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NOTE BY THE UNIVERSITY

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ABSTRACT

This thesis contributes to two main areas of research in the immersion of videogames. (I) The first study attempted to identify possible correlates between problem solving strategies and explicit reasoning with immersion. This was done using the 'Rational-Experiential Inventory' and the 'Gaming Experience Questionnaire'. Participants were MSc students at University College London with various levels of gaming experiences. Results showed that experiential scores had a significant positive correlation with immersion in a free-form explorative game 'Flower' but not with the more strategic puzzle game 'Critter Crunch', whereas rational scores did not present significant correlation for any aspect of the game experience. This was discussed in terms of the game types used and the lack of explicit reasoning involved with playing the games. (II) The second study investigated the understanding of immersion among a population of frequent gamers. Participants drawn from popular gaming forums ranked three descriptions of games in order of perceived immersive capabilities, which were created using qualitative findings from the first study, the 'GEQ', and Jennett et al.'s Immersion Questionnaire (2008). Participants also rated the ten most important aspects of immersion as identified by the above sources on a 10-point likert scale. Results showed that gamers did not agree with the current weightings granted to specific aspects of immersion, and suggestions were put forward to how methods to refine measurements could be improved to better utilise the practice of a user-centred design approach for research aimed at benefitting gamers in the long run.

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CHAPTER 1. INTRODUCTION

In the course of this thesis, the possibility that immersion in videogames may be affected by individual differences in thinking styles is investigated. Some current literature focuses on the creation and implementation of methods for measuring immersion in videogames. Their focus is primarily in producing reliable quantitative measurements of a state that is widely known about and frequently discussed among gamers. However, immersion has not yet been exhaustively studied and understood by the academic community. While it is understood that immersion is made up of a number of cognitive processes such as attention and learning (Cox, Cairns, Berthouze, & Jennett, 2006), there are a number of cognitive aspects yet to be explored such as explicit reasoning and problem solving strategies.

This thesis aims to build upon the work of present research by investigating a possible correlation between individual thinking styles and players' self-reported levels of immersion. Identifying what affects immersion on an individual level could contribute to understanding what causes the phenomena. The 'dual-route' theory of thinking styles encompasses not only how people process information and solve problems, but also whether they tend to have specific personality traits such as being extroverted, conscientious, or perceiving more meaning in the world (Pacini & Epstein, 1999; Schutte, Thorsteinsson, Hine, Foster, Cauchi, & Binns, 2010).

The hypothesis that individual differences in thinking styles would have an effect on immersion was investigated through the use of a self-report scale to identify participants' 'thinking style', and by comparing these results to how

immersive they found two games. The games' immersion was measured using a component of the 'Game Experience Questionnaire' or 'GEQ' (IJsselsteijn, de Kort, & Poels, in preparation) that specifically measures immersion, as well as multiple other components within the 'GEQ' measuring the overall gaming experience. Participants were also asked to explain their understanding of immersion. This was to check whether the current research's understanding of the term immersion mirrored that of game players. This was an important question because the literature's purpose is to aid the design of games by understanding the underlying user experiences during game play. In order for findings to be helpful, it is good practice to employ a user centred design approach when making suggestions for products or services (Kujala, 2003; Pagulayan, Keeker, Wixon, Romero, & Fuller, 2002). So it would be important that the suggestions brought forward from research into videogames, and immersion in particular, accurately reflected that of its end users.

The games that the participant played were chosen for their contrasting characteristics; one is a very free exploratory game in which players should experience more emotive and 'visceral' responses, while the other is a more strategic puzzle game demanding higher levels of cognitive processing. It was hypothesised that individuals that favour a more 'experiential' approach to thinking will be more immersed in the free-form emotive game than those that tend to think more 'rationally'. Also, players that tend towards a more 'rational' thinking style should in theory be more engaged and immersed with the puzzle based game than those that think 'experientially', due to the higher similarity between their thinking

style and the strategy required for successful engagement and completion of the game. This hypothesis was based on previous research identifying participants who scored more highly on the 'rational' aspect of the 'Rational-Experiential Inventory' or 'REI' to be better at solving problems and forming bias-free decisions (Handley, Newstead, & Wright, 2000). The 'REI' is a questionnaire developed to reliably measure two distinct thinking styles: 'rational', and 'experiential', and has been validated over a number of studies (Evans, Barston, & Pollard, 1983; Handley, Newstead, & Wright, 2000; Markman, Lindberg, Kray, & Galinsky, 2007). This will be explored in detail in the next chapter.

Investigating these thinking styles within the realm of immersion in videogames is important because findings could mean the largely recent research on immersion can be tied together to the relatively more extensively studied domain of cognition and thinking-styles. The 'dual-route' theory of thinking styles has shown that an individual's tendency to think 'rationally' or 'experientially' plays a role in their ability to solve problems and their susceptibility to belief-bias effects. Furthermore, investigating participants' understanding of immersion using a grounded theory approach will enable us to investigate whether there is a relationship between common gamers' understanding of the term and the understanding put forward by current literature. This would go towards either verifying the practical value of the findings of grounded research taken by Brown and Cairns (2004), or towards suggesting improvements or refinements.

We also investigated whether thinking styles affect overall immersion in either game type. It may be reasonable to suggest that those that reportedly think more

'experientially' should show a higher level of immersion for both games due to their tendency for greater levels of reliance on experiences and emotions for general thinking, and an increased likelihood to open themselves up to the experience (Pacini & Epstein, 1999).

Findings from this study show some interesting results. The main research question regarding whether thinking styles affected individuals' immersion produced significant results in the expected direction for one game but not the other. This was put down to the choice of games, which will be discussed in detail in the literature review and the methods section of the first study. Other comparisons of thinking styles with components of the 'GEQ' produced largely non-significant results.

The following literature review will identify briefly what is meant by immersion from the perspective of some of the most widely acknowledged research into immersion, flow, and presence of videogames. We will identify their definitions, look at the supporting evidence, and formulate a critique of the current literature. To look at the individual differences aspect of the study, we will focus on literature concerning differences in thinking styles. More specifically, literature referring to the 'dual-route processing' theory of thinking styles.

CHAPTER 2. LITERATURE REVIEW

Overview

This first study utilised many materials used in previous research. Measuring thinking styles was made unobtrusive by using a questionnaire; the 'Rational-Experiential Inventory' or 'REI' for short. Immersion was measured using another self-report questionnaire: the 'Game Experience Questionnaire' or 'GEQ'. These two questionnaires were chosen in favour of the many alternatives for a number of reasons. This chapter will try to acquaint the reader with the materials used in the study, and to explain the key terms and issues surrounding the study aims. Relevant literature will be discussed in order to better explain why the research undertaken is of importance, to justify the methods used to investigate the research questions, and to give an understanding of the 'story so far' in regards to researching immersion in videogames.

Flow and Presence

Some of the earlier research into how 'absorbed' people are during interactions came from the concept of 'flow' as described by Czikszentmihalyi (1975; 1990). 'Flow' was described as a state in which people became so focused on what they were doing that they just 'blanked out' irrelevant stimuli. Czikszentmihalyi (1975) reached his idea of 'flow' following a series of interviews during which participants were asked about their experiences while undertaking highly skilled based tasks such as playing a game of chess. While it could be argued that there are many games that would require a high skill level in order for successful completion, there are

undeniably simpler games that do not require as thought out tactics as chess in order to be considered immersive by gamers. According to later research from Czikszentmihalyi (1990) in which he identified 'flow' in terms of eight main components, the defining characteristics of a task that elicited 'flow' were that it: was challenging but completable; made people's attention fully focused on it; had clear unambiguous goals; provided immediate feedback of actions, enabled people to feel totally in control, removed your awareness from everyday life, reduced sense of self initially but strengthened it later, and that it made people less aware of the passage of time.

As we will see later on, much of the current literature on immersion hasn't changed from this concept of 'flow', with measurements of immersion still placing a great emphasis on player's dissociation from stimuli unrelated to the game when in an immersed state (e.g. Jennet, Cox, Cairns, Dhoparee, Epps, Tijs, & Walton, 2008). The idea of 'flow' will be revisited in section 4.6. (discussion) of study 2 when gamers were asked about their understanding of how they felt when they were immersed, and how well this tied in with the concept of 'flow' and quantitative measures of immersion.

The concept of 'presence' is different to that of 'flow' in that people experiencing 'presence' typically report sensations of literally 'being there' (Floridi, 2006). While this may seem like a relevant idea for videogames, it is almost common sense to assume that most gamers do not literally feel as if they are in realm of the videogame. Such an extreme would cause serious issues in games such as stealth game '*Manhunt*' from developer Rockstar North (2003) in which players

have to sneak up on enemies and terminate them in disturbing manners such as ‘plastic bag suffocations’. Although Takatalo, Hokkinen, Komulainen, Sarkela, and Nyman (2006) identify ‘presence’ in its literal physical sense as an important aspect of the videogaming experience, it is clearly not one that can be seen as universally desirable.

Rather than treating ‘presence’ as literally inhabiting the game world it may seem useful to see it as an analogy as opposed to a real effect. For example, using the term as an analogous description, players tended to feel more ‘presence’ in role-playing games and first-person shooters than puzzle games according to Nunez and Blake (2006). This is especially interesting as it links in to findings from Brown and Cairns’ (2004) grounded theory investigation of what immersion meant to gamers. Brown and Cairns (2004) discovered that role-playing games and first-person shooters were consistently listed as the most immersive. This suggests that treating ‘presence’ in an analogous capacity rather than a physical effect may help understand what immersion is from gamers’ perspectives. Despite this, asking whether players feel like they are more in the game world than the real world is often asked in current measurements of immersion. One such measure is one that was ultimately not used in this study due to, among other factors, the weighting of certain components of immersion not matching the literature reviewed in this thesis (Jennett et al., 2008).

With ‘flow’ focusing on the experiences felt by individuals performing successfully, and ‘presence’ providing an account of how closely linked individuals feel with the experience, we can now begin to look at the current understanding of

the term immersion. It is important to remember that immersion may be seen to descend from a combination of previous theories, which is why later sections identifying measurements used to quantify immersion share similarities with some of the concepts addressed in 'flow' and 'presence'.

Immersion

The study of immersion has progressed to a point where solid research is being conducted on identifying the cognitive mechanisms that underlie it. So far, there have been studies that have addressed the impact of distracters on those that are immersed, and have tied immersion to attention and learning (e.g. Jennett et al., 2008). It has been stated by Cox et al. (2006) that immersion is made up of a number of cognitive processes, and this thesis aims to address whether explicit reasoning and problem solving abilities can be identified as one of them. But first, an introduction to immersion and how it stands now.

The word 'immersion' is a common term in the gaming world. Game players usually have an appreciation for what it feels like to be immersed in a game, as they feel they have at some point felt the sensation. The term 'immersion', to give a very general meaning, could translate to when a player is focused on the game; they are occupied with the events within the game and pay little attention to distractions unrelated to their gaming experience. But the sensation people describe often varies, as the feeling is usually explained in terms of comparative analogies.

The variety of meanings and feelings people associate with the word is reflected in the diversity with which researchers treat the term. Being immersed in a

game can mean different things from one person to the next, and as such it is up to researchers to identify clearly which aspects they are encompassing when they talk about immersion, ranging from concentrating on the game (going back to the concept of 'flow') to more extreme depths where the player feels as if they are literally in the game world ('presence' as explained in Zahorik & Jenison, 1998).

A game's immersive quality is often linked to people's enjoyment of the game. Feeling like they are absorbed into the game world is often the aim of a gamer; but this may not always be a good thing. Game developers do not always want to create an entirely immersive atmosphere for gamers. As contradictory as it may seem, developers are often forced to limit the extent to how immersive a game could be. In a seminar on immersion in games at Quakecon 2010, renowned game designer Emil Pagliarulo of Bethesda Softworks (developers of Oblivion IV: Elder Scrolls and Fallout 3; both regarded as highly immersive open world role-playing games) stated that giving players the freedom to do 'crazy and violent things' is only safe when the player is fully aware they are playing a game; it would not be a good idea to let the player get 'sucked in' completely.

Judging by the statements made above, and the common use of the word in videogame reviews, it seems as though game players, developers and critics alike have a perceived general agreement on what it is for a game to be immersive. But in academia the study of and understanding of the term 'immersion' is a decidedly more complicated affair. As a fairly recent area of study, a significant amount of time is put into identifying what researchers mean by the term. While the many different takes on immersion each have their own value, it is almost inevitable that

occasionally new research in the area will draw upon its own definitions despite many themes overlapping with others' understanding of the term. For this reason, this section will summarise some of the more accepted accounts of the properties of immersion rather than create our own, and explain why a grounded theory approach such as that used by Brown and Cairns (2004) is at this early stage of research a helpful way to develop a commonly accepted and used understanding of the term.

In Brown and Cairns' (2004) grounded investigation into game immersion, they conducted interviews to gain an understanding of what immersion meant to the typical gamer. They discovered a set of three stages of immersion; ranging from engagement at the lower end, and engrossment in the middle, to total immersion at the uppermost level. According to their investigation, a number of barriers responsible for the divide in 'degrees of immersion' came in the form of simple factors such as (in the case of attaining the basic 'engagement' level of immersion): the gamer's preference of game type, the game's controls (gamers needed to be able to execute commands expertly given practice), the time a gamer puts into the game, and their attention (Brown & Cairns, 2004). The barrier to engrossment, the second level of immersion where-in the player becomes emotionally invested in the game, is the actual game construction itself; whether the game has given enough attention to detail and atmosphere to the extent that features in the game directly affect players' emotions (Brown & Cairns, 2004). The ultimate level of immersion, 'total immersion' occurs when players feel a direct link between themselves and the game; they become totally absorbed and empathise with the characters.

The grounded investigation showed that some particular aspects of games were seen to be almost deterministic of whether the game was capable of subjecting gamers to total immersion. In their study almost all games mentioned as totally immersive were first-person games (games in which the player sees the game world through the eyes of the game character's perspective) and role-playing games (games in which players controlled characters that were essentially 'theirs'; they are often responsible for their 'growth', appearance, and decisions that affect them) (Brown & Cairns, 2004). A further dependent variable that affected which stage of immersion a gamer reached on top of the barriers mentioned was time. Simply put, the more time a gamer put into a game, the more they could focus on and become immersed with it.

This grounded theory approach appears to be a logical way of ensuring that immersion is understood from the user's perspective. That is to say, it may be considered a user-centred research approach. This seems fitting, as with most research in the HCI world the ultimate beneficiaries of the research are intended to be the end users. However, in the Brown and Cairns study (2004) only seven participants were used. While this participant sample size is not particularly small for a grounded theory approach, it does bear limitations on the representativeness of all gamers, and may lead to unrepresentative findings. In addition, the findings were taken and transformed into the idea of 'immersion barriers'. The reasoning behind assigning the concept of barriers to immersion did not necessarily reflect the views of the participants. The approach taken in the study therefore serves better as a starting point for understanding immersion rather than as a means to constructing a

way of measuring it. Instead, the construction of scales involves more specific structuring, and some of the available methods to measuring immersion will be discussed next.

Measuring Immersion

There are many ways in which immersion can be measured ranging from complex setups measuring physiological data such as fMRI scans and eye tracking devices, to simple one item questionnaires asking "how immersed are you?" on a scale from one to ten (Jennett et al., 2008; Nacke & Lindley, 2008). But when is it best to use each method, and what do they actually measure?

A scale that has been used in a number of studies and has been shown to be reliable across a number of samples is the Immersion Questionnaire developed by Jennett et al. (2008). Developed initially as a 32 item questionnaire (with 33rd item: "How immersed did you feel?") the questionnaire was then refined to a 31 item questionnaire with slightly different wordings and a different answer structure. Participants were required to rate items such as "To what extent did you feel that the game was something you were experiencing, rather than something you were just doing?" on a scale from 1 (definitely not) to 5 (definitely yes). The items used were taken from literature on 'flow', 'cognitive absorption' and 'presence'. Items were assigned a factor structure based on an exploratory factor analysis. This meant that although a factor structure was obtained, it was not based on any previous theories, but rather on the similarities in the way specific items were answered.

The items bore a strong preference on the weighting of certain aspects of immersion. While it is good practice to ask similar questions numerous times when constructing any questionnaire in the interest of reliability (Martin, 2006), it is important not to use a higher number of items on one specific factor than others when an overall score is obtained unless that factor has been deliberately assigned a higher weighting than others for a justified reason. According to the literature reviewed for this thesis, there was a lack of rationale for choosing to assign such a high weight to one component of immersion (there were 7 items out of 31 that asked questions relating to real-world dissociation, or themes discussed within the concept of 'presence').

Another measurement of not just game immersion, but the overall game experience comes, in the form of the 'game experience questionnaire'. The 'GEQ' has some advantages over other immersion questionnaires in that it does not solely measure immersion, but a range of components that have been formulated to give a more general 'gaming experience' score. Of the 33 items in the core GEQ, 6 relate to immersion specifically (under the moniker 'sensory and imaginative immersion'), 5 relate to 'flow', and the remaining 22 items are split between a further 5 components including 'competence', 'tension/annoyance', 'challenge', 'negative affect', and 'positive affect' (Poels, de Kort, & IJsselsteijn, 2007). Aside from the 33 item 'core GEQ' there is also a shorter 'in-game' 'GEQ' consisting of the two strongest factors from each of the seven components. Both of these questionnaires have been validated in several studies and across multiple languages (Gajadhar, de Kort, & IJsselsteijn, 2008; Gajadhar, de Kort, & IJsselsteijn, 2009). Scores for each

item are scored from 0 to 4 depending on how strongly the participant agrees with the item statement (ranging from ‘not at all’ to ‘extremely’).

The ‘GEQ’ has been used to test immersion reliably in previous studies (Nacke & Lindley, 2008a; Nacke & Lindley, 2008b). The component for immersion was based on Ermi and Mäyrä’s (2005) notion of sensory, imaginative, and challenged-based immersion. This understanding of immersion encompasses the impact of graphics and sounds effects (sensory), skill and sense of challenge similar to ‘flow’ (challenge-based), and absorption in the characters and the narrative, similar to Brown and Cairn’s (2004) findings from their grounded theory (imaginative) (Ermi and Mäyrä, 2005).

Components of the ‘GEQ’ have been tested across various modalities such as galvanic skin response; think-aloud fMRI sessions, eye-tracking sessions, and across multiple languages to obtain a reliable (IJsselsteijn, van den Hoogen, Klimmt, de Kort, Lindley, Mathiak, Poels, Ravaja, Turpeinen, & Vorderer, 2008). The ‘GEQ’ was constructed using focus group sessions with various types of gamers to gain an understanding of the main themes they identified as affecting game experience, and previous theoretical work on the game experiences (Poels, de Kort, & IJsselsteijn, 2007). As such, the component for immersion in the ‘GEQ’ could be seen as more dissociated from other aspects of game experience, as other aspects are given their own components within the questionnaire. It is because of this user-centred creation process, the previously shown reliability and validity of the questionnaire, and the isolation of immersion from other game experience components that the ‘GEQ’ was chosen for use in the first study of this thesis to measure immersion.

Now that the concept of immersion has been discussed, and how it will be addressed in this thesis, we can move on to how we can further enhance our understanding of it. While game experience is being looked at from a variety of modalities (IJsselsteijn et al., 2008), the specific cognitive processes affecting immersion have not all been investigated. Cox et al. (2006) suggested that immersion is the product of many different cognitive processes working together, and many cognitive processes have yet to be addressed. Attention and learning have been shown to tie in with immersion, but this study aims to identify the possible impact of explicit reasoning, problem solving, and people's tendencies to think in one of two styles; i.e. the 'dual-theory' of thinking styles.

Thinking styles

Theories of reasoning may be sorted into two schools of thought: one a heuristic system which focuses on rule-based processes and the other a more universal system related to automatic processes (Goel, 2003). It has been suggested that these two systems are likely to be used together, as opposed to using each one separately. Previous research investigating differences in thinking styles has outlined two distinct styles: 'rational' (analytic, logical, 'planned-out') and 'experiential' (spontaneous, based on 'gut-reactions' or instincts). This 'dual-thinking' model has been backed-up by investigating the problem solving abilities of individuals, showing distinct differences in people's approach to solving logic based problems; and with the help of fMRI scans showing a 'dual-route' pathway for two different problem solving styles (Goel, 2003).

Measuring thinking styles

A useful measurement of whether people tend to actively think more analytically or heuristically as a personal preference is the 'Rational-Experiential Inventory' (or 'REI'). The 'REI', developed by Epstein, Pacini, Denes-Raj, and Heier (1996), is based on aspects of the Need for Cognition scale designed by Cacioppo and Petty (1982) to account for the 'rational' aspects of the scale; and the Faith in Intuition scale designed by Epstein et al. (1996) for the 'experiential' aspect. The scale was a result of Epstein et al.'s (1996) attempt to combine the many dual system theories regarding the way information is processed into one single theory labelled the 'cognitive-experiential self-theory' (CEST) (Epstein et al., 1996).

Whereas previous theories termed dual forms of information processing with labels such as 'heuristic versus analytic' (Tversky & Kahneman, 1983) and 'implicit versus explicit' (Reber, 1993), Epstein et al.'s (1996) distinctions were between 'rational' and 'experiential' systems of information processing. Their idea was that two cognitive systems are used together but have their own distinctions, such as one system would operate mainly at a conscious level and was "intentional, analytic, primarily verbal, and relatively affect free" (the rational system) while the other was "assumed to be automatic, preconscious, holistic, associationistic, primarily nonverbal, and intimately associate with affect" (the experiential system) (Epstein et al., 1996, p. 391).

The scale was initially made up of 31 items (19 from the Need for Cognition scale, 12 from the Faith in Intuition scale), and was later altered to contain 40 items

in total (20 for Rationality, 20 for Experientiality) with each of the two factors split into two further factors relating to Ability (referring to the confidence with which an individual carries out a thinking task/ relies on their intuition) and Engagement (referring to one's enjoyment of logical reasoning/ using intuition) (Handley, Newstead, & Wright, 2000). Since its creation, the validity of the REI scale has been investigated a number of times using various samples of test subjects. The scale has since been verified to contain useful psychometric qualities (Handley et al., 2000; Björklund & Bäckström, 2008) and is reliable not only with American students but also among a sample of adults drawn from a general population (from the British city of Plymouth), British students, and a Swedish population (Handley et al., 2000; Björklund & Bäckström, 2008).

While the scale has been used to show reliability in terms of the two factor solution ('rationality' and 'experientiality') the subscales are less consistent, at least for 'experientiality'. Whilst 'rationality' can be reliably split into 'ability' and 'engagement', 'experientiality' is more reliably split into positively and negatively worded items (Handley et al., 2000). This finding is consistent with studies from Pacini and Epstein (1999).

The 'REI' is a reliable measurement for underlying cognitive processes that has been validated against fMRI studies, and shows correlations between 'rational'/'experiential' factors with 'dual-routes' of processing during various problem solving tasks (Goel, 2003; Goel & Dolan, 2003). Using a questionnaire presents practical advantages over using fMRI on participants who are playing videogames. Although it may not be as accurate as fMRI data, there is a likelihood

that the use of fMRI scanners while playing videogames could act as a significant confounding variable, inhibiting participants' immersion. For this reason, the 'REI' was chosen to be used as an unobtrusive method to investigate whether 'rational' and 'experiential' thinking styles affected participants' immersion in the first study of this thesis.

Present study: choice of games

With research into immersion, the tools used to measure the affect are clearly important, but they would bear little to no value without the appropriate choice of games. Using a game that is going to be considered highly immersive regardless of conditions will likely result in ceiling affects for the immersion of the games tested. Therefore, it was decided that for this study a good practice would be to use a non first-person shooting game or role-playing game as studies have identified those as being the most immersive genres (Brown & Cairns, 2004; Nunez & Blake, 2006). So, rather than using a game likely to exhibit immersive qualities (such as the first-person shooter Half-Life used in Jennett et al.'s 2008 study), we decided to use games from the adventure and puzzle genres (adopting a less immersive type, such as used in Jennet, Cox, and Cairn's 2009 study involving a scrolling shooter game).

The games chosen were "*Flower*" developed by 'thatgamecompany' and "*Critter Crunch*" developed by 'Capybara Games'. The decision to use two 'downloadable' games as opposed to fully-fledged titles on the PS3 was taken due to the games' relatively simple controls, and the decreased likelihood of participants having played the games before. In a brief survey, it was found that out of 20 people

asked which of a series of games (that could potentially be used for the study) they had heard of, the majority had heard of the games "*Heavy Rain"* and "*Little Big Planet"*, and almost half had either played or seen game-play footage of those games. Out of the three downloadable games, only four out of twenty people had heard of "Braid" (game not used in the study), one had heard of "*Flower*", and none had heard of "*Critter Crunch*" (the people used in the survey were excluded from participating in the study).

The decision to use these particular games was motivated from the idea of using two opposing styles of games to identify whether a) less 'rational' thinkers could be more immersed in a more sensorial game than more 'rational' thinkers (using free-flowing game "*Flower*"), b) whether more 'rational' thinkers could be more immersed in a game that promotes the use of 'rational' thinking (using puzzle-game "*Critter Crunch*") and c) whether thinking-style affects general game immersion (using immersion scores from both games for each participant). Another consideration when choosing the games was their 'metacritic' score (obtained from the aggregate scoring website metacritic: http://www.metacritic.com/game/playstation-3/flower and http://www.metacritic.com/game/playstation-3/critter-crunch in order to use games that were regarded as equivalent in terms of game quality (so that immersion attributed to review score, but rather game type). 'Metacritic' is a website that assigns games 'metascores' by averaging a game's reviews from a number of different reviewing sites and magazines. It was considered a more fair and reliable scoring system than using a single source which may have biases or inconsistencies.

The ‘metacritic’ score for both games was 87%; both games were released in 2009, and were downloaded via the ‘playstation network’ on the Sony Playstation 3 (PS3).

Figure 1. A screenshot of the first level of the game 'Flower'

Figure 2. A screenshot of one of the first levels of the game 'Critter Crunch'

The PS3 video-gaming console was chosen due to the PS2 being the most widely used console in gaming history, and the fact that the older PSone and PS2 controllers (dual-shock and dual-shock2 respectively) are identical in appearance and size to the current PS3 controller (dual-shock3). As such, more potential participants will have had some experience and familiarity with the lay-out of the PS3 controllers than that for any other current generation console (this was deemed important to limit the effect of system familiarity/experience on immersion; only participants familiar with the PS2/PS3 system were chosen for the study). It should be noted that although both games were run on the PS3 with identical set-ups, the controls for each game varied; while "*Critter Crunch*" simply used the directional pad (up, down, left, and right directional arrows) and two buttons for actions, the controls for "*Flower*" instead mainly utilised the PS3 controller's tilt function. This meant that players travelled through the game by tilting their gamepads as opposed to using the directional buttons or analogue sticks, although players did have to press buttons to increase their travelling speed.

While the differences in control type were not ideal, it could potentially reduce 'learning effects' from one game to the next as participants couldn't directly apply the learned control scheme from the first game played to the second game. Another contributing factor for using games with differing control types was that similar games to "*Flower*" were very hard to find, with the closest match "*flOw*" yielding a far lower 'metacritic' score (71%) and being released a full two years prior to

"*Flower*" and "*Critter Crunch*". Thus the decision was taken to use two games that shared similar scores rather than similar control schemes.

CHAPTER 3. STUDY 1

3.1. Method

Participants

There were 17 participants who took part in the first study ranging in age from 22 to 34 years old (*mean* = 26.35, *SD* = 3.77). Participants were post-graduate MSc students at University College London, studying at the Bloomsbury campus. Participants were approached in a variety of locations including libraries, computer cluster rooms, and through personal communications (e-mails and forum postings on university message boards). They were obtained using opportunity sampling. There was an eligibility criterion of adequate English reading comprehension (due to the use of the 'REI' and 'GEQ') and familiarity with the PS2/PS3 videogame console controller. There were 12 males and 5 females.

Materials

Materials required for the experiments consisted of two sets of booklets, each containing a consent form (see appendix G), a cover sheet (see appendix A), the 'REI' scale questionnaire (see appendix B), two sets of the game experience questionnaire, instructions on the aims and how to play each of the two games (see appendix C), and a small voice recorder for recording the closing interviews. The two booklets differed in their ordering of the game instructions; booklet one had: the 'REI' scale questionnaire, instructions for '*Flower*', the 'GEQ' for '*Flower*', instructions for '*Critter Crunch*', and the 'GEQ' for '*Critter Crunch*'. Booklet two

reversed the order of '*Flower*' and '*Critter Crunch*' and maintained the placement of the consent form and 'REI' scale at the beginning of the booklet. The 'REI' scale was placed first in order to eliminate any possible influence of playing or completing the 'GEQ' on participants' responses to the 'REI' scale. Participants were told when their 10 minutes of playing for each game was finished, and were asked to fill in the corresponding 'GEQ' immediately after.

No 'distracter' tasks were given between the two games played due to time considerations for each experiment. It was important that participants did not feel their sessions were dragging on since this could have become a confounding variable in the immersion of each game. Alternating the order of games played from one participant to the next was determined to be a viable solution, though it should be made clear that participants were not given time to 'forget' their responses to the first immersion scale before engaging with the second game. For this reason, there may have been a recency effect in the closing interview for the second game played by each participant (Broadbent, Vines, & Broadbent, 1978).

The 40 item 'REI' scale was constructed by Pacini and Epstein (1999), and consisted of 20 questions on the *Need for Cognition* scale (referred to as '*rationality*') and 20 questions on the *Faith in Intuition* scale (referred to as '*experientiality*'). All items used in the scale were positively scored whereby a higher numerical value meant greater agreement with the statement. Scores were based on a 5-point likert scale ranging from 1 (*Definitely False*) to 5 (*Definitely True*), with a score of 3 denoting *Undecided or Equally True and False*. Although positively scored, 19 of the 40 items were worded negatively so that a lower score

was translated to a positive adherence to one of the factors of the scale. For example, item 9: *I am not a very analytic thinker* was reverse scored so that a score of 1 (*Definitely False*) would be translated as a score of 5 (*Definitely True*) to the statement *I **am** a very analytic thinker*. The 'REI' scale is included in appendix B with the negatively worded items clearly identified with an asterisk.

The games used were 'Flower' and 'Critter Crunch', with the rationale behind choosing them explained in section 2.6 of the literature review. 'Flower' is a free-form exploratory adventure game in which the player must take control of the wind and guide petals from one flower to the next in a field. There is no score based system, as the game was designed to allow players to choose the speed with which they tackled the game; it could be played as a free exploration type of game, or as a fast-paced objective based game (new sections of a level are opened up when petals of a certain colour are collected; red in the case of the first level participants played in this study). 'Critter Crunch' is a puzzle game similar in some respects to 'block busting' games like 'alleyway'. However, instead of a ball bouncing up that is deflected by a paddle the player controls, in this game the player controls a creature which moves left and right to place 'critters' in their mouth which they then must feed to larger 'critters' to explode their bellies and collect the jewel innards for points. The levels are time-pressured because as time passes the 'critters' move down towards the player, and if they reach the player then it is game over. The level is 'won' when the player accrues enough points; bonuses are given for 'combos' and 'chains', the full mechanics of which are presented in appendix C, which was given to players for reference during the experiments.

In order to identify participants' perceived level of immersion while playing each game, they were asked to fill in the 'game experience questionnaire' (or 'GEQ'). The 'GEQ' was chosen over other questionnaires which were more specific to immersion because often people's opinions of how much they enjoyed a game overlaps with their perception of how immersed they felt. In order to be able to distinguish more reliably between the two, the 'GEQ' was used, which measures overall game experience over seven distinct categories including immersion and 'flow'. Other questionnaires such as Jennett et al.'s (2008) immersion questionnaire focus solely on the aspect of immersion, and as such it is difficult to cross reference immersion scores with overall game experience without adding a further questionnaire, which would add extra length and potential boredom to the gamer. The 'GEQ' is simply worded, and as such enables players to quickly fill out their responses with minimal effort. There is a more detailed overview of the 'GEQ' in the literature review.

Analyses were carried out on 'REI' scores, 'GEQ' scores, and responses to the end of session interviews. 'REI' scores were translated from the positively and negatively worded responses to solely positively worded responses by recoding negative responses. This was done using a formula for subtracting each negative item response from 6 (i.e. 6 – x; where x = response for negatively worded item). The full list of negatively worded responses is given in appendix B. Recoded 'REI' scores were then split into their respective 'rational' and 'experiential' components; all 'rational' scores were summated, as were all 'experiential' scores. Participants were then split into high and low 'rational' and 'experiential' scorers by taking the

median scores for both ‘rational’ and ‘experiential’ scores and separating those that scored lower than the median level into the ‘low’ ‘rational’ or ‘experiential’ group, and those that scored at or above the median level into the ‘high’ ‘rational’ or ‘experiential’ group, in accordance with a previous study by Shiloh, Salton, and Sharabi (2002). The intention was to treat these groupings as post-hoc between-subjects conditions, but this step was retracted for reasons explained in the results section.

In previous studies using the ‘GEQ’, scores from separate components were considered individually rather than summated to achieve one overall game experience score. One issue with combining scores is that higher scores on some components of the ‘GEQ’ would mean a more negative experience, whilst others translate to a positive experience. As such, to obtain a score in a positive direction one would need to translate the components with negative interpretations into positive ones. However, it was not always as simple as translating the obvious negatively worded categories to mean a positive one (as is the case with ‘negative affect’ and tension/annoyance’). The main issue is with the category called ‘challenge’; with items such as ‘I felt challenged (item 26) and ‘I had to put a lot of effort into it’ (item 33). In these cases it is hard to establish whether a higher score can be said to be a positive or negative experience for the gamer. As will be seen from responses to the interview at the end of the experimental sessions, players generally agree that the level of challenge should be ‘just right’; not too hard, and not too easy. This could suggest an optimal score that has a middle value as opposed to very high or low. Due to the highly subjective nature of whether challenge in a

game is pleasant or not, the values for items relating to 'challenge' were kept as positively scored. This being said, it should be noted that the main components looked at were immersion and flow.

Finally, interview transcripts were used primarily to cross-validate the data given from the 'GEQs'. Responses relating to which game users found more immersive and which they enjoyed more were compared with their 'GEQ' responses to identify whether their post-game experiences matched their responses in the 'GEQ'. Open-ended questions regarding participants' understanding of immersion, and which types of games they found immersive, were used for comparisons with previous grounded theory studies (e.g. Brown and Cairns, 2004). With a higher sample size in the current study it seemed appropriate to examine whether some of the leading literature can be considered exhaustive or at the very least, reliable. In order to investigate this, common terms and themes in participants' understanding of immersion in games will be highlighted, with their frequencies of occurrence shown. A full list of the questions asked in the post-game session interviews can be found in appendix D.

Design

Participants were assigned to the conditions of a within-subjects design in an alternating manner; the order of the games played was controlled such that participants alternated between playing either '*Flower*' or '*Critter Crunch*' first. While all participants were placed in a within-subjects designed experiment initially, participants were separated post-hoc depending on the results of the 'REI' scale,

with a split between those that rated themselves as more or less highly on the 'rational' aspect of cognitive thinking-styles; to compare the relationship between thinking-styles and immersion for each of the two games (the split was made in accordance with the dual-processing account of thinking put forward by Goel, 2003). As such, it was intended that the final design would be a (post-hoc) 2x2 between-subjects design; [rational vs. experiential thinking-style x sensorial vs. tactical game]. However, for reasons that will be explained in the results, a correlational analysis was used to compare 'experiential/rational' scores and 'GEQ' components. The dependent variables measured were the participants' immersion scores for each game and the rational-experiential inventory scales' scores. The independent variables were the two types of games played; the free-flowing 'sensorial' game "*Flower*", and the more puzzle oriented 'tactical' game "*Critter Crunch*".

Procedure

Participants were given general information regarding the aims of the study before giving their consent to participate. They were advised the study should last between 35 and 45 minutes, based on trial runs conducted prior to the main study. After obtaining written consent, participants were told that their participation was voluntary and were made aware of their right to withdraw at any point during the experiment without the need to give a reason, and of their confidentiality. Throughout the experiment the researcher was always at hand to answer any questions participants may have had about the experimental questionnaires, assist with any technical difficulties or enquiries when playing the games, and provide

participants with writing equipment whenever necessary. Participants then proceeded to complete the 40-item 'REI' scale. Following the completion of the 'REI' scale participants were given a game to play for 10 minutes, followed with the 'GEQ' for that game, followed by a 10 minute play-through of a second game, and finally a second 'GEQ'. Participants were given very brief descriptions of the controls and aims of each game while the games were loading, and were told that should they require further assistance during game play they could either ask the experimenter or refer to a pre-prepared information sheet for each game outlining the controls and objectives (see appendix C). The order in which participants played the games was randomised to counterbalance order effects of both the games played and the given responses for each 'GEQ'. Following completion of the second 'GEQ' participants were given a short interview to identify their opinions on immersion, the games they played, and gaming in general. The interview contained demographic identifiers at the end so as not to influence the participants' responses throughout the experiments. It should be noted that although the researcher was always on site to assist with any enquiries and assist in the case of an emergency, the participants were advised that the researcher would have their back turned to the participant and would not be paying attention, and that they should play as if the researcher was not present.

3.2. Results

The aim of this results section is to firstly assess whether we can reject the null hypothesis that there is no relation between thinking styles and immersion, and then test for any significant correlations. It was hypothesised that 'rational' thinkers would be more immersed in the puzzle game 'Critter Crunch', and that 'experiential' thinkers would be more immersed in both games due to their openness to experience and tendencies to be emotionally expressive (Pacini & Epstein, 1999). Secondly, this section will aim to identify whether participants' who demonstrate they are more immersed in one game using the self-report questionnaire will mirror this view in a post-gaming interview in which they will be asked a series of questions relating to their experiences. This will go some way to cross-validate the reliability of the immersion component of the GEQ.

First we can look at the REI scores. 'Rational' scores were split into Rational Ability and Favourability. 'Experiential' scores were split into Experiential Ability and Favourability. The scores for the subcategories and overall 'rational/experiential' scores are shown in table 1 below.

Table 1. Descriptive statistics for 'Rational' and 'Experiential' scores

	Mean	Median	SD
Rational Ability	35.24	38	7.64
Rational Favourability	37.06	36	4.99
Rational Score	72.29	74	10.84
Experiential Ability	31.94	32	5.18
Experiential Favourability	31.59	32	5.90
Experiential Score	63.53	60	10.54

As we can see participants on average rated themselves as more 'rational' (*mean* = 72.29, *SD* = 10.84) than 'experiential' (*mean* = 63.53, *SD* = 10.54). This suggests that on average, the participants (MSc students) were more 'rational' than 'experiential'. This may be expected given the participants' background in education, but as has been shown in previous studies, the 'REI' is a reliable measure of the 'dual-route processing' theory of thinking styles across multiple sample sets including students (Stanovich & West, 1998).

Next we took a look at the descriptive results for each of the 'GEQ' components to see how the games themselves varied. Looking at table 2 below, we see that participants felt more 'competent' playing 'Critter Crunch' as well as feeling less 'negative affect' and more 'flow'. More importantly, participants seemed to be more immersed in 'Flower' than 'Critter Crunch', rating 'Flower' more immersive by an average value of 0.90 out of a theoretical maximum of 4.00.

Table 2. Descriptive statistics for GEQ components across both games

	Competence	Immersion	Flow	Tension/Annoyance	Challenge	Negative Affect	Positive Affect
Flower	1.81 (*sd*=.05)	2.32 (*sd*=1.03)	2.06 (*sd*=1.05)	0.73 (*sd*=1.10)	0.71 (*sd*=.70)	1.12 (*sd*=1.36)	2.59 (*sd*=1.12)
Critter Crunch	2.31 (*sd*=.66)	1.42 (*sd*=.56)	2.22 (*sd*=.91)	0.14 (*sd*=.29)	1.04 (*sd*=.70)	0.76 (*sd*=.89)	2.58 (*sd*=.71)

Following this, reliability analyses were run for the 'REI' and both instances of the 'GEQ'. As can be seen from table 3 below, all scales were reliable since α values were above 0.7, with Cronbach's Alpha values ranging from 0.793 to 0.822.

Table 3. Reliability analysis of the REI scale and the core GEQ for both games

	Cronbach's Alpha (α)	Number of items
REI	0.822	40
'Flower' GEQ	0.793	33
'Critter Crunch' GEQ	0.811	33

It should be noted at this point that while it may have been useful to undertake a factor analysis to verify the factor structures of both the 'REI' and 'GEQs' used in this instance, it was deemed inappropriate. Factor analyses are best used when a case to variable ratio (participants to items in this case) is above 10:1, and it has been suggested that a minimum value should be a ratio of 5:1 (Gorsuch, 1983). The 'REI' scale was completed by 17 participants, as were both instances of

the ‘GEQ’. This translates to case to variable ratios of 17:40 or 0.425:1 for the ‘REI’, and 17:33 or 0.515:1 for both ‘GEQs’; rendering any factor analyses fairly unreliable.

Splitting ‘REI’ scores between high and low ‘rational/experiential’ participants resulted in median scores (i.e. cut-off points according to Shiloh et al., 2002) of 74 for ‘rational’ scores, and 60 for ‘experiential’ scores (see table 1 above). In accordance with Shiloh et al. (2002), low ‘rational’ scorers were labelled as those with scores of less than 74, while high ‘rational’ scorers were those that scored at or above 74. Likewise, low ‘experiential’ scorers were those that attained an overall ‘experiential’ score of less than 60, and high ‘experiential’ scorers were those that attained a score at or above 60. This resulted in a split of 9 high vs. 8 low ‘rational’ thinkers, and 10 high vs. 7 low ‘rational’ thinkers. The initial plan was to use a series of ANOVAs to identify differences between high/low ‘rational/experiential’ thinkers and their levels of immersion, but guidelines suggest that ANOVAs are unreliable when one group is roughly 1.5 times the size of another (as is the case with high ‘experiential’ vs. low ‘experiential’ thinkers) (Brace, Kemp, & Snelgar, 2006). As such, it was deemed more reliable to use a series of correlational analyses to identify relationships between ‘REI’ and ‘GEQ’ scores. These results, split between the seven components of the ‘GEQ’ for each game against either ‘rational’ scores or ‘experiential’ scores are shown in tables 4 and 5 below.

Table 4. Correlations between GEQ component scores for 'Flower' and REI scores

		Competence	Immersion	Flow	Tension/Annoyance	Challenge	Negative Affect	Positive Affect
Rational Score	*r*	0.479	- 0.271	0.049	- 0.026	- 0.190	0.044	- 0.059
	p	0.052	0.292	0.852	0.921	0.466	0.866	0.821
Experiential Score	*r*	**0.500**	**0.535**	0.478	- 0.473	0.007	- 0.412	**0.628**
	p	**0.041**	**0.027**	0.052	0.055	0.978	0.101	**0.007**

Table 5. Correlations between GEQ component scores for 'Critter Crunch' and REI scores

		Competence	Immersion	Flow	Tension/Annoyance	Challenge	Negative Affect	Positive Affect
Rational Score	*r*	0.394	- 0.326	0.118	0.000	- 0.100	0.041	- 0.286
	p	0.117	0.202	0.653	0.999	0.702	0.875	0.265
Experiential Score	*r*	**0.503**	0.393	0.481	- 0.359	0.123	- 0.375	0.571
	p	**0.040**	0.119	0.051	0.157	0.639	0.138	0.071

The results show that ‘experiential’ scores have more consistent correlations with aspects of the ‘GEQ’ and that, crucially, ‘rational’ scores bear no strong correlations with immersion or ‘flow’. Significant correlations (**bolded** in the tables) were as follows: for ‘Flower’, correlations between ‘experiential’ scores and ‘competence’, immersion, and ‘positive affect’, with values of $r = 0.500$, $p = 0.041$; $r = 0.535$, $p = 0.027$; and $r =$ o.628, $p = 0.007$ respectively. There were no significant correlations between ‘rational’ scores and ‘GEQ’ components for ‘Flower’. For ‘Critter Crunch’, there was a significant correlation between ‘experiential’ scores and ‘competence’ ($r = 0.503$, $p = 0.040$). Again there were no

significant correlations between ‘rational’ scores and ‘GEQ’ components. Although not significant, ‘experiential’ scores were very close to correlational significance with the ‘flow’ component, with values of $r = 0.478$, $p = 0.052$ and $r = 0.481$, $p = 0.051$ for ‘Flower’ and ‘Critter Crunch’ respectively.

In order to investigate whether participants’ ‘GEQ’ scores mirrored their true opinions of which games they found more immersive, we looked at whether their scores for the immersion aspect of the ‘GEQ’ matched the game they stated as more immersive. It was found that ‘GEQ’ scores and interview selections were identical. This suggests that, as far as these participants are concerned, the ‘GEQ’s’ measurements of immersion reliably transfer self-reported written responses to vocal admissions.

Furthermore, statements from interviews were transcribed and reworded to identify common themes within participant’s views of what immersion was, what games are immersive, and why some games are more immersive than others (see appendix D for interview questions and a sample transcription). This was to identify an idea for what immersion was to compliment the grounded theory approach undertaken by Cairns and Brown (2004), although this study used 17 participants as opposed to Cairns and Brown’s 7. The common themes and the frequency with which they were stated are presented below in table 6.

Table 6. List of identified aspects of immersion and their frequency of occurrence

Factors Affecting Immersion	Frequency of Terms
demand constant attention/focus	13
Genres	12
unaware of surroundings	12
Story	9
right amount of challenge	9
escapism/be absorbed/ immersed	8
Realism	8
identify with it at a personal level	7
feeling in control	7
clear sense of progression	6
pressure/ tension	6
generally fun/ enjoyable	6
interesting/ vibrant world	6
temporal dissociation	5
clear objectives	5
visuals/graphics/ perspective	5
wanting to continue	4
sense of achievement	4
changes depending on genre or aim	3
personal preference	3
allow you to relax and take it at own pace	3
it's complicated	3
Uniqueness	2
good game	2
Skill	2
forget about base instincts (food, sleep, etc.)	2
being able to do what you want (freedom)	2

Splitting the statements by the frequency with which participants allegedly play games shows some interesting results. Participants that play games more frequently (i.e. at least once a week) tend to have more variations in their responses to what they think of as immersive. This suggests that more experienced gamers have a more varied understanding of immersion. It should be noted that all participants in the experiment have had some exposure to the term immersion during their time at

university at an academic level, and the responses of those individuals that do not play games as frequently tended to have similar, almost text-book like responses to what they thought immersion was (e.g. “I guess it’s the idea of flow”).

3.3. Discussion

The results showed that there was only a significant relationship between ‘experiential’ thinking and immersion for ‘Flower’, although there was a very close to significant correlation between ‘experiential’ thinking and ‘flow’ for both games. It is therefore important to remember at this point that the ‘GEQ’ splits immersion and ‘flow’, unlike other immersion questionnaires such as Jennett et al.’s (2008) questionnaire which also takes ‘presence’ into account. Thus, we can reject the null hypothesis that there is no relationship between thinking styles and immersion. As was predicted in the introduction, highly ‘experiential’ thinkers tend to be more immersed than those that do not think ‘experientially’; this thinking style had an overall stronger connection to immersion than ‘rational’ thinking. Looking at the correlations between the ‘GEQ’ component scores and the ‘rational’ and ‘experiential’ scores, it is clear that ‘experiential’ thinking is an overall more relevant variable for game experience. We can therefore say from these findings that players who are extraverted and more likely to view the world in a positive manner are more likely to enjoy videogames (based on Pacini & Epstein’s [1999] description of ‘experiential’ thinkers).

One possible explanation for the lack of a significant correlation between 'experiential' scores and immersion for 'Critter Crunch' could be its relatively low overall immersion score. Being perceived as having such low immersion from the majority of participants and exhibiting such less deviation in scores means that 'CritterCrunch' may have lacked many of the characteristic people seek in immersion. In fact, Nunez and Blake (2006) suggested that puzzle games were typically less immersive than other types of games; which may account for the lack of an effect of 'experiential' thinking style on immersion in this case.

The finding that 'experiential' scores were correlated with 'positive affect' and 'competence' can be attributed to past research that states those with more 'experiential' thinking styles have a more positive outlook on the world (Pacini & Epstein, 1999). The lack of any correlations between the 'GEQ' and 'rational' scores is unfortunate however. While of course types of games will play a factor with 'rational' scores (because 'rational' thinkers would exhibit a greater degree of success for challenging games involving logical problem solving) focusing research in that area may simply lead to confirming that 'rational' thinking affects problem solving. There is however still a useful application for the 'REI' in game experience research, and this will be discussed in the general discussion following the findings from study two.

Perhaps the most interesting finding was that the grounded theory approach to investigating what participants saw as immersion in games yielded some fairly differing responses. There were many overlaps with the research undertaken by Brown and Cairns (2004), but some interesting additions. It was clear

that players who tended to play games more frequently had more variation in their answers. This was perhaps due to the fact they are actually immersed in games far more often than those that play infrequently, and as such have more specific ideas about immersion due to their closer relationship or more frequent experiences with it. This would suggest that immersion is a term that becomes more and more subjective with increased exposure.

Another possible reason for this difference in variation can be accounted for when the participants' previous exposure to immersion research is taken into account. Using MSc students had, in hindsight, some fairly significant confounding factors. All the participants had to some capacity heard the term immersion and how it was understood under the research perspective of Cox and Jennett (e.g. Jennett et al., 2008). It is perhaps possible then that students that were frequent gamers were better able to successfully draw from their own experiences of immersion, rather than recall (either consciously or unconsciously) their learned understanding.

Since it is hard to test this from pure speculation, a second follow-on study was devised to identify whether the new set of terms for immersion were considered as more immersive to a larger group of gamers than the terms set out by Jennett et al.'s (2008) and IJsselsteijn et al.'s (in preparation) immersion questionnaires (or components). This was done in order to verify the new terms' relevance in a relatively under-defined field. The follow-up study is important because whereas the current study identified thinking-styles' role in immersion, aiming to open up an avenue for the study of more objective components for understanding immersion, the follow-up study can help to refine the subjective aspect of measuring a term

which is supposedly based on gamers' definitions of a term they frequently experience.

The follow-up study was not just used to verify the reliability of the findings made during the interview segment of study one, but rather to identify whether the idea of immersion was as subjective as the interviews suggested. This would affect whether the current style of immersion questionnaires really are in need of review. For if there are no favoured aspects of immersion then it could be argued that the current questionnaires are balanced and can justifiably ascribe each component an equal weighting. However, if findings show certain aspects of immersion are more important to gamers than others, then the scales need to be weighted in a particular direction, or possibly assigned rankings in order to correlate more strongly with gamers' opinions.

CHAPTER 4. STUDY 2

4.1. Introduction

It was clear from observations that gamers found different aspects of the gaming experience impacted on their level of immersion by varying degrees. Not only were different genres treated differently on an individual level, but there seemed to be different aspects people looked for in the immersion of different genres. It then became clear that the use of a singular questionnaire or subjective measurement could potentially lead to gross inaccuracies in terms of representing what a gamer thought was more immersive in each game. What this meant was that when the gamer answered a question regarding immersion in a questionnaire, it was according to the weighting the item had been assigned by the researcher who created the questionnaire.

Immersion and game play questionnaires vary in the way they assign weightings to different components; sometimes all components or factors are presumed equal and scores from each item are simply summated or averaged to produce overall scores (e.g. IJsselsteijn et al., in preparation), while in other instances higher priorities are placed on specific aspects, such as the heavy focus on 'real-world dissociation' in one immersion questionnaire (Jennett et al., 2008). This does not accurately reflect the findings from study one showing individuals placing a differing amount of importance on different aspects of immersion. As such, it could be useful to determine which the most important factors are to participants when they think of immersion. This way we can be more confident that the

participant's level of immersion is represented by their stated response to a more accurate degree.

For this reason the follow-up study, or study two, examined frequent game players' opinions on the immersive qualities of a series of game descriptions. They were asked which of a series of descriptions they found more immersive, ranking them in order of perceived immersion. They were then asked to rate (using a 10-point likert scale) the 10 most important factors affecting immersion as indicated by a combination of the findings from the first study, Jennett et al.'s (2008) immersion questionnaire and IJsselsteijn et al.'s (in preparation) 'sensory and imaginary immersion' component of their 'GEQ'.

4.2. Rationale for creating 'game personas'

While many of the elements of the first study remain in the second study, and much of the experimental stimuli is based off the literature described in the previous literature review, there were still aspects that were not addressed that seemed inappropriate to mention at the time. This short section will give a brief overview of the validity of the methods used in the design of the second study, and aim to justify a more qualitative application for the use of immersion questionnaires as well as the 'GEQ' and responses provided in the interview section of study one.

The technique used for creating stimuli was a combination of a grounded theory approach to immersion in videogames (from the interview section of the first study)

and a modified use of personas. In essence, three ‘game personas’ were created to represent the different types of immersive games available.

They can be seen as the ‘typical’ game for a specific understanding of immersion. As such, gamers reading these ‘game personas’ should be able to understand the bare essentials of the game, and ‘fill in’ the rest by providing their own back story. This does away with the bias of using specific games from different genres as players may have strong preferences. Instead, the reader assigns his/her own understanding of what types of game the ‘game personas’ may be referring to, and is not influenced by the stimuli to as great an extent as if they were shown descriptions of specific games. This was the problem of a pilot study that created game descriptions with specific genres and more specific information; players did not get past the type of game they had in their mind for the descriptions, which usually was the closest match they could remember playing.

The purpose of a persona is mainly to provide context for the reader. Personas usually describe the average or typical person, and are used to elicit a ‘filling in’ process from the reader (Pruitt & Grudin, 2003). What this means is that the reader reads about this typical person, and then forms his/her own story to ‘fill in’ the gaps, making the persona appear more real, and adding a sense of believability for the scenario the persona is used in. The three descriptions created with this in mind can be seen in appendix G.

The technique seemed successful, as numerous participants stated their reason for choosing a game description as “it feels like game ‘x’ to me”, where game x

could vary for the same game description (e.g. Game A was described as both 'Mass Effect' [a sci-fi action RPG] and 'Pokemon' [a turn-based game about collecting and trading creatures]). This option of stating a reason was optional however, in order to avoid deterring participants away, and so justifications were not usually obtained.

4.3. Creating stimuli descriptions

Using the responses from interview questions 4, 5, 6, and 7 (i.e. questions relating to immersion either within the games played during the experiments or with games in general) a spreadsheet was created which separated the 17 set of responses to the 4 questions into 17 sets of key terms and phrases said throughout the interviews. An initial stage of 'recursive abstraction' was undertaken with the phrases and terms from the spreadsheet to arrive at a series of recurring themes throughout responses to the interview questions. Although 17 terms and themes were initially formed using the recursive abstraction methodology, a total of 27 recurring themes were eventually identified during a lengthy process of assigning each term to a theme shared with at least one other participant.

The twenty-seven recurring themes coded were all described as 'factors affecting immersion' and included themes such as 'realism', 'sense of achievement', and 'right amount of challenge'. A full list of all the 'factors affecting immersion'

identified during coding of the interview responses along with the frequency of unique occurrences is presented above in table 8 and appendix E (each participant could only count as one occurrence per term, regardless of how many times he/she stated the same term). Although it was important to identify common themes and tie terms and phrases to common themes as much as possible there were inevitably instances of unique occurrences from some individuals that were not shared by any of the other 16 participants. These terms or phrases were not considered in the analysis and were dismissed due to their isolated occurrences.

The aim of this analysis was to identify the most prominent themes when participants thought of the term immersion. The Brown and Cairns (2004) grounded theory study used seven participants to identify a number of core elements to immersion, and used their findings as the basis for a three tiered explanation of the levels of immersion, as discussed in the literature review. This current study asked 17 participants their thoughts on immersion, and as such an analysis of the responses could give an indication of whether there were any aspects of immersion overlooked in the existing literature, and whether the literature is in need of refining or expansion.

In addition to being used as a method for comparing grounded theory approaches to understanding immersion, the coded responses with their dominant themes were used to test the hypothesis that gamers' understanding of immersion is separated (to some degree) from the understanding of immersion in some of the current literature. To test this, a series of game descriptions were created based on the main themes from the responses in the current study, those identified in the

current immersion literature, and main components of the game experience questionnaire. The inclusion of a stimulus based on the 'GEQ' was to act as a control stimulus which aimed at showing that immersion was thought of separately to the overall game experience.

The method employed to create the stimuli was quite experimental and had strong qualitative elements when compared to the use of questionnaires in the majority of immersion research. The stimulus for each condition consisted of a description of a game told in the manner of an anonymous overview of main game play characteristics for an ambiguous game. No mentions of specific game genres or platforms (videogame consoles) were given, in the interests of maintaining a bias-free response from gamers approached for participation in the study. No mention of the number of players or any online modes were mentioned, as this did not appear as a theme in any of the immersion research, and this study focused on immersion from a single-player perspective rather than contain an investigation into immersion in a competitive environment.

The stimuli all had identical lengths of 107 words and contained 13 main themes each. The aim here was to keep them as similar in length and style as possible so that participants did not favour one stimulus over another due to greater detail. However, while as much care was taken as possible to alleviate any unforeseen confounding variables in excess of those mentioned already (including order effects) it is clear there may be preferences in stimuli that can be attributed to factors apart from the main themes addressed. As such, a secondary measure was employed to help identify which of the terms and themes of immersion were most important to

gamers' own understanding of the term. This was achieved by generating a list of key terms identified in the first study and previous immersion literature as well as from the 'GEQ'.

This list was placed at the end of the stimuli and participants in the study were asked to rate the terms presented from 1-10, 10 being 'Extremely Important', and 1 being 'Not Important at all' for immersion. The specific phrasing used was as follows:

Please identify how important each of the following aspects of a game or the game experience is for the overall immersion of a game. Again, this is based on your personal understanding of immersion. There are no right or wrong answers here.

These ratings could then be used to identify what the most important aspects of immersion were from a population of frequent gamers, and to identify whether there were some terms or themes that seemed to have more importance than others.

4.4. Method

Participants

36 participants took part in the follow-up study. Specific age wasn't asked, but eight participants were aged 12-17, fifteen were aged 18-24, twelve aged 25-34, and one participant was aged 35 and over. Participants were respondents to an online

survey posted in forums of numerous gaming websites including Gamespot, IGN, Eurogamer, and Gamesradar. No incentives were offered, and all participants volunteered completely of their free will. There were 35 males and 1 female.

Materials

This study built upon the findings from study one, and so the materials used in this study derived from the analysis of responses to the interview segment of the first study. Responses to questions regarding immersion, listed as questions 4, 5, 6, and 7 in the interview question sheet (see appendix D), were referred to. This involved questions about the participants' personal understanding of immersion (q4), what made games more immersive (q5), whether specific genres of games were more immersive (q6), and what they found immersive out of two games they played in the previous study ('Flower' and 'Critter Crunch') (q7). Common themes were identified during the analysis of responses and their number of unique occurrences among the participants was tallied (shown in table 6 of the results section for study one). These common themes were then used as the basis for passage [1] 'study 1 immersion terms', in which an ambiguous game was described by an individual using the key themes from the analysis In order to separate the numerous common terms easily during coding, common themes were assigned specific colours, with some having a coloured text, and others a coloured background for the text (since there would have been too many similar colours otherwise). A screenshot of what the final colour coded terms looked like can be seen in appendix E, with one sample transcription colour coded for reference. The approach taken for passage [2] 'game experience terms' relied solely on the terms

expressed in the GEQ, featuring aspects from all of its seven components (words altered accordingly to provide terms with positive connotations). A similar approach was taken for the production of passage [3] 'previous immersion literature terms', except the key terms used to describe the ambiguous game were derived from literature and previously existing immersion scales such as Jennett et al.'s immersion questionnaire (2008) and IJsselsteijn et al.'s immersion component from the 'GEQ' (in preparation).

Design

The experiment had a within-subjects design in which all participants had to rank all of the passages, although the passages were ordered differently depending on which forum's link they travel through. The dependent variables were the rankings assigned to each passage, and the ratings assigned to each of the 10 items in the 'rate these aspects in terms of how much you feel they contribute to immersion' (a list of these 10 items can be found in Table 7. in section 4.5). The independent variables were the three passages used in the survey (with the conditions consisting of: [1] 'study 1 immersion terms', [2] 'previous immersion literature terms', and [3] 'game experience terms'.

Procedure

Participants were asked to click through a link to the online survey through instructions posted on online forums. They were directed to a completely anonymised survey consisting of three passages. They were not required to provide personal details save for age gender and frequency of game play at the end of the

survey. Participants were required to rank each of the three passages in terms of how immersive they found it in comparison to the others; they were first asked to state which they found most immersive, and why, and then which they found least immersive and why. This meant there each participant's data could be transformed into an immersion ranking for each of the statements. They were also asked to identify out of a list of 10 items (chosen as the most important aspects of the three conditions used for the ranking section) which they felt contributed most to their decision of how immersive they were, with the terms scored in terms of how much they affected immersion on a scale from 1 to 10 (where 10 'contributed most to immersion'). Participants then had to input their age, gender and frequency of game play. The participants then submitted their responses, and were thanked for their participation. A complete list of the passages as well as the items presented in the scale section of the questionnaire can be seen in appendix F and Table 8 in section 4.5.

4.5. Results

The choice of using participants that frequently visited the forums of popular internet gaming websites was so that we could study the opinions of frequent gamers. For this reason, any participants that did not meet the criteria of playing at least once a week were classified as infrequent gamers for the purposes of the study and excluded from subsequent analyses. As a result, from the 36 participants that took part in the study no one was excluded from the following analyses.

The first section of the web survey (see appendix F) involved participants stating which of the three game descriptions they found most and least immersive. This was transformed into a ranking from the most to least immersive game, and the results were as follows:

Table 7. Mean ranking scores for the three game descriptions based on perceived immersion

	N	Mean	SD
Game A (study 1)	36	1.94	0.826
Game B (GEQ)	36	1.69	0.668
Game C (Imm)	36	2.36	0.833

Using a one-way within-subjects Friedman test, it was found that perceived immersiveness varied significantly across the three immersive game descriptions: $\chi^2(2, N = 36) = 8.167$, $p = 0.017$. Table 6 (above) shows that the highest ranked game was Game C (*mean* = 2.36, *SD* = 0.833), followed by Game A (*mean* = 1.94, *SD* = 0.826), and then Game B (*mean* = 1.69, *SD* = 0.668). What this means is that Game C (based on the immersion questionnaires) was ranked as significantly more immersive than Game A (based on findings from the interview section of study one) and Game B (based on the Game Experience Questionnaire). As predicted, the description based on the 'GEQ' was perceived as the least immersive.

The next set of questions were used to identify which aspects of immersion gamers felt contributed most towards an immersive experience. The figure below (figure 3) shows the average importance rating for each of the 10 aspects of

immersion. A higher 'immersive importance' score denoted a higher perceived contribution to immersion.

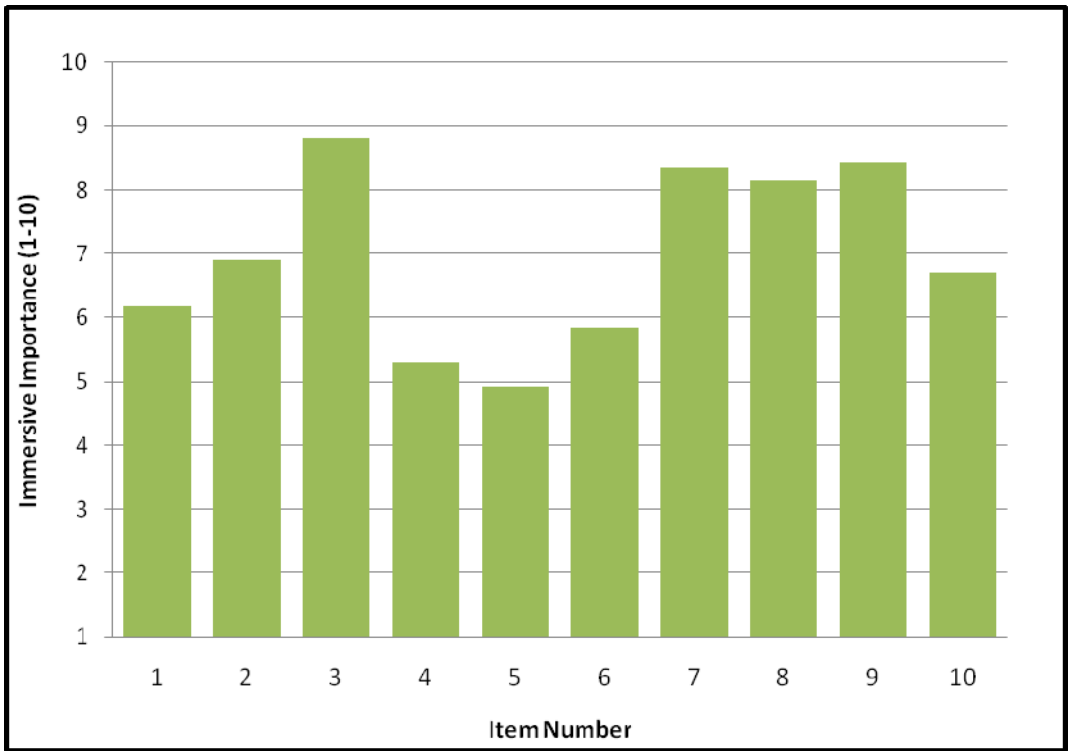

Figure 3. Bar graph showing average ratings of perceived contribution to immersion for each of the 10 aspects of immersion

To put these figures into context, please refer to the table below (table 8) which assigns each item number shown in the bar graph above to the aspect of immersion it refers to. The results showed that the most important aspects of immersion among a population of frequent gamers were items 3, 7, 8, and 9. This was decided by creating a threshold value for the most important aspects as those which have an average rating of 8 or above. Interestingly, the aspects with the highest weighting on the immersion questionnaires (item 2: *forgetting about the real world*) was not the most important aspect contributing to immersion in this data set.

Table 8. Most important aspects of immersion

Item Number	Aspect of Immersion
1	Losing track of time
2	Forgetting about the real world
3	Being generally enjoyable
4	Specific genre of game
5	A sense of realism
6	Demanding a certain level of skill
7	Having a compelling story
8	Right level of challenge
9	Responsive controls
10	Identifying with it at a personal level

4.6. Discussion

The above results showed that on average, frequent gamers clearly tend to feel some aspects of immersion are contributing more to the phenomenon than others. Interestingly, the most important aspects of immersion to frequent gamers were items 3: “Being generally enjoyable”, 7: “Having a compelling story”, 8: “Right level of challenge”, and 9: “Responsive controls”. This shows quite a contrast against the most important aspects of immersion as identified by both the first study and the previous immersion questionnaires. Whereas they focus more on the idea of ‘presence’ and ‘sensory immersion’, the findings here suggests that narrative,

enjoyment, and reducing barriers to immersion as described in Brown and Cairn's (2004) grounded theory play a more important role.

The aspect of immersion given the highest weighting in current immersion questionnaires (real world dissociation; part of item 2: forgetting about the real world) was not seen as the most important to frequent gamers in this study. Although, the overall terms used in the 'game persona' constructed using current immersion literature was seen as significantly more immersive than the others. What this suggests is that although the current measurements of immersion take relevant factors into account (at least in terms of agreeing with gamers' perceptions of immersion), there is still a discrepancy between the importance with the which the current literature assigns some of those aspects.

With a significant difference between the perceived immersion of the three game descriptions, it is important to understand what else could affect the results. While a great deal of care was taken not to create vast differences in structure and style used for the three descriptions (although obviously different terms had to be used), there was always a possibility that the way phrases were framed could have an impact on participants' perception of the descriptions. It is also not clear how susceptible these participants were to such influences as wording effects (and recency; although recency was counterbalanced at least to some extent via the use of different ordering for each of the links posted on different websites). This concept of participants being susceptible to wording effects and other subjective external factors comes back to aspects addressed in the first study of this thesis, and these will be explored in greater detail in the general discussion.

CHAPTER 5. GENERAL DISCUSSION

To summarise the findings of this thesis briefly: explicit reasoning and problem solving abilities were NOT shown to impact individuals' immersion (specifically flow, imaginative and sensory immersion) in videogames; 'experiential' thinking was a better determinant of game experience through its relation to extroversion and emotional expressiveness than 'rational' thinking; frequent gamers DO find the literature's interpretation of the aspects of immersion to match their own to some extent; but they do NOT agree with the way some aspects of immersion are prioritised in the current literature.

The first study investigated whether thinking styles, or more specifically, whether explicit reasoning and problem solving strategies, could account for differences in immersion among participants who completed the 'REI'. It was shown that participants' tendencies to think 'rationally' did not affect any component of the 'GEQ', and so the findings suggest that 'rational' thinking does not affect immersion nor any of the other measured components of the game experience. For immersion to be affected by participants' abilities to reason 'rationally', the immersion questionnaires used may have to contain some element of problem solving ability within the game. In order to test more reliably whether immersion and thinking styles correlate, more objective measurements of immersion such as biological changes in the body could be compared with fMRI data of participants playing games in order evaluate the activity of the 'rational' logical processing streams of the brain. However, 'experiential' thinkers were shown to exhibit more 'positive affect' in games as well immersion and a sense of

‘competence’. This is supported by Pacini and Epstein (1999) who associate ‘experiential’ thinking with agreeableness and emotional expressiveness.

The second study investigated whether participants agreed with the view of immersion in the current literature. This was tested by having participants, who were all frequent gamers, rank game descriptions based on how immersive they perceived them to be. These game descriptions were constructed as equally as possible using a grounded theory approach and a variation of the concept of using personas to elicit realistic and personal emotions towards traditionally ambiguous stimuli. Findings from the second study showed that participants from a background that had been exposed to the academic side of immersion had opinions that were heavily biased. However, frequent gamers viewed the current literature’s understanding of immersion as similar to their own, but did not believe that weightings to each aspect of immersion were represented accurately. This was made evident through the use of scoring 10 items based on the most common aspects of immersion in current literature and the grounded theory approach from the first study with a 10 point likert scale for how important participants thought they were for immersion.

The issue with previous research was the limited number of participants used in the study, leading to an inevitably unrepresentative sample of participants. The issue with the first study in this thesis was using participants who although were not unnecessarily frequent gamers, were still invariably biased in their opinions of immersion. For this reason, it is suggested that future research involve interview type experiments on a mass scale to formulate a user-centred understanding of immersion that can be used to benefit the end user more directly.

CHAPTER 6. CONCLUSION

As it stands, the first study did not aid in the progression of understanding immersion aside from removing 'rational' thinking as a possible predictor to immersion. The second study on the other hand contributes to understanding immersion in the sense that it highlights the discrepancy between gamers' true opinions on the importance of some aspects of immersion, and the importance assigned to these aspects through the construction of some of the leading measures of immersion. This would aid in moving towards identifying and constructing a more user-centred approach to understand immersion. The study of immersion can be seen in some respects as an exercise in improving the end experiences for gamers. By neglecting a user-centred approach to its study we risk alienating the core beneficiaries of the research.

So then how can we improve our methods of understanding immersion in games through a user-centred approach based on the findings of this thesis? It comes down to looking at the failures of the REI's involvement with immersion from a different perspective. Obviously, the first study showed that 'rational' thinking does not affect any part of the gaming experience significantly. But this is not necessarily without its uses. The 'REI', and more specifically 'rational' thinking, has been shown to reliably measure one's tendency to avoid belief-biases, and use logic over 'gut reactions'. A novel approach in this thesis; the use of ambiguous gaming descriptions (or 'game personas') has merits in the way it attempts to analyse immersion's core, as opposed to people's experiences of immersion with specific genres.

By avoiding specific genres or detailed descriptions, we are able to assess the more fundamental components of immersion in games. However, the impact wording and structure can have on descriptions may prove to be a significant confounding variable. If instead highly 'rational' thinkers were used to form opinions of how immersive the game descriptions were, it may be possible to reduce the effect of wording and leading participants to some extent through the use of participants who focus on logic rather than instinct. In this way it may then be possible to research what is meant by game immersion in a more fundamental sense, which has implications for studying immersion in areas outside of games.

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APPENDIX A

Cover sheet used in first study

Participant Number _____

Instructions

This experiment will take place in four parts:

1) In the first part you will be required to answer a series of questions, giving responses on how much you agree or disagree with a series of statements. (5 mins)

2) The second part involves playing a game, followed by completing a brief questionnaire regarding your opinion of the game-play experience. (15 mins)

3) The third part involves playing a second game, again completing a brief questionnaire regarding the game-play experience. (15 mins)

4) Finally, the fourth part involves a short interview with the researcher relating to your overall experience and opinions. (5 mins)

This experiment should last for approximately 40 minutes.

If any part of the experiment is unclear, or if you have any enquiries unrelated to the experiment, please feel free to ask the researcher for assistant. The researcher will be present at all times.

APPENDIX B

Epstein's Rational-Experiential Inventory

On the following pages is a list of statements that may or may not be true of you. After reading each statement carefully, please use the following scale and write down the number that corresponds to how you see yourself in the answer box. Treat each item individually even if they are similar.

Definitely False	Mostly False	Undecided or Equally True and False	Mostly True	Definitely True
1	2	3	4	5

1.* I'm not that good at figuring out complicated problems.

2.* If I were to rely on my gut feelings, I would often make mistakes.

3. I prefer complex to simple problems.

4.* I generally don't depend on my feelings to help me make decisions.

5. I have no problem in thinking things through clearly.

6. When it comes to trusting people, I can usually rely on my gut feelings.

7.* Thinking is not my idea of an enjoyable activity.

8. I like to rely on my intuitive impressions.

9.* I am not a very analytic thinker.

10. I believe in trusting my hunches.

11. I enjoy solving problems that require hard thinking.

12.* I think it is foolish to make important decisions based on feelings.

13.* I suspect my hunches are inaccurate as often as they are accurate.

14. I usually have clear, explainable reasons for my decisions.

15.* Knowing the answer without having to understand the reasoning behind it is good enough for me.

16.* I would not want to depend on anyone who described himself or herself as intuitive.

17. Using logic usually works well for me in figuring out problems in my life.

18. I enjoy intellectual challenges.

19. I can usually feel when a person is right or wrong, even if I can't explain how I know.

20. I often go by my instincts when deciding on a course of action.

21.* My snap judgements are probably not as good as most people's.

22.* Reasoning things out carefully is not one of my strong points.

23.* I don't like situations in which I have to rely on intuition.

24.* I try to avoid situations that require thinking in depth about something.

25. I trust my initial feelings about people.

26. I have a logical mind.

27.* I don't think it is a good idea to rely on one's intuition for important decisions.

28.* I don't like to have to do a lot of thinking.

29.* I don't have a very good sense of intuition.

30.* I am not very good in solving problems that require careful logical analysis.

31. I think there are times when one should rely on one's intuition.

32. I enjoy thinking in abstract terms.

33. Using my "gut feelings" usually works well for me in figuring out problems in my life.

34.* I don't reason well under pressure.

35. I tend to use my heart as a guide for my actions.

36.* Thinking hard and for a long time about something gives me little satisfaction.

37. I hardly ever go wrong when I listen to my deepest “gut feelings” to find an answer.

38. I am much better at figuring things out logically than most people.

39. Intuition can be a very useful way to solve problems.

40. Learning new ways to think would be very appealing to me.

*Reverse scored items

Rational items = 1, 3, 5, 7, 9, 11, 14, 15, 17, 18, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40.

Experiential items = 2, 4, 6, 8, 10, 12, 13, 16, 19, 20, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39.

APPENDIX C

Controls and objectives for 'flower' and 'critter crunch'

Part 2a
Game 1 – Flower

You will now be given the chance to play Flower. The game's controls are explained within the game and the objectives are designed to become self-evident upon exploration; as such ***it is strongly advised that this page is only referred to if you are unable to follow or remember the in-game instructions or cues.*** The controls and objectives are given below:

Controls:

Objective:

The aim of Flower is to go around the fields collecting petals to progress to the next stage. The order in which you collect petals is up to the player, but collecting all of the red coloured petals triggers the next area of the game. The speed at which the player moves does not affect a final 'score' of any kind; it is up to the player to move as slowly or as quickly as they like.

Once you are asked to stop playing the game please turn over the page and complete the relevant questionnaire.

Part 3a
Game 2 – Critter Crunch

You will now be given the chance to play Critter Crunch. The game's controls and objectives are explained within the game, and as such ***it is strongly advised that this page is only referred to if you are unable to follow or remember the in-game instructions.*** The controls and objectives are given below:

Controls:

Objective:

The aim of Critter Crunch is to remove the 'Critters' from the screen before they reach the bottom by feeding them to each other. Letting the critters reach the bottom of the screen will result in game over.

Each level is completed by filling your hunger bar; scores are raised by feeding critters to each other until they burst. Bursting critters will drop jewels, these must be collected to fill the hunger bar and increase your score.

Critters can be fed to each other in a hierarchical manner (a food-chain): small flies can be fed to small round critters; small round critters can be fed to fat round critters; and any critters can be fed to bombs.

Feeding two critters of the same type (e.g. small flies) to the next critter in the food-chain (e.g. small round critters) will cause the fed critter to burst.

Any critters of the same type immediately adjacent to the fed bursting critters will also burst, and bursting chains can be formed by linking critters of the same type to each other and bursting one of them (they must be linked using combinations of horizontal and vertical chains; diagonal chains will not work).

Any critter that is thrown at an incompatible critter will simply place that critter at the bottom of the column it was thrown in. Critters will simply not eat critters that are larger than them, or that are too small.

In later levels, different coloured critters make an appearance. The game-mechanics remain largely unchanged except for the fact that coloured critters of the same type will not form bursting chains with critters of a different colour.

Once you are asked to stop playing the game please turn over the page and complete the relevant questionnaire.

APPENDIX D

Interview questions for study one

Q1) How often do you play videogames?

Q2) Which gaming platforms do you own?

Q3) Before today, had you played either 'Flower' or 'Critter Crunch' before?

Q4) When you think of the term 'immersed' within the context of someone playing a videogame, what does that mean to you? So how would you describe a player that is immersed in the game?

Q5) What to you makes a game immersive?

Q6) Do you think there are some types or genres of games you would find more immersive than others?

Q7) Of the two games you just played, which did you find more immersive, and why?

Q8) Did you have to refer to the game controls or objectives on the sheet at any point for either games?

Q9) Did you ever look at your controller while you were playing the game in order to remind yourself of the button layout or for any other reason for either game?

Q10) Which types of games do you usually enjoy playing?

Q11) Out of the two games you just played, which did you enjoy more?

Q12) What is your age?

Q13) Is English your first language? If not, what is your first language?

Sample interview transcript

Participant: 01A	Interview Length: *05mins:17secs*
Gender: Male	Age: 26

Questions	Responses
Q1) How often do you play videogames?	Every day.
Q2) Which gaming platforms do you own?	PC, Xbox 360, PS3, Girlfriend has Wii.
Q3) Before today, had you played either 'Flower' or 'Critter Crunch' before?	No, Flower is really a surprise.
Q4) When you think of the term 'immersed' within the context of someone playing a videogame, what does that mean to you? So how would you describe a player that is immersed in the game?	"I think immersed is **different for different genres** of games. In adventure games, immersed means the player is completely **fixated on the character's story**; you're really **concerned and care about the main character**. In first-person shooters **you feel like you are actually playing the main character**. It's different from third-person and actions games. For games like Flower, you really get immersed in the **unique style** of the game. It also means you are **dragged into the game**, and your **concerns with the outside world are reduced to a minimum**."
Q5) What to you makes a game immersive?	**Strong story, graphics, uniqueness, point-of-view.**
Q6) Do you think there are some types or genres of games you would find more immersive than others?	It's definitely **different for different genres**. **Adventure and First-Person Shooters** for the **perspective** and **story** they have.
Q7) Of the two games you just played, which did you find more immersive, and why?	Flower, when i played it i felt like i was in the **spirit or realm** of the flower. It might be because of the **3D flying** in the air, and the second is **just 2D**. The **graphics** had a role in it, but it was mainly the idea of playing as flowers (the **uniqueness**). The **view-point** also helps a lot.
Q8) Did you have to refer to the game controls or objectives provided on the sheet at any point for either game?	No.
Q9) Did you ever look at your controller while you were playing the game in order to remind yourself of the button layout or for any other reason for either game?	When i played Critter Crunch, I had to look to see if i was pressing square or circle, i still get mixed up between those two. But not for Flower.
Q10) Which types of games do you usually enjoy playing?	Adventure, RPG, First-Person Shooter. More hardcore games, more mature titles.
Q11) Out of the two games you just played, which did you enjoy more?	Flower. The **enjoyment was closely related to immersion**.
Q12) What is your age?	26
Q13) Is English your first language?	No, Chinese.

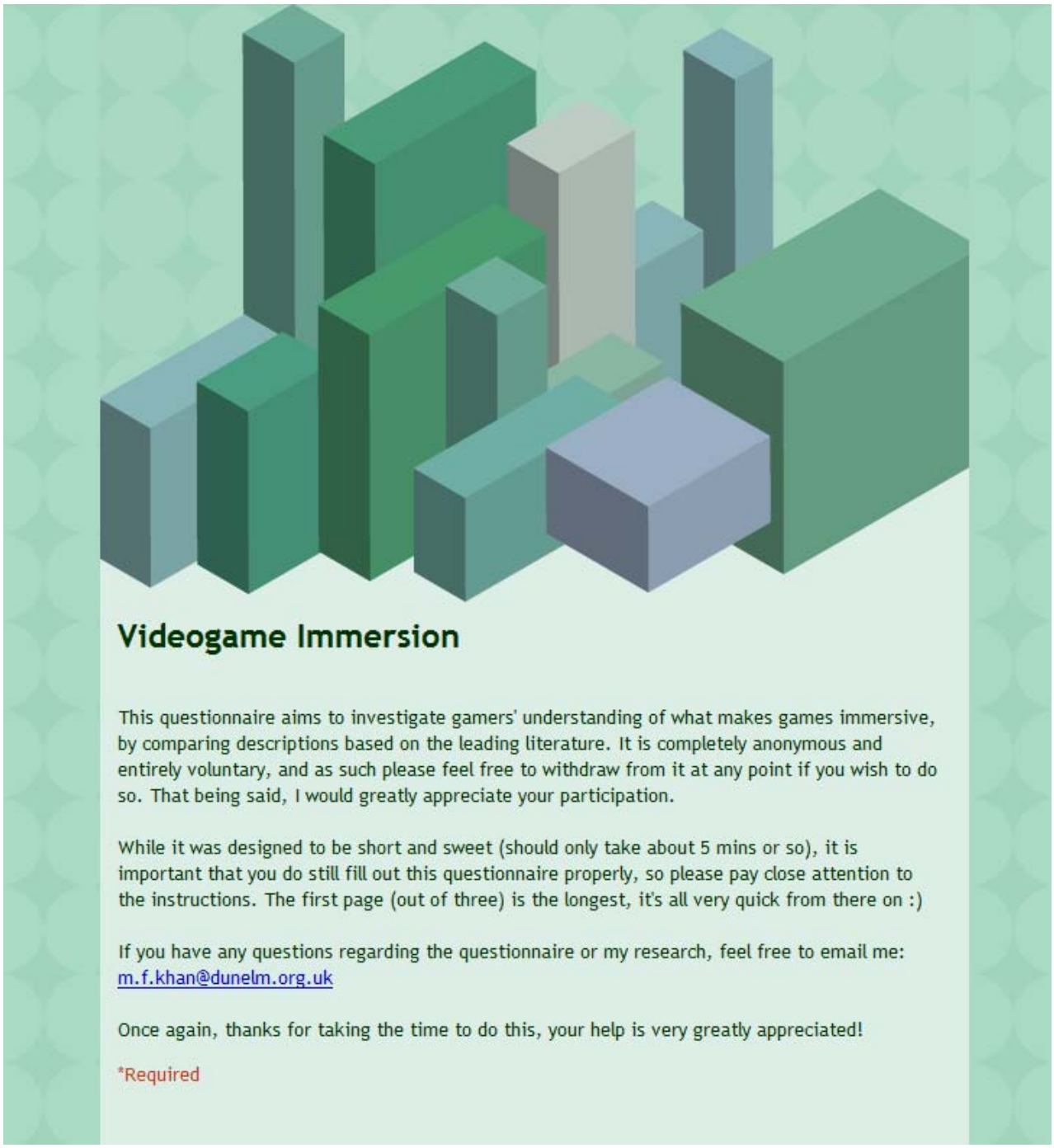
APPENDIX E

Frequency of terms affecting immersion

Q	R	S	T
17A		Factors Affecting Immersion	Frequency of Occurance
frequent (every day) to once a week(-)		story	3
unaware of their surroundings		changes depending on genre or aim	3
focused on game		unaware of surroundings	12
don't react to stimuli unrelated to game		uniqueness	2
#		right amount of challenge	9
personal preferences		temporal dissociation	5
storyline affects immersion		clear objectives	5
ability to relate to story or character		clear sense of progression	6
easy to play, not too hard		wanting to continue	4
relative skill level		genres	12
#		escapism/be absorbed/ immersed	8
depends on people		pressure/ tension	6
different genres are immersive for different people		sense of achievement	4
football games		identify with it at a personal level	7
good at the game		good game	2
realistic		personal preference	3
share the same interest in real life		skill	2
unpredictable		demand constant attention/focus	13
#		allow you to relax and take it at own pace	3
more engaging		feeling in control	7
freedom to move where and how you want		forget about base instincts (food, sleep, etc.)	2
		generally fun/ enjoyable	6
		it's complicated	3
		visuals/graphics/ perspective	5
		realism	8
		being able to do what you want (freedom)	2
		interesting/ vibrant world	6

APPENDIX F

Web survey screenshots



Videogame Immersion

This questionnaire aims to investigate gamers' understanding of what makes games immersive, by comparing descriptions based on the leading literature. It is completely anonymous and entirely voluntary, and as such please feel free to withdraw from it at any point if you wish to do so. That being said, I would greatly appreciate your participation.

While it was designed to be short and sweet (should only take about 5 mins or so), it is important that you do still fill out this questionnaire properly, so please pay close attention to the instructions. The first page (out of three) is the longest, it's all very quick from there on :)

If you have any questions regarding the questionnaire or my research, feel free to email me: m.f.khan@dunelm.org.uk

Once again, thanks for taking the time to do this, your help is very greatly appreciated!

*Required

Which of the following games do you find MOST and LEAST immersive?

1a) Of the following descriptions, which do you feel best fits your idea of an immersive game? (MOST IMMERSIVE) *

Please read through the following game descriptions and choose the option that most closely matches your own personal idea of what an immersive game would be. There are no right or wrong answers here, I am simply interested in your opinion.

- Game A - While playing this game I couldn't help but feel focused on it. I was absorbed by the experience, not paying attention to what was happening around me. I usually get absorbed by games of this genre more so than others, and found the story compelling and the characters natural and believable. The difficulty was just right, it was always challenging enough to keep things interesting and I did feel tense at times, but never to the point of frustration. The controls were also tight; I thought that my character responded well to commands, and the game was realistic in terms of visual design and the sound effects.
- Game B - When playing this game I felt I was competent at completing my objectives. I found myself engaged with the game's story, as the plot and characters were rich. Exploration was quite free, and I felt like I was able to be creative with how I played. I found I was so focused that I forgot what was going on around me in the real world. The game is challenging; I was quite involved during some sequences to the extent of feeling tense, but I always felt good after playing it. I never became bored or frustrated. The game had a way of making me feel very powerful.
- Game C - This game had an ability to render me unaware of my surroundings. It held my attention and I was interested in the story and felt to progress I really had to try my best. At times I forgot I was using controls, the visuals were pleasing, and I found myself losing track of time. It was fun and I felt free to explore and progress however I wanted. I had wanted to perform really well in this game, and at times I found myself speaking to the game directly. I formed an emotional bond to some extent so was disappointed when the game came to an end.

1b) Is there a particular reason for your choice?

(optional)

APPENDIX G

Consent forms for study one

Information Sheet for Participants in Research Studies

You will be given a copy of this information sheet.

Title of Project: **Thinking styles and immersion**

This study has been approved by the UCL Research Ethics Committee [Project ID Number]:
MSc/0910/019

Name, Address and Contact Details of Investigators:

Mohammed Khan
30 Helena Road
NW10 1JA
E: ucjtmfk@live.ucl.ac.uk
T: 07814713742

We would like to invite you to participate in this research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important for you to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or you would like more information.

Details of Study
This study aims to identify the relationship between thinking-styles and individuals' immersion in a variety of videogames. Sessions should run for approximately 40 minutes each. Participants will be given the opportunity to play a series of enjoyable videogames, and asked to complete a small battery of questionnaires. Participants may be selected for a brief interview upon completion of the study regarding their gaming experiences. This study poses no foreseeable risks.

It is up to you to decide whether or not to take part. If you choose not to participate it will involve no penalty or loss of benefits to which you are otherwise entitled. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason.
All data will be collected and stored in accordance with the Data Protection Act 1998.

Informed Consent Form for Participants in Research Studies

Title of Project: **Thinking styles and immersion**

This study has been approved by the UCL Research Ethics Committee
[Project ID Number]: MSc/0910/019

Participant's Statement

I …….....

agree that I have

- read the information sheet and/or the project has been explained to me orally;
- had the opportunity to ask questions and discuss the study;
- received satisfactory answers to all my questions or have been advised of an individual to contact for answers to pertinent questions about the research and my rights as a participant and whom to contact in the event of a research-related injury.

I understand that I am free to withdraw from the study without penalty if I so wish and I consent to the processing of my personal information for the purposes of this study only and that it will not be used for any other purpose. I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.

Signed: Date:

Investigator's Statement

I ……..

confirm that I have carefully explained the purpose of the study to the participant and outlined any reasonably foreseeable risks or benefits (where applicable).

Signed: Date:

Researcher Notes, Optional Clauses:

- I understand that I must only take part if I am familiar with at least one of the Playstation/ Playstation 2/ Playstation 3 controllers, and if my English reading comprehension skill is at a good standard.
- I understand that my responses to interviews may be recorded (audio or written data), and I give permission to the researcher to use these recordings for research purposes only. I accept that the researcher will not distribute or pass on this information, and that all my data will be treated with the strictest confidentiality.
  Agree: Yes/ No (please circle)
- I agree to be contacted in the future by UCL researchers who would like to invite me to participate in follow-up studies.
- I understand that the information I have submitted will be published as a report and I will be sent a copy. Confidentiality and anonymity will be maintained and it will not be possible to identify me from any publications.