time playing games are similar to other addicts in that they get irritable if unable to play, they sacrifice time from family and friends, personal health and hygiene might even be neglected (Freeman, 2008). Addictive behaviour is most likely to be seen regarding one type of game-play, MMORPGs (Freeman, 2008; Caplan et al., 2009; Hsu et al., 2009). Hsu et al. (2009) suggests that five factors predict MMORPG addiction: belonging, obligation, curiosity, reward and role playing. Caplan et al. (2009) also found that loneliness was the most significant indicator of Problematic Internet Use for players of MMORPG users. The difference between game addiction and game immersion is that the player is unable to control when to stop playing; individuals that already suffer from impulsivity are particularly at risk (Freeman, 2008; Bioulac et al., 2008).

Expanding upon this, the current research suggests that it a person's sense of progression in the elaborate game worlds of MMORPGs that motivates the player to keep playing despite other commitments. The extraneous factor of social influence also plays an important motivating role in such game-play, as players feel that they are part of a community. One can suggest that in order to limit another person's immersive experience, particularly for those individuals that are unable to control the length of time that they play, one needs to disrupt their sense of progression. Hsu et al. (2009) and Eggen et al. (2003a; 2003b) have both used methods of breaking game immersion that involve disrupting the player's sense of progression. Hsu et al. (2009) suggests that if a person has been logged in for too long, the system can discourage users to stop playing by preventing them from travelling to new zones, slowing the pace of the character, and reducing the power of their weapons. Similarly, Eggen et al. (2003a; 2003b) suggests that a game can be made less immersive by building a feature that decreases the challenge level of the game, thereby making the game less motivating. Additionally the current research would suggest that if a person wants to attract another person's attention without completely disrupting the person's gaming experience, for example reminding the person to do something for later, they can attract the person's attention by using relevant distracters such as referring to the game or saying the person's name before giving their message.

7.3.4.4. Practical Applications in Non-Game Contexts

As well as implications for enhancing and limiting immersion in gaming, another practical application of this research is that features that make games appealing can be applied to other areas. For example, one can suggest that feedback is a useful feature for people to consider when designing web pages and paper-based learning activities, if one wishes to engage the reader's attention to a greater extent. Also there are a number of jobs that require attention but can be repetitive and boring, such as monitoring CCTV footage and scanning luggage at airports. One can suggest that by adding game-like elements to these jobs, such as surprise testing and feedback of performance, this could make the employees' experience more enjoyable.

7.4. FUTURE RESEARCH

In terms of the experimental methods used, we have acknowledged that some of the games used in our studies were quite simple (Study Two, Study Three). In future studies, it would be useful to investigate awareness of distracters for more complicated games. It is possible that previous experience would have more of an effect on awareness of distracters when playing complicated games, because experts are able to get to grips with the controls quicker. Also it seems likely that a person's awareness of their environment would differ in a multi-player game compared to a single-player game.

Another limitation that we have acknowledged is that the majority of participants in our samples tended to be female. In future studies it would be useful to replicate the experiments with a male sample, in order to ensure that similar results are found in both genders.

Regarding Study Four and Five it was particularly notable that despite the majority of the sample being female, the majority of male participants were always classified as "high performers". On the one hand, this could just be an artifact of our sampling, as perhaps males only wanted to volunteer to take part if they knew they were good at games, whereas females were more likely to volunteer whether or not they were good at games. On the other hand, this could be reflecting a cultural difference in which males tend to play games more than females and so they perform better as a result. In future research it would be interesting to investigate this further, and whether such gender differences in game performance do actually exist.

In terms of game feedback, in Study Two and Three conditions with or without feedback were compared. In future research it would be interesting to investigate the impact of different types of feedback (e.g. visual, auditory, scores) and see which is best. It would also be interesting to investigate whether it is possible to have too much feedback, i.e. cognitive over load.

In terms of types of distracters, only auditory distracters and a visual distracter were investigated. In future research it would be interesting to investigate awareness of tactile distracters as one might expect those to be the most disruptive for immersion, for example someone tapping you on the shoulder while you are playing. It would also be interesting to investigate the effect of the proximity / loudness of distracters, the effect of different voices and the impact of familiarity of the gaming location. For example, one might suggest that if the auditory distracters in the experimental studies were spoken by someone the participant knew, such as their mum telling them their lunch is ready rather than the experimenter's voice, this would have been more personally-relevant and thus more noticeable. Also it is possible that in an experimental setting, due to the nature of the gaming situation, participants will pay more attention to distracters than they would normally at home.

In terms of gaming performance, Study Five investigated differences in awareness of distracters between "high performers" and "low performers" for a challenging game. As mentioned in the General Discussion section of Chapter Five (Section 5.5), in future research it would be interesting to investigate differences in awareness of distracters for an easy game, as one might expect to observe the opposite, e.g. "low performers" being engaged, while "high performers" are bored and easily distracted. In line with our grounded theory, such a result would emphasise the importance of gamers being challenged at an appropriate level for their skills.

It would also be interesting to investigate the relationship between RWD and increasing game expertise. For example, in gaming research expertise is often associated with practice (Green & Bavelier, 2003). Therefore one can suggest that after a couple of practice sessions, as a person becomes better at a game they will become less aware of distracters than they were previously.

In terms of the differences between SA and RWD, Study Six showed that awareness of distracters differed in conditions that differed in perceived game performance but yet had equal cognitive loads. In future research it would be useful to investigate other dissociations between the two concepts, for example situations that involved high attention but low immersion.

Furthermore, now that we have some understanding of RWD, it would be interesting to investigate other components of immersion and how they relate to each other. For example, one might predict that as emotional involvement increases more RWD is experienced.

There is also a need to investigate the practical applications of this research further, designing ways to enhance immersion in educational games and inhibiting immersion in addictive contexts where immersion could be dangerous.

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APPENDIX 1: Interview Schedule used in Study 1

INTERVIEW SCHEDULE

What kinds of games do you like playing?

- Fighting Shoot 'em up Car racing Football
- Adventure Simulation PC games Arcade / retro

What do you have to do in these games?
Why do you like playing them? How does it make you feel?

- Do you ever play to relax? To let out frustrations?
- Do you ever have any negative feelings about playing?
- Do you ever feel guilty after playing? Feel like you play too much?

What games do you not like playing?

What console do you use?

- Playstation, Xbox / PC computer / Handheld
- Keyboard / Mouse / Joypad / Steering wheel / Gun
- Arcades = Dance mats, Simulators

Would you still enjoy these games if you played them on different consoles?

Gaming Environment

- When do you play during the day? Where do you play?
- Do you set up the room in any way?
- Do you usually play one game continuously until you finish it, or do you play several games at once?
- How long do you usually play in one session?
- Do you ever find yourself playing for much longer than you intended to?
- How many times do you play during the week?

Some people talk about being "in the game". What do you think they mean by this?

- Have you ever had this experience? What is it like? What does it feel like?
- Does it seem like a long time has passed or a short time?
- To what extent do you notice things around you?
- E.g. Notice someone enter a room? Forgot to do something important?
- Eyes hurt? Finger cramp? Heart racing? Moving closer / very still?

Does the game environment seem real to you, or are you always aware that you are just playing a game? Why do you think this is?

- Do you feel emotionally attached to the game?
- Do you react to the game as if you are really there, or are you really still?

Are these reactions any different to how you respond when you are just playing a game, but not actually in the game? What makes being in the game special?

- Can you be emotionally attached, but not "in the game"
- Do you always have to play for a long time? What about just 15 minutes?
- Can you be in the game when other people are physically present?
- Is being in the game different from being really into a good book or film?

Does a game always have to tell a story?

- What kind of game narratives do you like / dislike?
- Games with clear structure of where you have to go + what you have to do, or games less clear, with big environments you can explore and find your way?
- Do you always have to be working towards a big goal? Or play just to play?
- Have you ever played a game where goals are not important?

Does a game have to challenge you to be enjoyable?

- When you do come across difficult parts of the game, what keeps you going?
- What games have you found to be too easy / too difficult in the past?
- How do the games you like compare to these games?

Do you have a favourite character you like to play as?

- Why do you like this character? Would you say that you identify with this character?
- Have you ever played a game where you had to play as character you did not like?
- Do you have a favourite villain / baddie? Why do they stand out to you?

What kinds of graphics do you like / dislike?

- Does a game have to look good to be enjoyable?
- Often computer game designers are aiming to produce games with more realistic graphics and character movements. How important is realism to you? Or if Cartoonish?
- Do realistic graphics give you a greater sense of actually being in the environment?
- Can you ever be "in the game" when the graphics are non-realistic?

What kind of game sounds do you like / dislike?

- Do you like games with music throughout, or do you prefer games to just have sounds relevant to the game (i.e. when a character jumps, etc.)?
- How does sound affect your game play? Can sounds ever get annoying?
- Have you ever tried played mute?

Some people talk about games in terms of game-play. What do you think they mean?

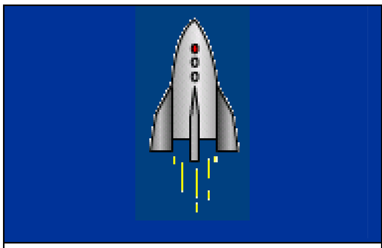
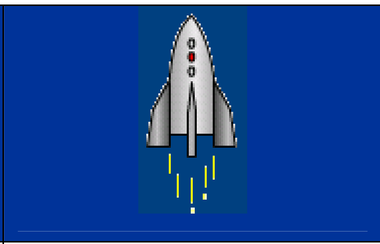
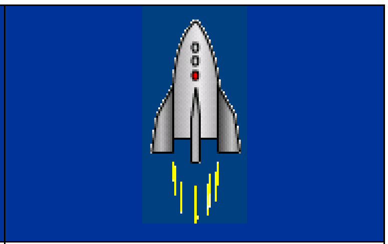
- Do you like games with simple controls, or games that are more complex?
- In your opinion which games has good game-play? Bad game-play?

What got you into playing these types of games?

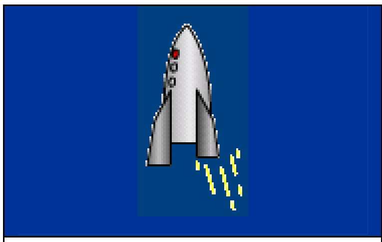
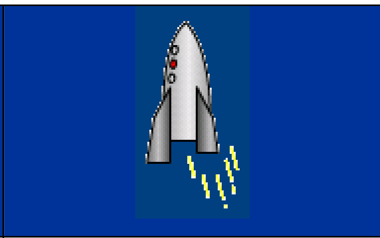
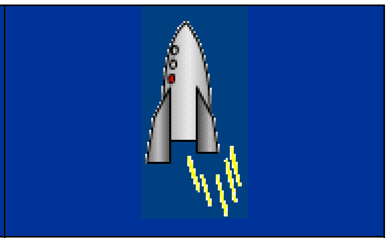
- Do other family members / friends play?
- Do you talk about gaming with others or is it more private?
- Do you ever think about gaming during the day? Have you ever had "cravings" to play a game? Do you view this as a good or bad thing?
- How do other people view your gaming? Positive / Negative?
- What impact do you think gaming has had on your life, if any?

APPENDIX 2: Rocket States of the Space Trek Game

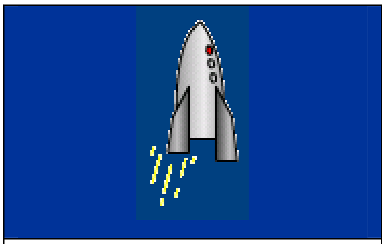
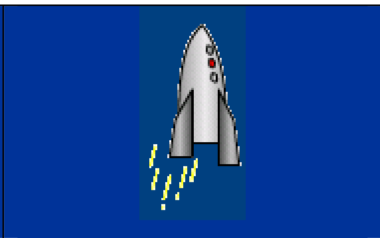
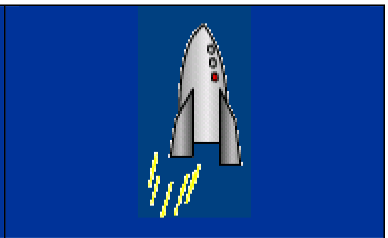
"Forward" rocket state, graphics 1-3.

		
Graphic 1	Graphic 2	Graphic 3

"Move left" rocket state, graphics 1-3.

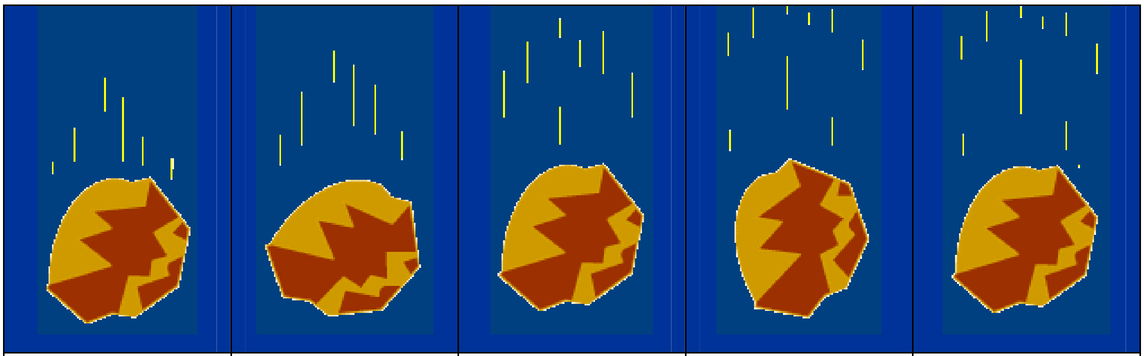
		
Graphic 1	Graphic 2	Graphic 3

"Move right" rocket state, graphics 1-3.

		
Graphic 1	Graphic 2	Graphic 3

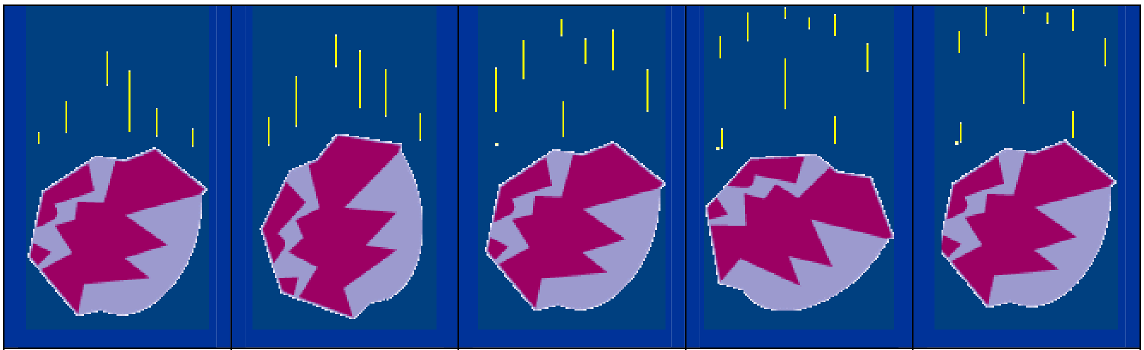
APPENDIX 3: Asteroid States of the Space Trek Game

Asteroid 1, Graphics 1-5.



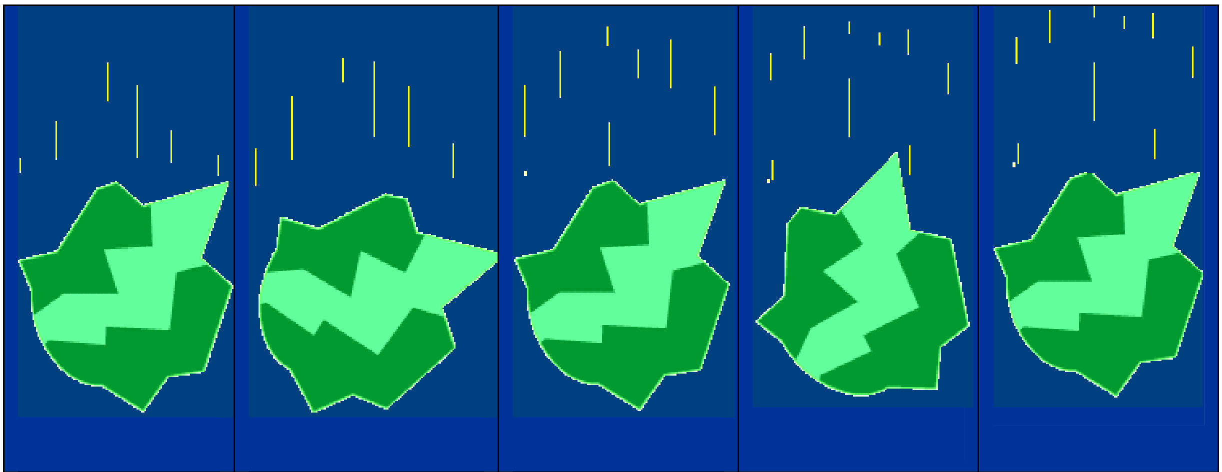
Graphic 1	Graphic 2	Graphic 3	Graphic 4	Graphic 5

Asteroid 2, Graphics 1-5.



Graphic 1	Graphic 2	Graphic 3	Graphic 4	Graphic 5

Asteroid 3, Graphics 1-5.



Graphic 1	Graphic 2	Graphic 3	Graphic 4	Graphic 5

APPENDIX 4: Immersive Experience Questionnaire (IEQ) used in Study One

YOUR EXPERIENCE OF GAME A / B

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 <u>end</u> of the game.

1. To what extent did the game hold your attention?
   Not at all 1 2 3 4 5 6 7 A lot

2. To what extent did you feel you were focused on the game?
   Not at all 1 2 3 4 5 6 7 A lot

3. How much effort did you put into playing the game?
   Very little 1 2 3 4 5 6 7 A lot

4. Did you feel that you were trying you best?
   Not at all 1 2 3 4 5 6 7 Very much so

5. To what extent did you lose track of time?
   Not at all 1 2 3 4 5 6 7 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 6 7 Very much so

7. To what extent did you forget about your everyday concerns?
   Not at all 1 2 3 4 5 6 7 A lot

8. To what extent were you aware of yourself in your surroundings?
   Not at all 1 2 3 4 5 6 7 Very aware

9. To what extent did you notice events taking place around you?
   Not at all 1 2 3 4 5 6 7 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 6 7 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 6 7 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 6 7 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 6 7 Very much so

14. 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 6 7 Very much so

15. 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 6 7 Very much so

16. To what extent did you feel as though you were moving through the game according to your own will?
Not at all 1 2 3 4 5 6 7 Very much so

17. To what extent did you find the game challenging?
Not at all 1 2 3 4 5 6 7 Very difficult

18. Were there any times during the game in which you just wanted to give up?
Not at all 1 2 3 4 5 6 7 A lot

19. To what extent did you feel motivated while playing?
Not at all 1 2 3 4 5 6 7 A lot

20. To what extent did you find the game easy?
Not at all 1 2 3 4 5 6 7 Very much so

21. 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 6 7 A lot

22. How well do you think you performed in the game?
Very poor 1 2 3 4 5 6 7 Very well

23. To what extent did you feel emotionally attached to the game?
Not at all 1 2 3 4 5 6 7 Very much so

24. To what extent were you interested in seeing how the game's events would progress?
Not at all 1 2 3 4 5 6 7 A lot

25. How much did you want to "win" the game?
Not at all 1 2 3 4 5 6 7 Very much so

26. Were you in suspense about whether or not you would win or lose the game?
Not at all 1 2 3 4 5 6 7 Very much so

27. At any point did you find yourself become so involved that you wanted to speak to the game directly?
Not at all 1 2 3 4 5 6 7 Very much so

28. To what extent did you enjoy the graphics and the imagery?
Not at all 1 2 3 4 5 6 7 A lot

29. How much would you say you enjoyed playing the game?
Not at all 1 2 3 4 5 6 7 A lot

30. When interrupted, were you disappointed that the game was over?
Not at all 1 2 3 4 5 6 7 Very much so

31. Would you like to play the game again?
Definitely no 1 2 3 4 5 6 7 Definitely yes

How immersed did you feel? (10 = very immersed; 0 = not at all immersed)
1 2 3 4 5 6 7 8 9 10

APPENDIX 5: Scoring the Immersive Experience Questionnaire (IEQ)

IEQ Immersion Score

The IEQ immersion score is computed by adding up the responses to all 31 questionnaire items; responses to Q6, Q8, Q9, Q10, Q18 and Q20 were negated.

Single Question Measure of Immersion

The single question measure of immersion at the end of the questionnaire, "How immersed did you feel?" gives the researcher an additional measure to check whether the IEQ is reliably reflecting participant's immersive experience. The IEQ immersion score can then be correlated against this measure.

IEQ Immersion Factors

As well as total immersion, the IEQ also allows scores for five immersion factors to be computed.

- The cognitive involvement factor is computed by adding up 10 of the questions: Q1, Q2, Q3, Q4, Q17, Q19, Q21, Q22, Q25, Q29.
- The real world dissociation factor is computed by adding up 6 of the questions: Q6, Q7, Q8, Q9, Q12, Q14 (where Q6, Q8 and Q9 were negated).
- The emotional involvement factor is computed by adding up 12 of the questions: Q6, Q7, Q13, Q19, Q23, Q24, Q25, Q26, Q27, Q29, Q30, Q31 (no negations).
- The challenge factor is computed by adding up 5 of the questions: Q17, Q18, Q20, Q22, Q26 (no negations).
- The control factor was computed by adding up 8 of the questions: Q10, Q11, Q13, Q14, Q15, Q16, Q21 and Q28 (no negations).

APPENDIX 6: Modifications made to 5 of the IEQ Items as a Result of Piloting the Space Trek Games

	Original Questionnaire Item	Modified Questionnaire Item
Q5	To what extent did you lose track of time?	To what extent did you lose track of time, e.g. did the game absorb your attention so that you were not bored?"
Q13	To what extent did you feel that the game was something you were experiencing, rather than something you were just doing?	To what extent did you feel that the game was something fun you were experiencing, rather than a task you were just doing?
Q15	At any point did you find yourself become so involved that you were unaware you were even using controls?	At any point did you find yourself become so involved that you were unaware you were even using controls, e.g. it was effortless?
Q26	Were you in suspense about whether or not you would win or lose the game?	Were you in suspense about whether or not you would do well in the game?
Q30	When interrupted, were you disappointed that the game was over?	When it ended, were you disappointed that the game was over?

APPENDIX 7: Modified Immersive Experience Questionnaire (IEQ) used in Study Three, Study Four, Study Five and Study Six

YOUR EXPERIENCE OF GAME A / B

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 <u>end</u> of the game.

1. To what extent did the game hold your attention?
   Not at all 1 2 3 4 5 6 7 A lot

2. To what extent did you feel you were focused on the game?
   Not at all 1 2 3 4 5 6 7 A lot

3. How much effort did you put into playing the game?
   Very little 1 2 3 4 5 6 7 A lot

4. Did you feel that you were trying you best?
   Not at all 1 2 3 4 5 6 7 Very much so

5. To what extent did you lose track of time, e.g. did the game absorb your attention so that you were not bored?
   Not at all 1 2 3 4 5 6 7 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 6 7 Very much so

7. To what extent did you forget about your everyday concerns?
   Not at all 1 2 3 4 5 6 7 A lot

8. To what extent were you aware of yourself in your surroundings?
   Not at all 1 2 3 4 5 6 7 Very aware

9. To what extent did you notice events taking place around you?
   Not at all 1 2 3 4 5 6 7 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 6 7 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 6 7 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 6 7 Very much so

13. To what extent did you feel that the game was something fun you were experiencing, rather than a task you were just doing?
    Not at all 1 2 3 4 5 6 7 Very much so

14. 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 6 7 Very much so

15. At any point did you find yourself become so involved that you were unaware you were even using controls, e.g. it was effortless?
    Not at all 1 2 3 4 5 6 7 Very much so

16. To what extent did you feel as though you were moving through the game according to your own will?
    Not at all 1 2 3 4 5 6 7 Very much so

17. To what extent did you find the game challenging?
    Not at all 1 2 3 4 5 6 7 Very difficult

18. Were there any times during the game in which you just wanted to give up?
    Not at all 1 2 3 4 5 6 7 A lot

19. To what extent did you feel motivated while playing?
    Not at all 1 2 3 4 5 6 7 A lot

20. To what extent did you find the game easy?
    Not at all 1 2 3 4 5 6 7 Very much so

21. 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 6 7 A lot

22. How well do you think you performed in the game?
    Very poor 1 2 3 4 5 6 7 Very well

23. To what extent did you feel emotionally attached to the game?
    Not at all 1 2 3 4 5 6 7 Very much so

24. To what extent were you interested in seeing how the game's events would progress?
    Not at all 1 2 3 4 5 6 7 A lot

25. How much did you want to "win" the game?
    Not at all 1 2 3 4 5 6 7 Very much so

26. Were you in suspense about whether or not you would do well in the game?
    Not at all 1 2 3 4 5 6 7 Very much so

27. At any point did you find yourself become so involved that you wanted to speak to the game directly?
    Not at all 1 2 3 4 5 6 7 Very much so

28. To what extent did you enjoy the graphics and the imagery?
    Not at all 1 2 3 4 5 6 7 A lot

29. How much would you say you enjoyed playing the game?
    Not at all 1 2 3 4 5 6 7 A lot

30. When it ended, were you disappointed that the game was over?
    Not at all 1 2 3 4 5 6 7 Very much so

31. Would you like to play the game again?
    Definitely no 1 2 3 4 5 6 7 Definitely yes

How immersed did you feel? (10 = very immersed; 0 = not at all immersed)
1 2 3 4 5 6 7 8 9 10

APPENDIX 8: Piloting the Auditory Distracters: A List of the 30 Distracters

15 distracters in Set A

	Game-Relevant	Person-Relevant	Not Relevant
Factual	Did you know that there are millions and millions of stars in the universe?	Did you know that millions of people take part in psychology research in the UK?	Did you know that there are millions of fish in the sea?
Goes against game objective	Hey what happens if you crash into those asteroids really fast? Go on, try it!	Hey there is someone pulling a face behind you, turn around and see!	Hey there is a really good cleaning tip here, come and take a look!
De-motivating	I don't see the point of playing games, I think they are a waste of time.	I don't see the point of doing experiments, I think they are a waste of time.	I don't see the point of reality tv shows, I think they are a waste of time.
De-motivating	Aw man, you are so rubbish at this game! I did much better when I played it, you might as well give up now.	Aw man, you are doing so poorly in this experiment! I did much better when I took part in it, you might as well give up now.	Aw man, you are such a bad chess player! I play chess much better than you, you might as well give up now.
Directional	Move the rocket right, right, now left. Left, left, right, right. Watch out for that asteroid! Ah, you just missed it. Right, left, right.	Move your body right, right, now left. Left, left, right, right. Lift those arms high in the air! Now down again. Right, left, right.	Move the saucepan right, right, now left. Left, left, right, right. Flip that pancake! Ah, you just caught it in time. Right, left, right.

15 distracters in Set B

	Game-Relevant	Person-Relevant	Not Relevant
Factual	Did you know that rockets fly faster than the speed of light through out of space?	Did you know that psychology experiment can be as quick as 5 minutes sometimes?	Did you know that motor car racing is the fastest sport on earth?
Goes against game objective	Have you ever tried playing a game with your eyes closed? Go on, try it!	Experiments don't take much effort. See if you can do it with your eyes closed!	Have you ever tried singing a song with your eyes closed? Go on, try it!
De-motivating	Space games are so boring. Have you got any idea what other games I can play that might be more fun?	London is such a boring city. Have you got any ideas what attractions I can visit to make my stay here more fun?	Cats as pets are so boring. Have you got any idea what other pets I can buy that might be more fun?
Goes against game objective	Hey the time of this game has malfunctioned! You'd better stop playing now or you will be playing forever!	Hey your lunch is ready! You'd better come and get it now or it will become cold!	Hey this cleaning product if out of date! You'd better throw it away now or it will go off!
Object-oriented	Star, star, asteroid. Asteroid, asteroid, star, star. Asteroid, star, asteroid, star. Star, star, star.	Collect, collect, dodge. Dodge, dodge, collect, collect, Dodge, collect, dodge, collect. Collect, collect, collect.	Turn, turn, flip. Flip, flip, turn, turn. Turn, flip, turn, flip. Turn, turn, turn.

APPENDIX 9: Piloting the Auditory Distracters: Distraction Ratings During Game-Play

Set A (aggregate of "feedback" and "no feedback" conditions)

		Distraction	Mean	SD
Game	Directional	6. Move the rocket right, right, now left…	4.75	2.01
Game	De-motivating 2	5. Aw man, you are so rubbish at this game…	4.17	1.59
Irrelevant	Directional	13. Move the saucepan right, right, now left…	4.00	1.95
Person	De-motivating 2	14. Aw man, you are doing so poorly in this experiment…	3.58	2.23
Person	De-motivating 1	3. I don't see the point of doing experiments…	3.42	1.38
Person	Against game objective	8. Hey there is someone pulling a face behind you…	3.42	1.88
Person	Directional	10. Move your body right, right, now left…	3.25	1.06
Irrelevant	Against game objective	2. Hey there is a really good cleaning tip here…	3.25	1.60
Game	De-motivating 1	15. I don't see the point of playing computer games…	3.17	2.12
Irrelevant	Factual	1. Did you know that there are millions of stars in the universe…	3.08	1.16
Person	Factual	7. Did you know that millions of ppl take part in psychology research…	3.08	1.38
Irrelevant	Factual	4. Did you know that there are millions of fish in the sea…	2.92	1.62
Irrelevant	De-motivating 2	12. Aw man, you are such a bad chess player…	2.83	1.34
Game	Against game objective	11. Hey what happens if you crash into the asteroids…	2.75	0.75
Irrelevant	De-motivating 1	9. I don't see the point of reality tv shows…	2.58	1.08

Set B (aggregate of "feedback" and "no feedback" conditions)

		Distraction	Mean	SD
Game	Object-oriented	6. Star, star, asteroid. Asteroid, asteroid, star…	4.08	1.16
Game	Against game objective 2	11. Hey the time of this computer game has malfunctioned…	3.50	1.45
Person	Factual	7. Did you know that psychology experiments can be as quick as 5 minutes…	3.42	1.51
Person	Against game objective 2	5. Hey your lunch is ready! You'd better come and get it now…	3.42	2.27
Person	De-motivating	14. London is such a boring city. Have you got any idea what attractions I can visit…	3.17	1.40
Person	Against game objective 1	8. Experiments don't take much effort. See if you can do it with your eyes closed…	3.08	1.16
Game	De-motivating	3. Space games are so boring. Have you got any idea what other games I can play…	3.08	1.24
Person	Object-oriented	10. Collect, collect, dodge. Dodge, dodge, collect…	3.33	0.89
Irrelevant	Against game objective 1	12. Have you ever tried singing a song with your eyes closed…	3.00	1.41
Game	Against game objective 1	15. Have you ever tried to play a computer game with your eyes closed…	2.92	1.16
Irrelevant	Against game objective 2	2. Hey this cleaning product is out of date! You'd better throw it away now…	2.92	1.68
Irrelevant	Object-oriented	13. Turn, turn, flip. Flip, flip, turn…	2.83	1.03
Irrelevant	Factual	4. Did you know that motor car racing is the fastest sport…	2.75	1.29
Game	Factual	1. Did you know that rockets fly faster than the speed of light…	2.67	0.98
Irrelevant	De-motivating	9. Cats as pets are so boring. Have you got any idea what other pets I can buy…	2.67	1.23

APPENDIX 10: Piloting the Auditory Distracters: Distraction Rankings After Game-Play

Set A (aggregate of "feedback" and "no feedback" conditions)

		Distraction	Mean	SD
Game	Directional	6. Move the rocket right, right, now left…	13.67	2.53
Person	Directional	10. Move your body right, right, now left…	11.92	2.75
Irrelevant	Directional	13. Move the saucepan right, right, now left…	11.42	4.23
Person	De-motivating 2	14. Aw man, you are doing so poorly in this experiment…	9.75	2.90
Game	De-motivating 2	5. Aw man, you are so rubbish at this game…	9.58	4.32
Person	Against game objective	8. Hey there is someone pulling a face behind you…	9.42	3.68
Game	Against game objective	11. Hey what happens if you crash into the asteroids…	8.67	3.11
Game	De-motivating 1	15. I don't see the point of playing computer games…	8.00	3.64
Person	De-motivating 1	3. I don't see the point of doing experiments…	7.42	3.34
Irrelevant	De-motivating 2	12. Aw man, you are such a bad chess player…	6.50	3.06
Irrelevant	Against game objective	2. Hey there is a really good cleaning tip here…	5.67	3.82
Person	Factual	7. Did you know that millions of ppl take part in psychology research…	5.42	2.54
Irrelevant	Factual	1. Did you know that there are millions of stars in the universe…	4.75	3.17
Irrelevant	De-motivating 1	9. I don't see the point of reality tv shows…	4.00	2.59
Irrelevant	Factual	4. Did you know that there are millions of fish in the sea…	3.83	3.81

Set B (aggregate of "feedback" and "no feedback" conditions)

		Distraction	Mean	SD
Person	Object-oriented	10. Collect, collect, dodge. Dodge, dodge, collect…	10.50	5.45
Game	Object-oriented	6. Star, star, asteroid. Asteroid, asteroid, star…	10.50	5.04
Irrelevant	Object-oriented	13. Turn, turn, flip. Flip, flip, turn…	9.25	4.83
Game	Against game objective 1	15. Have you ever tried to play a computer game with your eyes closed…	8.92	3.37
Person	Factual	7. Did you know that psychology experiments can be as quick as 5 minutes…	8.83	4.11
Person	De-motivating	14. London is such a boring city. Have you got any idea what attractions I can visit…	8.58	4.01
Person	Against game objective 2	5. Hey your lunch is ready! You'd better come and get it now…	8.25	5.21
Game	Against game objective 2	11. Hey the time of this computer game has malfunctioned…	7.92	4.42
Game	De-motivating	3. Space games are so boring. Have you got any idea what other games I can play…	7.75	3.60
Game	Factual	1. Did you know that rockets fly faster than the speed of light…	7.67	3.70
Irrelevant	De-motivating	9. Cats as pets are so boring. Have you got any idea what other pets I can buy…	6.92	4.38
Irrelevant	Against game objective 1	12. Have you ever tried singing a song with your eyes closed…	6.58	3.65
Person	Against game objective 1	8. Experiments don't take much effort. See if you can do it with your eyes closed…	6.00	3.30
Irrelevant	Factual	4. Did you know that motor car racing is the fastest sport…	6.00	4.05
Irrelevant	Against game objective 2	2. Hey this cleaning product is out of date! You'd better throw it away now…	6.33	4.10

APPENDIX 11: Piloting the Auditory Distracters: Set A Rankings for the "No Feedback" and "Feedback" Games

"No Feedback" version of Space Trek

		Distraction	Mean	SD
Game	Directional	6. Move the rocket right, right, now left…	14.33	0.82
Person	Directional	10. Move your body right, right, now left…	12.67	2.16
Irrelevant	Directional	13. Move the saucepan right, right, now left…	12.50	1.52
Person	Against game objective	8. Hey there is someone pulling a face behind you…	9.00	4.65
Game	De-motivating 2	5. Aw man, you are so rubbish at this game…	9.00	4.52
Game	Against game objective	11. Hey what happens if you crash into the asteroids…	8.83	3.60
Person	De-motivating 2	14. Aw man, you are doing so poorly in this experiment…	8.50	3.27
Person	De-motivating 1	3. I don't see the point of doing experiments…	8.17	3.31
Game	De-motivating 1	15. I don't see the point of playing computer games…	8.17	2.71
Person	Factual	7. Did you know that millions of ppl take part in psychology research…	6.00	2.68
Irrelevant	De-motivating 2	12. Aw man, you are such a bad chess player…	5.33	3.50
Irrelevant	Against game objective	2. Hey there is a really good cleaning tip here…	5.17	3.87
Game	Factual	1. Did you know that there are millions of stars in the universe…	4.83	2.04
Irrelevant	De-motivating 1	9. I don't see the point of reality tv shows…	4.50	3.27
Irrelevant	Factual	4. Did you know that there are millions of fish in the sea…	3.00	3.63

"Feedback" version of Space Trek

		Distraction	Mean	SD
Game	Directional	6. Move the rocket right, right, now left…	13.00	3.52
Person	Directional	10. Move your body right, right, now left…	11.17	3.25
Person	De-motivating 2	14. Aw man, you are doing so poorly in this experiment…	11.00	2.00
Irrelevant	Directional	13. Move the saucepan right, right, now left…	10.33	5.85
Game	De-motivating 2	5. Aw man, you are so rubbish at this game…	10.17	4.44
Person	Against game objective	8. Hey there is someone pulling a face behind you…	9.83	2.79
Game	Against game objective	11. Hey what happens if you crash into the asteroids…	8.50	2.88
Game	De-motivating 1	15. I don't see the point of playing computer games…	7.83	4.67
Irrelevant	De-motivating 2	12. Aw man, you are such a bad chess player…	7.67	2.25
Person	De-motivating 1	3. I don't see the point of doing experiments…	6.67	3.50
Irrelevant	Against game objective	2. Hey there is a really good cleaning tip here…	6.17	4.07
Person	Factual	7. Did you know that millions of ppl take part in psychology research…	4.83	2.48
Irrelevant	Factual	4. Did you know that there are millions of fish in the sea…	4.67	4.13
Game	Factual	1. Did you know that there are millions of stars in the universe…	4.67	4.23
Irrelevant	De-motivating 1	9. I don't see the point of reality tv shows…	3.50	1.87

APPENDIX 12: Piloting the Auditory Distracters: Set B Rankings for the "No Feedback" and "Feedback" Games

"No feedback" version of Space Trek

		Distraction	Mean	SD
Person	De-motivating	14. London is such a boring city. Have you got any idea what attractions I can visit…	10.17	4.26
Game	Object-oriented	6. Star, star, asteroid. Asteroid, asteroid, star…	10.17	5.12
Person	Against game objective 2	5. Hey your lunch is ready! You'd better come and get it now…	10.00	4.98
Person	Factual	7. Did you know that psychology experiments can be as quick as 5 minutes…	9.33	3.88
Person	Object-oriented	10. Collect, collect, dodge. Dodge, dodge, collect…	8.83	5.78
Irrelevant	De-motivating	9. Cats as pets are so boring. Have you got any idea what other pets I can buy…	8.67	4.13
Irrelevant	Against game objective 2	2. Hey this cleaning product is out of date! You'd better throw it away now…	8.50	4.03
Game	De-motivating	3. Space games are so boring. Have you got any idea what other games I can play…	8.00	4.29
Game	Against game objective 1	15. Have you ever tried to play a computer game with your eyes closed…	7.83	4.11
Irrelevant	Object-oriented	13. Turn, turn, flip. Flip, flip, turn…	7.67	4.97
Irrelevant	Factual	4. Did you know that motor car racing is the fastest sport…	7.00	4.34
Game	Against game objective 2	11. Hey the time of this computer game has malfunctioned…	6.67	5.32
Irrelevant	Against game objective 1	12. Have you ever tried singing a song with your eyes closed…	6.17	4.45
Person	Against game objective 1	8. Experiments don't take much effort. See if you can do it with your eyes closed…	5.50	2.43
Game	Factual	1. Did you know that rockets fly faster than the speed of light…	5.50	3.08

"Feedback" version of Space Trek

		Distraction	Mean	SD
Person	Object-oriented	10. Collect, collect, dodge. Dodge, dodge, collect…	12.17	5.04
Game	Object-oriented	6. Star, star, asteroid. Asteroid, asteroid, star…	10.83	5.42
Irrelevant	Object-oriented	13. Turn, turn, flip. Flip, flip, turn…	10.83	4.54
Game	Against game objective 1	15. Have you ever tried to play a computer game with your eyes closed…	10.00	2.28
Game	Factual	1. Did you know that rockets fly faster than the speed of light…	9.83	3.06
Game	Against game objective 2	11. Hey the time of this computer game has malfunctioned…	9.17	3.31
Person	Factual	7. Did you know that psychology experiments can be as quick as 5 minutes…	8.33	4.63
Game	De-motivating	3. Space games are so boring. Have you got any idea what other games I can play…	7.50	3.15
Person	De-motivating	14. London is such a boring city. Have you got any idea what attractions I can visit…	7.00	3.35
Irrelevant	Against game objective 1	12. Have you ever tried singing a song with your eyes closed…	7.00	3.03
Person	Against game objective 1	8. Experiments don't take much effort. See if you can do it with your eyes closed…	6.50	4.18
Person	Against game objective 2	5. Hey your lunch is ready! You'd better come and get it now…	6.50	5.24
Irrelevant	De-motivating	9. Cats as pets are so boring. Have you got any idea what other pets I can buy…	5.17	4.22
Irrelevant	Factual	4. Did you know that motor car racing is the fastest sport…	5.00	3.79
Irrelevant	Against game objective 2	2. Hey this cleaning product is out of date! You'd better throw it away now…	4.17	3.06

APPENDIX 13: 18 Distracters Selected as a Basis for Use in the Experimental Studies

Nine distracters from Set A.

	Game-Relevant	Person-Relevant	Not Relevant
Directional	Move the rocket right, right, now left. Left, left, right, right. Watch out for that asteroid! Ah, you just missed it. Right, left, right.	Move your body right, right, now left. Left, left, right, right. Lift those arms high in the air! Now down again. Right, left, right.	Move the saucepan right, right, now left. Left, left, right, right. Flip that pancake! Ah, you just caught it in time. Right, left, right.
De-motivating	Aw man, you are so rubbish at this game! I did much better when I played it, you might as well give up now.	Aw man, you are doing so poorly in this experiment! I did much better when I took part in it, you might as well give up now.	Aw man, you are such a bad chess player! I play chess much better than you, you might as well give up now.
Goes against game objective	Hey what happens if you crash into those asteroids really fast? Go on, try it!	Hey there is someone pulling a face behind you, turn around and see!	Hey there is a really good cleaning tip here, come and take a look!

Nine distracters from Set B.

	Game-Relevant	Person-Relevant	Not Relevant
Object-oriented	Star, star, asteroid. Asteroid, asteroid, star, star. Asteroid, star, asteroid, star. Star, star, star.	Collect, collect, dodge. Dodge, dodge, collect, collect, Dodge, collect, dodge, collect. Collect, collect, collect.	Turn, turn, flip. Flip, flip, turn, turn. Turn, flip, turn, flip. Turn, turn, turn.
De-motivating	Space games are so boring. Have you got any idea what other games I can play that might be more fun?	London is such a boring city. Have you got any ideas what attractions I can visit to make my stay here more fun?	Cats as pets are so boring. Have you got any idea what other pets I can buy that might be more fun?
Goes against game objective	Hey the time of this game has malfunctioned! You'd better stop playing now or you will be playing forever!	Hey your lunch is ready! You'd better come and get it now or it will become cold!	Hey this cleaning product if out of date! You'd better throw it away now or it will go off!

APPENDIX 14: Modifications made to 13 of the 18 Auditory Distracters Selected from the Auditory Distracters Pilot Study, in Order to Make Them More Appropriate for the Experimental Studies

	Version used in Pilot Study	Modified Version used in Study Two
1	Move the rocket right, right, now left. Left, left, right, right. Watch out for that asteroid! Ah, you just missed it. Right, left, right.	Move the rocket to the right, move the rocket to the right again, now move the rocket to the left. Watch out for that asteroid! Ah, you just missed it. Move the rocket to the right.
2	Move your body right, right, now left. Left, left, right, right. Lift those arms high in the air! Now down again. Right, left, right.	Tap your fingers to the right, tap your fingers to the right again, now tap your fingers to the left. Lift those arms high in the air! Now down again. Tap your fingers to the right.
3	Move the saucepan right, right, now left. Left, left, right, right. Flip that pancake! Ah, you just caught it in time. Right, left, right.	Swing the bat to the right, swing the bat to the right again, now swing the bat to the left. Hit that ball hard! Ah, you just hit it in time. Swing the bat to the right.
4	Aw man, you are so rubbish at this game! I did much better when I played it, you might as well give up now.	Aw man, you are so rubbish at this game! When I played this game I collected hundreds and hundreds of stars. You might as well give up now.
5	Aw man, you are doing so poorly in this experiment! I did much better when I took part in it, you might as well give up now.	Whoa, you are doing so poorly in this experiment! When I did this experiment my reaction times were really fast. You might as well give up now.
6	Aw man, you are such a bad chess player! I play chess much better than you, you might as well give up now.	Dearie me, you are such a bad chess player! When I play chess I always check mate the king, every single time. You might as well give up now.
7	Cats as pets are so boring. Have you got any idea what other pets I can buy that might be more fun?	Collecting stamps is so boring. Have you got any idea what other items I can collect that might be more fun?
8	Hey what happens if you crash into those asteroids really fast? Go on, try it!	Hey what happens if you crash into those asteroids really fast? Go on, try it! See what happens!
9	Hey there is someone pulling a face behind you, turn around and see!	Look there is someone pulling a face behind you, turn around and see! Go on, you know you want to!
10	Hey there is a really good cleaning tip here, come and take a look!	Oi there is a really good newspaper article about water pollution here, come and take a look! See what it is about!
11	Hey the time of this computer game has malfunctioned! You'd better stop playing now or you will be playing forever!	Oi the timer on this game has malfunctioned, its not going to stop after ten minutes after all! You'd better stop playing now or you will be playing for ages and ages!
12	Hey your lunch is ready! You'd better come and get it now or it will become cold!	Hey your lunch is ready and I've cooked you your favourite food! You'd better come and get it now or it will become cold!
13	Hey this cleaning product is out of date! You'd better throw it away now or it will go off!	Look this cleaning product is months out of date, it must have gone off a long time ago! You'd better throw it away now and buy a new one or else you will forget!

APPENDIX 15: 18 Auditory Distracters Used in:

- Study Two ("Feedback" and "No Feedback" conditions)
- Study Three ("No Feedback" condition)
- Study Six ("High Performance" and "Low Performance" conditions)

	GAME	PERSON	IRRELEVANT
Directional	Move the rocket to the right, move the rocket to the right again, now move the rocket to the left. Watch out for that asteroid! Ah, you just missed it. Move the rocket to the right.	Tap your fingers to the right, tap your fingers to the right again, now tap your fingers to the left. Lift those arms high in the air! Now down again. Tap your fingers to the right.	Swing the bat to the right, swing the bat to the right again, now swing the bat to the left. Hit that ball hard! Ah, you just hit it in time. Swing the bat to the right.
Object-oriented	Star, star, asteroid. Asteroid, asteroid, star, star. Asteroid, star, asteroid, star. Star, star, star.	Collect, collect, dodge. Dodge, dodge, collect, collect, Dodge, collect, dodge, collect. Collect, collect, collect.	Turn, turn, flip. Flip, flip, turn, turn. Turn, flip, turn, flip. Turn, turn, turn.
De-motivating 1	Aw man, you are so rubbish at this game! When I played this game I collected hundreds and hundreds of stars. You might as well give up now.	Whoa, you are doing so poorly in this experiment! When I did this experiment my reaction times were really fast. You might as well give up now.	Dearie me, you are such a bad chess player! When I play chess I always check mate the king, every single time. You might as well give up now.
De-motivating 2	Space games are so boring. Have you got any idea what other games I can play that might be more fun?	London is such a boring city. Have you got any ideas what attractions I can visit to make my stay here more fun?	Collecting stamps is so boring. Have you got any idea what other items I can collect that might be more fun?
Against game objective 1	Hey what happens if you crash into those asteroids really fast? Go on, try it! See what happens!	Look there is someone pulling a face behind you, turn around and see! Go on, you know you want to!	Oi there is a really good newspaper article about water pollution here, come and take a look! See what it is about!
Against game objective 2	Oi the timer on this game has malfunctioned, its not going to stop after ten minutes after all! You'd better stop playing now or you will be playing for ages and ages!	Hey your lunch is ready and I've cooked you your favourite food! You'd better come and get it now or it will become cold!	Look this cleaning product is months out of date, it must have gone off a long time ago! You'd better throw it away now and buy a new one or else you will forget!

APPENDIX 16: Scoring Participant Recall of Distracters for:

- Study Two ("Feedback" and "No Feedback" conditions)
- Study Three ("No Feedback" condition)
- Study Six ("High Performance" and "Low Performance" conditions)

	GAME		PERSON		IRRELEVANT	
Directional	Move the rocket right / left	½	Tap your fingers right / left	½	Swing the bat right / left	½
	Watch out for that asteroid! Ah, you just missed it!	½	Lift those arms high in the air! Now down again!	½	Hit that ball hard! Ah, you just hit it in time!	½
Object-oriented	Star	½	Collect	½	Turn	½
	Asteroid	½	Dodge	½	Flip	½
De-motivating 1	Aw man you are so rubbish at this game!	½	Whoa you are doing so poorly in this experiment!	½	Dearie me you are such a bad chess player!	½
	When I played this game I collected 100s of stars, you might as well give up now	½	When I did this experiment my reaction times were really fast, you might as well give up now	½	When I play chess I always check mate the king, every single time. You might as well give up now	½
De-motivating 2	Space games are so boring	½	London is such a boring city	½	Collecting stamps is so boring	½
	Have you got any idea what other games I can play that might be more fun?	½	Have you got any idea what other attractions I can visit to make my stay here more fun?	½	Have you got any idea what other items I can collect that might be more fun	½
Against game objective 1	Hey what happens if you crash into those asteroids really fast?	½	Look there is someone pulling a face behind you	½	Oi there is a really good newspaper article about water pollution here	½
	Go on try it, see what happens!	½	Turn around and see! Go on, you know you want to!	½	Come and take a look, see what it is about!	½
Against game objective 2	Oi the timer on this game has malfunctioned	½	Hey your lunch is ready	½	Look this cleaning product is months out of date	½
	It's not going to stop after 10 mins after all! You'd better stop playing now or you will be playing for ages!	½	I've cooked you your favourite food! You'd better come and get it now or it will become cold!	½	It must have gone off a long time ago! You'd better throw it away and buy a new one or else you will forget!	½
	TOTAL	6	TOTAL	6	TOTAL	6

APPENDIX 17: Modifications made to 4 of the 18 Auditory Distracters from Study Two, in Order to Make Them More Appropriate for the Star Fly 3 condition of Study Three

	Version used in Study Two	Version used in Study Three, Star Fly 3 condition
1	Star, star, asteroid. Asteroid, asteroid, star, star. Asteroid, star, asteroid, star. Star, star, star.	Fire, fire, asteroid. Asteroid, asteroid, fire, fire. Asteroid, fire, asteroid, fire. Fire, fire, fire.
2	Collect, collect, dodge. Dodge, dodge, collect, collect, Dodge, collect, dodge, collect. Collect, collect, collect.	Shoot, shoot, dodge. Dodge, dodge, shoot, shoot. Dodge, shoot, dodge, shoot. Shoot, shoot, shoot.
3	Aw man, you are so rubbish at this game! When I played this game I collected hundreds and hundreds of stars. You might as well give up now.	Aw man, you are so rubbish at this game! When I played this game I blew up hundreds and hundreds of asteroids. You might as well give up now.
4	Oi the timer on this game has malfunctioned, its not going to stop after ten minutes after all! You'd better stop playing now or you will be playing for ages and ages!	Oi the computer code of this game has malfunctioned, its not going to stop when you run out of energy after all! You'd better stop playing now or you will be playing for ages and ages!

APPENDIX 18: 18 Auditory Distracters used in Study Three for the Star Fly 3 condition

	GAME	PERSON	IRRELEVANT
Directional	Move the rocket to the right, move the rocket to the right again, now move the rocket to the left. Watch out for that asteroid! Ah, you just missed it. Move the rocket to the right.	Tap your fingers to the right, tap your fingers to the right again, now tap your fingers to the left. Lift those arms high in the air! Now down again. Tap your fingers to the right.	Swing the bat to the right, swing the bat to the right again, now swing the bat to the left. Hit that ball hard! Ah, you just hit it in time. Swing the bat to the right.
Object-oriented	Fire, fire, asteroid. Asteroid, asteroid, fire, fire. Asteroid, fire, asteroid, fire. Fire, fire, fire.	Shoot, shoot, dodge. Dodge, dodge, shoot, shoot. Dodge, shoot, dodge, shoot. Shoot, shoot, shoot.	Turn, turn, flip. Flip, flip, turn, turn. Turn, flip, turn, flip. Turn, turn, turn.
De-motivating 1	Aw man, you are so rubbish at this game! When I played this game I blew up hundreds and hundreds of asteroids. You might as well give up now.	Whoa, you are doing so poorly in this experiment! When I did this experiment my reaction times were really fast. You might as well give up now.	Dearie me, you are such a bad chess player! When I play chess I always check mate the king, every single time. You might as well give up now.
De-motivating 2	Space games are so boring. Have you got any idea what other games I can play that might be more fun?	London is such a boring city. Have you got any ideas what attractions I can visit to make my stay here more fun?	Collecting stamps is so boring. Have you got any idea what other items I can collect that might be more fun?
Against game objective 1	Hey what happens if you crash into those asteroids really fast? Go on, try it! See what happens!	Look there is someone pulling a face behind you, turn around and see! Go on, you know you want to!	Oi there is a really good newspaper article about water pollution here, come and take a look! See what it is about!
Against game objective 2	Oi the computer code of this game has malfunctioned, its not going to stop when you run out of energy after all! You'd better stop playing now or you will be playing for ages and ages!	Hey your lunch is ready and I've cooked you your favourite food! You'd better come and get it now or it will become cold!	Look this cleaning product is months out of date, it must have gone off a long time ago! You'd better throw it away now and buy a new one or else you will forget!

APPENDIX 19: Scoring Participant Recall of Distracters for Study Three Star Fly 3 condition

	GAME		PERSON		IRRELEVANT	
Directional	Move the rocket right / left	½	Tap your fingers right / left	½	Swing the bat right / left	½
	Watch out for that asteroid! Ah, you just missed it!	½	Lift those arms high in the air! Now down again!	½	Hit that ball hard! Ah, you just hit it in time!	½
Object-oriented	Fire	½	Shoot	½	Turn	½
	Asteroid	½	Dodge	½	Flip	½
De-motivating 1	Aw man you are so rubbish at this game!	½	Whoa you are doing so poorly in this experiment!	½	Dearie me you are such a bad chess player!	½
	When I played this game I blew up 100s of asteroids, you might as well give up now	½	When I did this experiment my reaction times were really fast, you might as well give up now	½	When I play chess I always check mate the king, every single time. You might as well give up now	½
De-motivating 2	Space games are so boring	½	London is such a boring city	½	Collecting stamps is so boring	½
	Have you got any idea what other games I can play that might be more fun?	½	Have you got any idea what other attractions I can visit to make my stay here more fun?	½	Have you got any idea what other items I can collect that might be more fun	½
Against game objective 1	Hey what happens if you crash into those asteroids really fast?	½	Look there is someone pulling a face behind you	½	Oi there is a really good newspaper article about water pollution here	½
	Go on try it, see what happens!	½	Turn around and see! Go on, you know you want to!	½	Come and take a look, see what it is about!	½
Against game objective 2	Oi the computer code of this game has malfunctioned	½	Hey your lunch is ready	½	Look this cleaning product is months out of date	½
	It's not going to stop after you have run out of energy after all! You'd better stop playing now or you will be playing for ages!	½	I've cooked you your favourite food! You'd better come and get it now or it will become cold!	½	It must have gone off a long time ago! You'd better throw it away and buy a new one or else you will forget!	½
	TOTAL	6	TOTAL	6	TOTAL	6

APPENDIX 20: Modifications made to 2 of the 18 Auditory Distracters Selected from Study Three, in Order to Make Them More Appropriate for the Star Fly 3 game

	Version used in Study Three	Version used in Study Four
1	Move the rocket to the right, move the rocket to the right again, now move the rocket to the left. Watch out for that asteroid! Ah, you just missed it. Move the rocket to the right.	Fly the rocket to the right, fly the rocket to the right again, now fly the rocket to the left. Watch out for that asteroid! Ah, you just missed it. Fly the rocket to the right.
2	Turn, turn, flip. Flip, flip, turn, turn. Turn, flip, turn, flip. Turn, turn, turn.	Slide, slide, flip. Flip, flip, slide, slide. Slide, flip, slide, flip. Slide, slide slide.

APPENDIX 21: 18 Auditory Distracters used in Study Four

	GAME	PERSON	IRRELEVANT
Directional	Fly the rocket to the right, fly the rocket to the right again, now fly the rocket to the left. Watch out for that asteroid! Ah, you just missed it. Fly the rocket to the right.	Tap your fingers to the right, tap your fingers to the right again, now tap your fingers to the left. Lift those arms high in the air! Now down again. Tap your fingers to the right.	Swing the bat to the right, swing the bat to the right again, now swing the bat to the left. Hit that ball hard! Ah, you just hit it in time. Swing the bat to the right.
Object-oriented	Fire, fire, asteroid. Asteroid, asteroid, fire, fire. Asteroid, fire, asteroid, fire. Fire, fire, fire.	Shoot, shoot, dodge. Dodge, dodge, shoot, shoot. Dodge, shoot, dodge, shoot. Shoot, shoot, shoot.	Slide, slide, flip. Flip, flip, slide, slide. Slide, flip, slide, flip. Slide, slide slide.
De-motivating 1	Aw man, you are so rubbish at this game! When I played this game I blew up hundreds and hundreds of asteroids. You might as well give up now.	Whoa, you are doing so poorly in this experiment! When I did this experiment my reaction times were really fast. You might as well give up now.	Dearie me, you are such a bad chess player! When I play chess I always check mate the king, every single time. You might as well give up now.
De-motivating 2	Space games are so boring. Have you got any idea what other games I can play that might be more fun?	London is such a boring city. Have you got any ideas what attractions I can visit to make my stay here more fun?	Collecting stamps is so boring. Have you got any idea what other items I can collect that might be more fun?
Against game objective 1	Hey what happens if you crash into those asteroids really fast? Go on, try it! See what happens!	Look there is someone pulling a face behind you, turn around and see! Go on, you know you want to!	Oi there is a really good newspaper article about water pollution here, come and take a look! See what it is about!
Against game objective 2	Oi the computer code of this game has malfunctioned, its not going to stop when you run out of energy after all! You'd better stop playing now or you will be playing for ages and ages!	Hey your lunch is ready and I've cooked you your favourite food! You'd better come and get it now or it will become cold!	Look this cleaning product is months out of date, it must have gone off a long time ago! You'd better throw it away now and buy a new one or else you will forget!

APPENDIX 22: Scoring Participant Recall of Distracters for Study Four

	GAME		PERSON		IRRELEVANT	
Directional	Fly the rocket right / left	½	Tap your fingers right / left	½	Swing the bat right / left	½
	Watch out for that asteroid! Ah, you just missed it!	½	Lift those arms high in the air! Now down again!	½	Hit that ball hard! Ah, you just hit it in time!	½
Object-oriented	Fire	½	Shoot	½	Slide	½
	Asteroid	½	Dodge	½	Flip	½
De-motivating 1	Aw man you are so rubbish at this game!	½	Whoa you are doing so poorly in this experiment!	½	Dearie me you are such a bad chess player!	½
	When I played this game I blew up 100s of asteroids, you might as well give up now	½	When I did this experiment my reaction times were really fast, you might as well give up now	½	When I play chess I always check mate the king, every single time. You might as well give up now	½
De-motivating 2	Space games are so boring	½	London is such a boring city	½	Collecting stamps is so boring	½
	Have you got any idea what other games I can play that might be more fun?	½	Have you got any idea what other attractions I can visit to make my stay here more fun?	½	Have you got any idea what other items I can collect that might be more fun	½
Against game objective 1	Hey what happens if you crash into those asteroids really fast?	½	Look there is someone pulling a face behind you	½	Oi there is a really good newspaper article about water pollution here	½
	Go on try it, see what happens!	½	Turn around and see! Go on, you know you want to!	½	Come and take a look, see what it is about!	½
Against game objective 2	Oi the computer code of this game has malfunctioned	½	Hey your lunch is ready	½	Look this cleaning product is months out of date	½
	It's not going to stop after you have run out of energy after all! You'd better stop playing now or you will be playing for ages!	½	I've cooked you your favourite food! You'd better come and get it now or it will become cold!	½	It must have gone off a long time ago! You'd better throw it away and buy a new one or else you will forget!	½
	TOTAL	6	TOTAL	6	TOTAL	6