

The relation between personality, immersion experience and narrative games

Hsin-Ying Kuang

Project report submitted in part fulfilment of the requirements for the degree of Master of Science (Human-Computer Interaction with Ergonomics) in the Faculty of Life Sciences, University College London, 2011.

NOTE BY THE UNIVERSITY

This project report is submitted as an examination paper. No responsibility can be held by London University for the accuracy or completeness of the material therein.

ACKNOWLEDGMENTS

First of all, I would like to thank my supervisor, Dr Charlene Jennett, for her guidance, help, patient and encouragement throughout the whole project. I would also like to thank Dr Anna Cox for her insightful advices. Thanks also to all the participants that spent time on my survey as well as experiment.

I would also like to thank Dr Paul Cairns for his advice on statistical analysis and Dr Sacha Brostoff from Computer Science Department for his help with online survey.

I am grateful to David Tisserand in Sony Computer Entertainment Europe Limited for helpful discussions and advice on selecting games and for his kindness of lending PS3 console and games for my study.

Finally, I would like to thank my family, friends for all their help and support during this project and throughout this course.

ABSTRACT

Gaming is a fast growing business in the entertainment industry and game companies would undoubtedly like to understand what affects people's preference on games. However, research related to personality and the immersion experience (a total engaged experience during game play) is rare. Although Weibel et al. (2010) have indicated a relation between personality and Immersive Tendency in their online survey study (N=220), it can be argued that Immersive Tendency is one's disposition to be immersed in games, whereas the immersion experience is subjective and can vary depending on the person's game play. In addition, we argue that Weibel et al. failed to justify the statistical approach they used. They also suggested that high-scorers on the personality trait 'openness' (one of the Big Five personality factors; Costa & McCrae, 1992) are more likely to be immersed in narrative game. However, this claim lacks empirical examination.

In this work, we conducted two studies. Study 1 was a large-scale online survey (N=630) aiming to investigate the relation between personality and immersion experience. It replicated Weibel et al. (2010)'s work but with some key differences. We used the Immersive Experience Questionnaire (Jennet et al., 2008) instead of Immersive Tendency and analysed data with factor analysis and correlation (Kline's approach, 1998) instead of structural equation modelling. The factor analysis indicated that personality traits (Big Five) and immersion experience load onto separate constructs; correlations reveal that several of the items are related (e.g. openness and agreeableness).

Building on Study 1, Study 2 was a lab study (N=18) aiming to test whether openness affects one's immersion experience in narrative games (as claimed by Weibel et al.). It was predicted that when playing a narrative game, openness will be significantly correlated with the Immersive Experience Questionnaire scores, where the same will not be found for a non-narrative game. The results revealed that openness was not significantly correlated with immersion in the narrative game. One possible reason for non-significant findings include that there was no distinctive difference between two chosen games.

Together, the results suggest that although personality is related to immersion experience, it may not necessarily indicate one's preference for narrative games. The findings provide an initial step towards investigating immersion experience and possible influencing factors (personality), and imply that there may be other important factors affecting people's immersion experience, in addition to narrative.

CONTENTS

Acknowledgements	
Abstract	i
Contents	iv
Index of tables and figures	vii
Chapter 1 Introduction	1
Chapter 2 Literature review	5
2.1 Immersion	5
2.1.1 Concept of game immersion	5
2.1.2 Related concepts	11
Flow	11
Cognitive absorption	12
Presence	12
2.2 Personality	14
2.3 Personality and immersion	19
2.4 Narrative	23
2.5 Research questions	29
Chapter 3 Study 1	33
3.1 Method	34
Participants	34
Materials	34
Procedure	35
Pilot study	36
3.2 Results	36
Scores on personality traits	36

Correlation between personality traits and immersion	37
Factor analysis	40
3.3 Discussion	44
Chapter 4 Study 2	48
4.1 Method	49
Participants	49
Materials	50
Apparatus	51
Design	51
Procedure	53
Pilot study	54
4.2 Results	54
IEQ and Personality	55
Order effects	56
INQ and Post-Study interview	56
4.3 Discussion	57
Chapter 5 General discussion	60
2.1 Personality and immersion experience in narrative games	60
2.2 Limitations and possible confounds	62
2.3 Future work and implications	64
Chapter 6 Conclusion	67
References	69
Appendix A Cattell's 16 Personality Factors	75
Appendix B NEO Five-Factor Inventory	76
Appendix C Past gaming questionnaire	80

Appendix D	Immersive Experience Questionnaire	81
Appendix E	Immersive Narrative Questionnaire	85
Appendix F	Post-study interview	87
Appendix G	Information sheet	88
Appendix H	Consent form	90
Appendix I	Demographical questions in Study 2	92
Appendix J	Instructions	93
Appendix K	Factor loading matrix	94

INDEX OF TABLES AND FIGURES

Tables

Table 1: Pearson's Correlation for Personality Traits and Immersion	38
Table 2: Pearson's Correlation between Personality Traits and the Level of Immersion in Games	55

Figures

Figure 1: Scree plot for factor analysis	41
Figure 2: Screen shot of Call of Duty 4: Modern Warfare	52
Figure 3: Screen shot of Call of Duty: Modern Warfare 2	52

1. INTRODUCTION

Gaming is one of the fastest growing entertainment industries. It is expected to be a \$68 billion business by 2012 (Caron, 2008). Games have evolved from using simple pixel graphics, such as *Space Invaders*, to complex interface design. Different game genres are released to attract different types of payers, from adventures, puzzle solving to dancing. Game designers and companies devote significant budgets and effort to attract payers by understanding what attracts payers. Recently, games have even been integrated with new technologies. For instance, *L.A. Noire*, a crime investigating game, one of the new games recently published by *Rockstar Games*, uses animation technology to capture the actors' facial expressions from every angle, which allows payers to use the suspects' reaction to identify criminals (<http://www.rockstargames.com/lanoire/>).

Compared to traditional forms of entertainment such as watching films and reading novels, gaming is relatively new. One of the differences is that traditional forms of entertainment contain strong elements of narrative, whereas games rely more on interactivity. Not all games have narratives. For instance, action adventure games such as *Uncharted 2: Among Thieves* contain narrative elements such as characters, storyline progression. On the other hand, *Tetris* is one of most popular games in the world but there is no narrative as all the game does is change the shape of the blocks in order to fit them together.

As narrative plays a role across different game genres, e.g. adventure and

action games, we argue that investigating the role of narrative in games provides more insight into game design. Therefore, we aimed to investigate the relation between personality and narrative in a game experience.

Past research has investigated the relation between personality and entertainment media preference— personality factors, such as ‘openness’ and ‘neuroticism’, have been found to be important factors (Rentfrow, Goldberg & Zilca, 2011; Kraaykamp & Eijck, 2005; Weaver, 1991). However, these works did not include games in their investigation. In addition to this research, some other studies have examined the relation between personality and game genres such as sports and adventures (Park, Song & Teng, 2011; Zammitto, 2010). However, we are more interested in the role of narrative.

Relevant to the current research is the work of Weibel, Wissmath and Mast (2010). They suggested that people with a high score on the personality trait of ‘openness’ tend to prefer narrative games. Expanding on this, we further ask: do personality traits affect one’s experience of immersion in narrative games?

Many concepts have been proposed to investigate game experience (Agarwal & Karahana, 2000; Brown & Cairns, 2004; Grimshaw, Lindley & Nacke, 2008; McMahan, 2003; IJsselsteijn et al., 2007; Jennett et al., 2008; Nacke & Lindley, 2008); however, there is no agreement on how to describe the phenomena of game experience. For example, Sweetser and Wyeth (2005) proposed a model, named GameFlow, to evaluate and understand game experience; Agarwal and Karahana (2000) defined cognitive absorption as a state of

involvement to describe using software. In the current research, we use the term 'immersion'. In 2008, Jennett et al. used '**immersion**' to integrate related literature. Immersion is defined as a total experience where the player fully concentrates on the game (Brown & Cairns, 2004; Jennett et al., 2008). Furthermore, Jennett et al. (2008) proposed a questionnaire, the Immersive Experience Questionnaire (IEQ), to measure the immersion experience.

This thesis aims to answer two research questions:

1. Is there a relationship between personality and immersion experience?
2. Is a relationship between personality and immersion in narrative games?

Two studies were conducted to answer our questions. In Study 1, we investigated the relation between personality and game experience. This study was replicated from Weibel et al. (2010) but with some key differences, which are discussed in Chapter 2. We adapted the definition of immersion from Brown and Cairns (2004) and Jennett et al. (2008) to describe the game experience and the IEQ was used as an instrument to measure the level of immersion in our study. In addition, we adapted the Five-Factor model to define personality and used the NEO Five-Factor Inventory (NEO FF-I) (McCrae & Costa, 2004) to measure one's personality traits.

In Study 2, we aimed to understand the relation between personality traits and narrative in games within the scope of immersion experience. In the work of

Weibel et al. (2010), they suggested that a user with a high-score on openness, which is one of the personality traits from the Five-Factor model, prefers narrative games. This offered us a standpoint to focus our study on one personality. As their work lacked empirical testing, we designed a lab study to examine the relationship between the personality trait of openness and narrative game.

This report is divided into 6 chapters:

- Chapter 1 introduces the questions we are interested in and our motivation.
- Chapter 2 discusses the literature related to this study; it also explained the reason of our chosen constructs, including game experience, narrative in games and personality, as well as the chosen measures of game immersion (IEQ) and personality traits (NEO-FFI).
- Chapter 3 and 4 describe two studies we conducted to investigate the hypotheses, including methods, results and discussions.
- Chapter 5 provides a general discussion on our findings and its implications and limitations. Also, it gives recommendations for future work.
- The last chapter, chapter 6, summarises the key ideas in our research.

2. LITERATURE REVIEW

In this chapter we will review relevant literature in game immersion, personality and narrative in games. First, the concept of immersion is introduced as well as several related concepts. Secondly, we discuss several models of personality. Thirdly, we will discuss literature that has investigated personality and games. Fourthly, concepts of narrative are introduced, drawing on communication literature as well as game literature. In the last part, our research questions are stated and explained.

2.1 Immersion

Although immersion is a common word widely used to describe the level of involvement or engagement one experiences during game play (IJsselstein et al., 2007; Ermi & Mäyrä, 2005), researchers have yet to establish consensus regarding the definition of game immersion. In the following chapter, we introduce several concepts that are widely discussed in game research as well as questionnaire methods used to measure immersion level.

2.1.1 Concept of game immersion

Immersion is considered as a psychological experience (Jennett et al., 2008; Wild, 1995; Witmer & Singer, 1998), especially a cognitive phenomenon (Jennett et al., 2008; Brown & Cairns, 2004); yet, some argue that immersion could be divided into two categories: perceptual and psychological (Grimshaw et al., 2008; Lombard & Ditton, 1997; McMahan, 2003). **Perceptual**

immersion refers to the physical sense such as hearing and sight, which are monopolised by the experience that game provides. **Psychological**

immersion refers to the mental absorption that payers experience in games.

Jennett et al. (2008) suggested that when payers gradually get immersed in a game, their ability to re-engage with the real world is decreased. In an immersive game, payers' attention becomes mainly focused on the stimuli related to game; thus, their eye movement decreases. They also considered that emotional involvement is a crucial factor in immersion, which coheres with Brown and Cairns (2004). It was also suggested that immersion is an individual experience (Ermi & Mäyrä, 2005; Jennett et al., 2008; Witmer & Singer, 1998) as two can argue that their game experiences are different when they play the same game.

In the qualitative work of Brown and Cairns (2004), game immersion is viewed as a gradual process throughout game play. They conducted an interview with 7 people and asked them about issues of immersion such as their experience of time whilst playing. Using a qualitative approach known as 'Grounded Theory' to analyse the qualitative data they collected, they suggested that there are three levels of immersion: engagement, engrossment and total immersion.

1. **Engagement** is the first level of immersion. In this level, individual game preference and usability of game controls are the barriers that the player needs to overcome. Moreover, it requires payers to invest their

time, effort and attention to play the game; the more they invest, the more they experience immersion.

2. The next level is **engrossment**. As payers have already invested their time and attention, it implies that payers are actively willing to play the game. At this point, players are emotionally invested in the game play. Payers are decreasingly aware of the surrounding and less self-aware. The interview conducted in Brown and Cairns' study revealed some clues: Zen-like state, where your mind carries on with the game play without realising using the control. The barrier to this level is game construction itself, such as whether the character is believable, the graphic is acceptable and the flow of game is understandable. That is, if the game does not construct well, payers are more likely to notice the flaw and to be blocked from the game itself.

3. The final level is **total immersion**, which is described as 'presence' in their study. The barriers to presence are whether payers can project their emotion to the character in game and whether the atmosphere that constructed by game is able to cut off the connection between player and real world. Thus, total immersion is an experience that payers feel connected to the game world instead of the real world emotionally and physically.

Ermi and Mäyrä (2005) criticised Brown and Cairns' grounded theory,

suggesting that it did not explain the qualitative difference between the three different levels. They argued that there is an apparent difference in terms of individual preference in different game genres, where Brown and Cairns failed to adequately respond.

Ermi and Mäyrä (2005) approached immersion by creating a model: the game play experience model (SCI-model). As they argued that game immersion is a multidimensional phenomenon, the SCI-model is proposed to emphasize and to comprehend the complex dynamics between game and player. The SCI-model is a heuristic game play experience model, concluding from observations among game, children (player) and their non-player parents. Three key dimensions in immersion are identified from SCI-model: sensory immersion, challenge-based immersion and imaginative immersion. **Sensory immersion** refers to the multi-sensory stimuli that games provide, such as audio and visual. With the evolution of technology in game design, players experience a comprehensive perceptual experience (IJsselsteijn et al., 2007). As reaching and maintaining the state of immersion, or flow (Csikszentmihalyi, 1992), requires the balance between challenges and skills, **challenge-based immersion** involves cognitive and motor aspects to achieve the balance (IJsselsteijn et al., 2007). **Imaginative immersion** refers to the imaginary characters and fantasy world that exist in games, which is the narrative component of games. Although certain games, such as Tetris, contain less sensory impact or narrative component, Ermi and Mäyrä (2005) argued that these factors can contribute not only one dimension but three dimensions at the same time. That is, the three dimensions are actually mixed and

overlapped. In addition, they also derived a SCI questionnaire from the SCI-model.

It is evident that Brown and Cairns (2004) considered the gradation of immersion and tried to understand how a player moves up the scale to become more immersed in a game. Ermi and Mäyrä (2005) took another approach. They broke immersion into its separate components and argued that different games have different features that get players immersed. In our study, we take the approach of Brown and Cairns as we think that immersion is an experience across game play. Even when playing different games, the immersion experience itself should be consistent but only have the difference on the level of immersion.

Jennett et al. (2008) agreed with the finding of Brown and Cairns. They further pointed out that most game experiences are between level 1 and level 2; level 3 is a very rare experience. Jennett et al. (2008) considered past research on related concepts of immersion and produced a more comprehensive definition. They argued that immersion is distinctively different from other concepts of immersion, such as cognitive absorption, flow and presence. In their definition of immersion, they state that its features include being less time-aware, being less aware of the real-world, and the sense of being involved in the task environment. Drawing on this definition, they conducted three experiments to develop and test a questionnaire measuring the level of immersion, named the **Immersive Experience Questionnaire (IEQ)**. In the first experiment, they designed a lab study to test whether the level of immersion affects task

performance after the game play. They conducted the second experiment to test whether participants were engaged in the game by recording their eye movement and participants' self-reported rating. They refined their questionnaire by conducting the third experiment to find out if speed is another variable that affects game experience.

As a result of a factor analytic study, Jennett et al. (2008) broke up immersion experience into five factors: cognitive involvement, real world dissociation, emotional involvement, challenge and control. **Cognitive involvement** describes the level of subjective perceived usefulness and engagement to the game. **Real world dissociation** indicates the extent to which payers feel disconnected with the real world. **Emotional involvement** is related to the emotional attachment to the game; it includes questions such as 'to what extent were you interested in seeing how the game's events would progress' and 'at any point did you find yourself becoming so involved that you wanted to speak to the game directly'. **Challenge** refers to perceived subjective difficulty level and **control** indicates payers' perceived dominance in game play. These five factors are a mix of three person factors (cognitive involvement, real world dissociation and emotional involvement) and two game factors (challenge and control), which incorporate both payers and game.

The IEQ offers not only a total immersion score but also five immersion factors scores. Thus, using the IEQ gave us a further opportunity to examine five factors of the immersion experience, which we believe is valuable for our study.

2.1.2 Related concepts

There are several concepts similar to Brown and Cairns (2004) and Jennett et al.'s (2008) concept of immersion, investigated by a number of other researchers (Csikszentmihalyi, 1990; Agarwal & Karahanna, 2000; Slater, Usoh and Steed, 1994). These related concepts are described and compared in this section.

Flow

Csikszentmihalyi (1992) used **flow** as the term to describe the state of optimal experience after he conducted several interviews in 1975. He suggested eight components in flow: clear goals, high degree of concentration, loss of feeling of self-consciousness, distorted sense of time, direct and immediate feedback, balance between ability level and challenge, sense of personal control and intrinsic reward (Csikszentmihalyi, 1990). Flow happens when the balance between the perceived level of challenge and the skill payers perform is reached (Ermi & Mäyrä, 2005). To maintain the experience of flow, payers need to find the adequate level of challenge, which can differ from person to person. This suggests that individual differences in perceiving the level challenge should be taken into consideration.

Csikszentmihalyi's (1990) description clearly shows that there is overlap between flow and immersion as they both recognise that when absorbed in an activity, a person is less aware of his or her surrounding and tends to neglect daily affairs (Brown & Cairns, 2004; Jennett et al., 2008). Although these two

concepts are similar in the sense of distorting time and providing challenge, it was argued that there are fundamental differences between them (Brown & Cairns, 2004; Jennett et al., 2008). Jennett et al. (2008) argued that flow implies an extreme experience as it is optimal, whereas immersion is not. One can have a frustrating game experience due to their inability to overcome the obstacle set in game but still being immersed in it; it is not necessarily less immersive (Seah & Cairns, 2008).

Cognitive absorption

Agarwal and Karahanna (2000) proposed the concept of **cognitive absorption** (CA), defined as 'a state of deep involvement with software'. They reviewed previous research and exhibited CA through five dimensions: temporal dissociation, focused immersion, heightened enjoyment, control and curiosity. Based on their survey study, Agarwal and Karahanna (2000) concluded that CA captures the totality of an individual's experience with new software. They further suggested that as absorption is the individual's propensity to enter a psychological state, it is likely to be the indicator of the state of CA.

Although Agarwal and Karahanna (2000) describe the relationship between CA and behavioural intention, it is limited by its central focus on information technology. Jennett et al. (2008) argued that game immersion is an actual experience from payers rather than just an attitude toward technology use.

Presence

Presence is defined as a subjectively psychological sense of being in the virtual environment (VE) (Slater et al., 1994; Witmer & Singer, 1998). Although immersion and presence are considered interchangeable (McMahan, 2003), it was argued that immersion is the component leading participants to experience presence (Slater et al., 1994; Witmer & Singer, 1998). Some even argued that involvement is also necessary (Witmer and Singer, 1998). Lombard and Ditton (1997) reviewed past relevant literature and concluded six conceptualisations of presence: presence as social richness, as realism, as transportation, as immersion, as medium and as social actor. They further argued that presence cannot occur unless using a medium, such as television or video game.

As the concept of presence is widely used in the discussion of VE, Witmer and Singer (1998) developed a questionnaire in order to measure presence, called the **Presence Questionnaire (PQ)**. They grouped four factors from previous literature to define presence: Control factors, Sensory factors, Distraction factors and Realism factors. At the same time, they created an **Immersion Tendency Questionnaire (ITQ)** to measure the tendency of individual being immersed in VE. The PQ is used to measure the degree of individuals' presence experience in VE; nevertheless, Slater (1999) criticised that none of the questions in the PQ are directly about presence. He claimed that the PQ conducted by Witmer and Singer fails to measure presence.

Since presence emphasises the importance of feeling being in the virtual environment, Jennett et al. (2008) distinguished the difference between

immersion and presence. They argued that immersion is an experience in time as one has a gradual experience from being less immersed to feeling more immersed. In addition, they illustrated that even though Tetris has no vivid graphics to make players experience presence, players can still be immersed. Thus, they suggested presence is only a small part of game immersion. In addition, we argued that playing games is quite a different experience from interacting with a VE in terms of motivation. While playing games, players aim to achieve certain goals, e.g. defeating enemies, solve puzzles or collecting points; whereas interacting with a VE does not necessarily have such an element. That is, players may experience presence without being immersed whilst interacting with a VE (Jennett et al., 2008).

In sum, we adopted the definition of game immersion from Brown and Cairns (2004) as well as Jennett et al. (2008) in our study as they considered other related immersion studies and integrated them into a more comprehensive concept. In addition to the definition, we also used the IEQ designed by Jennett et al. (2008) to measure the immersion level in our study. Not only is it connected with the definition we adopted, but its sub-components can provide us with a better opportunity to examine immersion. The potential limitation of using the IEQ is that it can only measure the level of immersion that players experience at that moment in time; there is a potential concern to generalise the result beyond this single experience.

2.2 Personality

Personality is referred to as 'the unique psychological qualities of an individual that influence a variety of characteristic behaviour patterns, both overt and covert, across different situations and over time' (Gerrig & Zimbardo, 2009). It is an important research topic in Psychology; several theories have arisen from the study of personality, such as psychodynamic theory, phenomenological theory, trait theory and social-cognitive theory (Pervin, Cervone & John, 2004). In our study, we used **trait theory** to approach personality as traits may be used to summarise, predict and to explain one's conduct (Pervin et al., 2004). Thus, trait theory provides an efficient approach to compare how one person is different from another. In this section, we outline three commonly used approaches built upon trait theory: the three-factor theory, the 16 personality factors and the five factor model.

The **three-factor theory** is proposed by Hans Eysenck in the late 1970's. He used factor-analytic methods to find out the basic traits. The three identified dimensions of personality are introversion – extraversion, neuroticism and psychoticism. In Eysenck's theoretical systems, everyone has a greater or lesser amount in three dimensions, i.e. the three dimensions are uncorrelated with each other. A person who is higher on extraversion is described as active and optimistic. The description of a person who is higher on neuroticism is anxious, shy and emotional. One who has a greater amount of psychoticism tends to be solitary, insensitive and opposed to accept normal social customs.

The **16 personality factors** were derived by Raymond Cattell. He analysed the data he collected, including the life record data and questionnaire data, and devised a well-known questionnaire – the **sixteen Personality Questionnaire** (16 P.F.). The 16 personality factors include reserved - outgoing, undisciplined - controlled and trusting - suspicious (see Appendix A), which cover a wide variety of aspects of personality (Pervin et al., 2004).

The **Five-Factor Model**, known as the **Big Five**, is an emerging consensus among trait theorists suggesting five basic factors to human personality. The five factors result from the factor analysis on participants' self-reported rating of their personality traits, which are (Costa & McCrae, 1992):

- **Neuroticism** (N) is the tendency of emotional instability. Individuals are likely to experience psychological distress, negative emotions and over reacting toward stress when scoring high.
- **Extraversion** (E) assesses one's quantity and intensity of interpersonal interaction and capacity of joy. The typical characteristic scoring high on E is sociable, optimistic and affectionate.
- **Openness** (O) is characterised as seeking and exploring the unfamiliar, being curious and appreciating art and adventure. One with high scores on O has broader interests, is creative and imaginative, compared to those with low scores.

- **Agreeableness (A)** assesses the quality of one's interpersonal orientation along a continuum from compassion to antagonism in thoughts, feelings and actions. The characteristics of those with high scores are considerate, friendly and helpful.
- **Conscientiousness (C)** is a tendency of individual organisation, persistence and motivation in goal-directed behaviour. People with high scores on C are considered more reliable, self-disciplined and preserving, in contrast to low scorers.

The **Revised NEO-Personality Inventory (NEO PI-R)** is the standard instrument to measure the Big Five (Egan, Deary & Austin, 2000). The NEO PI-R comprises 240 statements, which are answered by self-reported five-point Likert scales. In addition, it measures six subordinate dimensions of each factor. For example, 'Anger', 'Depression' and 'Impulsiveness' are the three of sub-elements that contribute to the factor of N (Egan et al., 2000).

Despite the Big Five and the NEO PI-R being widely accepted in research (Bono & Judge, 2004; Lee, Johnston & Dougherty, 2000; Malouff et al, 2007), there are still criticisms. One argument is that the Big Five lacks explanation of how personality is organised. It only indicates the compositions of personality, regardless of how these factors are organised and how these factors are influenced by personal experience and behaviour (Pervin et al., 2004). That is, from the point of view of the Big Five or trait theory, a person seems like just a bundle of traits. Another criticism is the nature of rating response of the NEO

PI-R (McAdams, 1992). As the NEO PI-R is a self-rating questionnaire, McAdams (1992) argued that one's rating may be affected by comparing it with other people to get a sense of parameter.

To be more practical for research and for clinical contexts (Hyer et al., 1994; Podolska et al, 2010; Schmidt, Hooten & Carlson, 2010), a shortened version was also created, known as the **NEO Five-Factor Inventory** (NEO-FFI) (McCrae & Costa, 2004). The 60-item NEO-FFI consists of a selected 12 items from the pool of 180 NEO Personality Inventory (NEO-PI) for each factor. Similar to the NEO PI-R, it uses a five-point Likert response format (McCrae & Costa, 2004). While the internal reliability and validity of the NEO-FFI were demonstrated well by using principal components analysis and confirmatory factor analysis, it was argued that the N, A and C are more reliable than O and E (Egan, Deary & Austin, 2000). Egan et al. (2000) conducted a factor analysis of the NEO-FFI in a British sample and suggested that NEO-FFI should be revised, especially on O and E. McCrae and Costa (2004) then reviewed the weaker items and had two large scaled samples (N=1959; N=1492) to select new items. As a result, the revised items in five factors showed absolute discriminant validity (McCrae & Costa, 2004).

Despite the criticisms on the Big Five, in terms of practicality, the Big Five indeed provides a quick and clear route to understand one's personality traits, which is enough for our study. Compared to the 240-item version, the length of the NEO-FFI was deemed to be more acceptable for our purposes, as it would require less participant effort. Therefore, we used the NEO-FFI as a tool to

measure the personality traits not only due to its use in game studies (Phillips, Butt & Blaszczynski, 2006; Zammito, 2010) but also its characteristics of high reliability (Lang et al. 2011).

2.3 Personality and immersion

Previous research related to personality and games mostly focused on the relation between violent video games and aggressive behaviours (Fang & Zhao, 2010), yet some studies began to explore the connection between personality traits and game immersion (Weibel et al., 2010; Johnson & Gardner, 2010) because the results may help game designers to understand whether personality affects payers' preference.

Finn (1997) investigated the relationship between personality traits and **mass media use**. Based on previous research, he suggested that neuroticism, extraversion and openness in the Big Five traits were more related to media use, whereas agreeableness and conscientiousness are less related. He then proposed 7 hypotheses to examine whether personality traits could be predictors of media use. A study was conducted where 219 participants filled in the NEO-Personality Inventory and were asked to maintain diaries of their daily activities. These activities were then selected and classified into mass media use and non-mediated communication activities. This study arrayed four types of media use: television, radio, reading for pleasure and films. Finn (1997) found that higher levels of openness correlated with less television watching,

more pleasure reading and film attendance. On the other hand, lower levels of extraversion correlated with more television watching and pleasure reading, but there was no relation to film attendance. Furthermore, neuroticism failed to show any connection with media use. A limitation of this study is that it was based on the assumption of individual's media choice revealing their personal preference; however, making a media choice may be influenced by other factors, such as peer, ethnicity and culture. As Finn mentioned in the end of his work, media choice may be more than just personality-based preferences. A person who scores high on extraversion or agreeableness may choose the media that can satisfy their interpersonal need rather than mediated sources of gratification.

Weibel et al. (2010) released an online survey to relate the Big Five with a trait known as 'immersive tendency'. **Immersive tendency** is proposed by Witmer and Singer (1998), which is a disposition of individual's capability or tendency to be involved or immersed in mediated environment. The **Immersive Tendency Questionnaire** (ITQ) was developed to measure such disposition. There are three sub-dimensions in the ITQ: Involvement, Focus and Games. Involvement items ask about an individual's propensity to get involved passively in games, such as watching films and reading novels. Focus items relate to the cognitive ability of being able to concentrate and blocking out distractions. Games items relate to the frequency of video game play and whether they are immersed in the game. In this survey, 220 participants answered the NEO Personality Inventory (NEO FF-I) to measure their

personality traits as well as the ITQ to determine their capability of being immersed.

With the quantitative data they collected, Weibel et al. (2010) computed factor analysis to examine the dimensionality of immersive tendency as they argued that the sub-dimensions proposed by Witmer and Singer have not yet been examined empirically. Two factors were classified. The first factor is **emotional involvement**, which is about the emotional reactions during media usage. The second factor is **absorption**, referring to focused attention, losing track of time perception and involvement in games. They then investigated how the Big Five personality traits related to immersive tendency with structural equation modelling. In the structural equation modelling, they include the immersive tendency as a latent variable, which is estimated by endogenous variables, emotional involvement and absorption. They suggest that openness, neuroticism and extraversion are positively related to immersive tendency as these paths are highly significant. Furthermore, they argue that when participants score high on neuroticism and/or on extraversion and openness, they are more likely to be immersed in media use.

A limitation of Weibel et al. (2010) was that they performed structural equation modelling in their data analysis, but lacked theoretical reasoning. Structural equation modelling requires a prior model and they failed to explain it in their paper. We suggested that instead of using structural equation modelling, the approach mentioned by Kline (1998) is more appropriate. In this approach, two questionnaires are put together to be examined whether there are co-loaded

on the same factors, which indicated how the two concepts defined in the questionnaires relate.

In addition to their analytic method, the use of the ITQ is another limitation. As the ITQ is to measure one's disposition to be immersed in games, one can argue that actually being immersed in games is quite different. If a person scores low in the ITQ, it does not indicate that he/she cannot be immersed in games.

Another criticism is that in Weibel et al. (2010)'s study, neuroticism has the strongest influence, whereas, in Finn's (1997) finding, he suggested there is no relation between neuroticism and media use. The inconsistency of the two studies may imply that the tendency of being immersed in media does not indicate the preference of media use as mentioned in Finn's work.

As Finn (1997) suggested, film watching and pleasure reading provides the chance to imagine and the richness of a mediated experience; in comparison, television watching is conventional entertainment with less support for imagination. Weibel et al. (2010) further applied Finn's conclusion, i.e. openness has a negative relation with television watching, to games studies. They found that people who score high on the dimension of absorption in the immersive tendency are more likely to focus on television programs, books and video games and openness is the only personality trait that determined absorption, according to their result. Combining their finding with Finn's, they inferred that people who score high on openness are more likely to be

immersed in high cognitive demanding games, compared to physically challenging games. Thus, in our study, we suggest that payers who have high score on openness would prefer games with stronger narrative as it is more cognitively demanding, like films and reading.

2.4 Narrative

With the development of video games, the element of narrative and story inevitably becomes one of the attractions for payers. Such attraction is built upon not only the background provided but payers also find meaning in performing actions in games. Although some genres of games contain a certain level of narrative, such as the information about the era and characters in the game story, they do not provide enough richness to motivate payers to believe the story narrated in games. In other words, it makes no difference whether such narrative exists or not. The motivation for payers playing such games does not increase because of the existence of narrative. To investigate the role of narrative, many game studies derived a narrative method from traditional media, such as literature and films.

Although the narrative aspect of games shares some similarity with traditional media, e.g. literature and films, differences and conflicts exist between these two media (Juul, 1999; Juul, 2001; Qin, Patrick Rau & Salvendy, 2009; Lindley, 2002; Bizzocchi, 2007). Juul (1999) suggested that there is a conflict between game and narrative. Part of the incentive for readers of narrative is the desire

of know the ending. However, he argued, the ending of an action-based game is known from the beginning of game play, i.e. defeat the enemy. It is the interactivity experienced during the course of game play that attracts them. Furthermore, it was argued that games do not necessarily involve narrative (Juul, 1999; Bizzocchi, 2007), such as Tetris. Tetris, which has high cognitive demand, has no narrative element. Payers simply must figure out how to fit the blocks in with each other. Thus, it is all about the interactivity between payer and the puzzles created in Tetris.

However, we argued that in the action-based games, narrative is not the incentive that attracts payers. The problem of such action-based game is that the role of narrative is not strong enough to change payers' motivation, either increase or decrease. Koster (2004) pointed to a creative but deeply disturbing Tetris variant, i.e. replacing coloured blocks with human being in different positions piling up. This Tetris variant added a narrative element. Even though the mechanism remains the same, the changed context changes one's attitude toward the game play as it is strong enough, i.e. the changed component makes payers feel extremely uncomfortable, even disgust. It may not change one's attitude in such a significant way if colour blocks are replaced with fruits and vegetables.

In addition to Juul's work (1999), other research mentioned the same idea of interactivity in games (Qin et al., 2009; Murray, 2006; Ermi & Mäyrä, 2005). Qin et al. (2009) believed that the narrative features of traditional media and games conflicted with each other. Linear and fixed structure was assumed to

be the characteristic of narrative, which conflicted with the idea of interactivity. Murray (2006) argued that storytelling and gaming have always been overlapping experiences. She argued, however, it is interactivity in game that provides the player with a new medium to experience beyond storytelling and gaming. She further suggested it is neither storytelling nor gaming; she proposed a term '**cyberdrama**' to describe such genre. The best example is the Role-Play games (RPG) genre, which provides the payer with high freedom to build their world and interact with the characters in game. In RPG, the narrative is not pre-written by the developers; the interactivity in the game is the narrative. By comparison, game genre without characteristics of cyberdrama is fixed, following the story pre-written by designers. One can argue that the game experience in non-cyberdrama type genre is somehow similar to the plots: the story and the interaction with characters in game is the same. In cyberdrama type of games, such as RPG, payers have freedom to build the world and interact with the characters; moreover, the decisions they made in games have fundamental influence on what they will experience next. In other words, the game experiences of different payers playing the same game could be different as they may make different decisions in game. Therefore, Cyberdrama suggested that the experiences of a player in game play is an interactive narrative (Qin et al., 2009; Lindley, 2002), which is the missing element in traditional media.

Divéky and Bieliková (2009) used the term '**interactive storytelling**' to describe the narrative feature in games. They argued that in traditional media, the storyteller communicates the information with the audience by telling the

story, whereas in interactive storytelling, the computer transforms the information into a story world. Audience interacts with the story world to gain the information from designers. The concept of interactive storytelling is similar to Murray's 'cyberdrama' in a way that they both suggested that payers perceive the narrative in games through interacting with the game.

As mentioned, some games clearly had no narrative such as Tetris and some were considered to be dependent on narrative. For instance, narrative is a crucial element throughout the experience of game play in the game genres including First-Person Shooter (FPS) games, Role-Play games (RPG) and adventure games (Mallon & Webb, 2005; Qin, Patrick Rau & Salvendy, 2009).

Murray (2006) and Perlin (2006) argued that narrative in traditional media and games are intended to serve different purposes. In traditional media, storytelling has great emphasis on plot and aims to bring readers to experience the emotional fluctuation along with the plot. Yet, in games, it puts a great emphasis on the action of players and provides the player with the succession of overcoming challenges. Perlin (2006) argued that traditional media and games have different forms of narrative. He further questioned whether there is a form between a game and a story. He argued that a story in traditional media is so strong that readers immerse themselves even after the end of story; the emotional immersion and involvement aspect attract them to the story (Ermi & Mäyrä, 2005). By comparison, in some game genres such as action adventure, it is rare to see such phenomena after game play.

Bryan (2006) responded to Murray's argument of cyberdrama with their work, **interactive drama**. Murray and his colleague first introduced the idea of interactive drama in their project called the OZ project. Interactive drama is a form of narrative that combines the high interactivity and immersion of many computer games and the linear story feature of traditional media. That is, payers are given the experience of witnessing the evolution of the events; at the same time, they have the chance to react to the situation as the story unfolds. It is about the balance between storytelling, i.e. plots in games, and the interactivity, i.e. the freedom to control the story. Compared to Murray's (2006) cyberdrama, interactive drama emphasises the balance between storytelling and interactivity, where cyberdrama only puts stress on interactivity.

Although the definition of Bryan's (2006) 'interactive drama' has technical difficulty to reach a perfect balance, we argued that the trend of current game design has somehow achieved such definition. For instance, in adventure games, it was provided by a great storyline with sufficient freedom for payers to explore the story world; the story and the interactivity are intertwined.

To investigate how narrative components affect payers immersion in story world in game, Qin et al. (2009) conducted two surveys (N=309; N=325) to design and evaluate the questionnaire they proposed, the **Immersion Narrative Questionnaire (INQ)**, to measure payer's immersion in narrative game. They used factor analyses to analysis the quantitative data the collected and finalised the INQ with 27 items. In addition, they concluded 7 dimensions

from the analysis results: curiosity, concentration, challenge and skills, control, comprehension, empathy and familiarity. **Curiosity** refers to the attraction to payers to explore the game. **Concentration** is the ability to concentrate on the game narrative. **Challenge and skills** correspond to the difficulty in game and payer's related skill. **Control** is the perceived ability from payers to control the game narrative. **Comprehensive** is payers' understanding of the structure and storyline in the game. **Empathy** refers to the state of mentally entering into the imaginary game world during game play. **Familiarity** is about whether payers are familiar with the game story.

In this study, we adapted the definition of interactive drama from Bryan (2006) as the concept of narrative in games. The interactivity is essential for games as it distinguishes games from traditional media such as films and novels. Story is a critical component in narrative as it creates the story world for payers, using plots. One can argue that the interactive dialogues can convey the story; however, we argued that the story cannot be communicated as complete as plots. Thus, we agreed with Bryan that there is a balance between interactivity and storytelling in narrative games; the story is provided by plots and is unfolded along with payers' interactivity with game. With such definition, we suggested that RPG is not one of the narrative games as it lacks plots to provide a story, i.e. the story world is mainly constructed by payers. Although most of current games e.g. adventure and action games have different level of storytelling, we argued that an effective storytelling should be able to affect one's emotion and to provide the meaning for payers to take actions, which is the distinction between narrative games and non-/less-narrative games. It

implies that such games are more task-based and have less coherence between chapters because of the weakness of the story.

In addition, we used the INQ from Qin et al. (2009) to test the narrative component in the game we chose. Although the definition Qin et al. gave is different from the one we adapted from Bryan (2006) in terms of story component, we believed that the INQ provided us a chance to understand the narrative components as well as to compare games we chose in terms of narrative.

2.5 Research questions

Drawing on past literature, it was found that there are links between personality traits and media use; however, as of yet, there has been little research exploring links between personality and game. Thus, Study 1 aims to bridge this gap by empirically investigating whether personality traits have an influence on one's immersion in games. As it is popular as well as practical, we used the Big Five model and the NEO FF-I to define and measure personality traits in our study. We also adapted the definition of immersion from Brown and Cairns (2004) as well as Jennett et al. (2008) since it provides us with a comprehensive idea in terms of game immersion. At the same time, to make sure that we properly measure one's immersion experience instead of just disposition, we used the IEQ instead of the ITQ.

Study 1 builds upon Weibel et al. (2010) as it provides a standpoint of investigating the relation between personality and game. They examined the relation between personality traits and Immersive Tendency by carrying out a large-scale survey study (N=220). However, we suggest two problems with their approach. Firstly, they used structural equation modelling to relate five personality traits with Immersive Tendency. But, the use of structural equation modelling requires a prior model and they failed to justify why they did not have this model. Secondly, in spite of having the high scores in Immersive Tendency, it does not necessarily mean that one will have immersive experience when playing a game. There is a missing link that explains what stimulus provokes the state of immersive experience. For example, one can score low on Immersive Tendency but still be immersed in a game.

Overall, two questions have arisen and we conducted two studies to tackle them.

Question 1: Is there correlation between the Big Five personality traits and the Immersion Experience?

Study 1 is a large-scale survey study, conducted to answer question 1. It replicates the survey study from Weibel et al. (2010) but with some key differences. As mentioned, Weibel et al.'s approach failed to suggest the prior model for the use of structural equation modelling. Instead, we adopt an approach from Kline (1998) to examine the correlation between two questionnaires, i.e. the NEO FF-I and the IEQ, using factor analysis to co-load

the same factors from the items in two questionnaires. This approach helps us to identify how the two concepts defined in the questionnaires relate, which is important because it can suggest that whether personality is related to immersion.

Another difference is that we measured Immersive Experience (using the IEQ) instead of Immersive Tendency in our study. That is, we aim to measure the actual game experience, rather than the disposition of being immersed.

Although one can argue that immersive experience can be different from time to time, we assume that if personality has a strong effect on game immersion, we could still expect to see a relationship between personality traits and game immersion.

Question 2: Is openness a link between personality and immersion in narrative game?

Our hypothesis is:

H1: When playing a narrative game, openness will be significantly correlated with IEQ scores, where the same will not be found for a non-narrative game.

Study 2 is a lab study and builds upon Study 1 because it investigates how personality traits (specifically openness) relate to the stimulus that provokes the state of immersive experience. Drawing on their own work and Finn's

(1997), Weibel et al. (2010) suggest the personality trait of openness relates to immersion experience in narrative games. Since there are problems with their approach, as mentioned above, we conducted an experiment to test whether openness is the link. We designed a study where people would play both a narrative game and a non-narrative game. We adapted the definition of narrative from Bryan (2006), which emphasises the balance between the storytelling as well as the interactivity in games. It was hypothesised that when playing a narrative game, openness will be significantly correlated with IEQ score (Jennett et al., 2008), whereas the same correlation would not be found a non-narrative game.

3. STUDY 1

The aim of this study was to replicate Weibel et al. (2010)'s the large-scale survey study (N=220), investigating the relation between personality traits and immersion experience, but overcoming several drawbacks of their study. An advantage of using an online survey is that it provides an opportunity of recruiting a large number of participants, which minimises the variable sampling error in the estimates and increases the predictive validity. At the same time, the use of survey also increases the reliability. As participants were presented with a set of standardised questionnaire as well as information, the subjectivity from observer is greatly decreased.

The personality traits were measured by the NEO FF-I (Costa & McCrae, 1992) and levels of immersion were measured by the IEQ (Jennett et al., 2008). Since the use of the IEQ requires an actual game experience, we included a section 'think about a recent game experience' in our survey to guide participants recall. One can argue that participants may not properly recall a recent game experience and the IEQ does not allow investigator to gauge the immersion experience in a dynamic way as the questions are fixed. However, using the IEQ provided not only gives us the quantitative data (needed for statistical tests) but also allows us to efficiently and massively collect data.

The Pearson correlation was used to test whether the data we collected - the NEO FF-I scores and the immersion scores - relate with each other. The factor analysis was used as well. As mentioned before, one of the drawbacks of Weibel et al.'s work was failing to justify using sequence equation modelling.

We suggested using the factor analysis, i.e. an approach more like Kline (1998), to examine whether the factors from two questionnaires co-load onto the same factors. All the statistical analyses were performed using SPSS 17.0.

3.1 Method

Participants

A total of 630 participants were recruited from the pool of UCL email address and personal acquaintances. 413 participants were male (65%) and 218 were female (35%). Their ages ranged from 18 to 61. The mean age was 23.91 (SD=5.33). 94% of the participants were UCL students, 3% were non-UCL students and 3% were non-students. In terms of past game experience, 72% have played games over ten years; 24% had experience playing games for more than one year. Only 4% had less than one year's experience. More than half of the participants (55%) played games less than three times a week and the rest (45%) played more than three times a week. As for the length of each game play, the percentage of more than half an hour was 85.5; less than 30 minutes was 14.5. Participants were also provided with an incentive of a raffle prize draw, which was a £20 Amazon gift voucher.

Materials

An online survey was created using Limesurvey. The survey had three main components: (1) personality, (2) past gaming experience, and (3) recent gaming experience.

1. *Personality*. To measure the personality traits of the participants, the NEO Five-Factor Inventory (NEO FF-I) (Costa & McCrae, 1992) was used. Based on the five-factor model in Psychology, it contained five personality dimensions: neuroticism (N), extraversion (E), openness to experience (O), agreeableness (A) and conscientiousness (C). It was a shortened version of the Revised NEO Personality Inventory (NEO PI-R) (Costa & McCrae, 1992). The NEO PI-R had 240 items and the NEO-FFI was cut-downed to 60 items. The items were answered on 5-point Likert scale (see Appendix B).

2. *Past Gaming Experience*. To understand the game hobbies of participants, such as what game genre they usually play and how often they play games, 5 questions were created (Appendix C). Three questions were single-choice question and two were multiple choice questions.

3. *Recent Gaming Experience*. Participants were asked to reflect on a recent gaming experience – i.e. what was the game they had played? Which platform did they use to play game? When did they play it and for how long? Then they were asked questions about their level of immersion. The immersion level that the participants had experienced during the game play was measured with the Immersive Experience Questionnaire (IEQ) (Jennett et al, 2008). The IEQ was a 31-item questionnaire, answered on 5-point Likert scale (Appendix D).

Procedure

A mass email was sent to all UCL students (app. 20,000 people) as well as

personal acquaintances. The email contained a link to the online survey. Also, it has general information about the study in order to let potential participants decide whether to take part in this study.

At the beginning of the survey, the instructions and the purpose of the study were clearly explained. If they consented to take part, they were instructed to click 'next'. The survey consisted of three components: personality, past gaming experience and recent gaming experience. The survey took approximately 20-30 minutes to complete.

At the end of the survey, participants were asked to enter their email address if they would like to enter a raffle prize draw, where one participant was randomly chosen to receive an Amazon gift voucher. Participants were also asked if they were willing to take part in a follow-up study.

Pilot study

Before releasing the online survey, four participants were invited to evaluate its fluency and adjustment was made based on feedback.

3.2 Result

Scores on personality traits

Scores on personality traits were calculated for each participant on five dimensions: neuroticism (N), extraversion (E), openness to experience (O),

agreeableness (A) and conscientiousness (C). The scores are compared with the British norms (N=1025) (Egan et al., 2000) to get a sense of whether the sample was representative.

The mean scores on N was 21.83 (SD=8.86), compared with 19.5 in the British norms (SD=8.6). On E, the mean scores was 26.88 (SD=6.55), where in the British norms, the mean was 27.1 (SD=5.9). The mean scores on O was 32.25 (SD=5.62), where in British norms, it was 26.5 (SD=6.5). As it shows, the mean scores in our study is higher than one deviation in the British norms. The scores mean on A in our study was 30.53 (SD=6.11) and in the British norms it was 29.7 (SD=5.9). Lastly, the mean scores on C was 30.10 (SD=7.10), compared with 32.1 (SD=6.6) in the British norms.

In sum, the representative of the sample in study 1 is considerably high, as only one dimension (O) is slightly higher than one deviation. Especially, only 103 participants (19.5%) scored lower than the British norm on openness, whereas 80.5% scored higher than the British norm.

Correlation between personality traits and immersion

Total immersion scores were computed for each participant. In addition, scores for five immersion factors were calculated as well. Five immersion factors include cognitive involvement, real world dissociation, emotional involvement, challenge and control. These scores were used to measure the degree of relationship between the NEO FF-I and the IEQ; thus, a test of correlation was performed. The results are represented in Table 1.

Table 1

Pearson's Correlation for Personality Traits and Immersion (N=630)

	Personality traits									
	N		E		O		A		C	
	<i>R</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
IEQ score	-.027	.252	.000	.493	.083*	.019	-.137**	.000	-.063	.058
IEQ immersion factors										
Cognitive involvement	-.159**	.000	.071*	.038	.026	.260	-.067*	.045	.062	.060
Emotional involvement	-.011	.389	.004	.464	.048	.112	-.151**	.000	-.046	.123
Real world dissociation	.108**	.003	-.069*	.042	.102**	.005	-.092*	.011	-.100**	.006
Challenge	.006	.444	.016	.342	-.070*	.040	-.190**	.000	.024	.271
Control	-.020	.312	-.403**	.000	.098**	.007	-.138**	.000	-.063	.057

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

As shown in Table 1, there are 12 significant correlations.

- A significant correlation between neuroticism and cognitive involvement ($r_{(n=630)} = -.159, p = .000$)
- A significant correlation between extraversion and real world dissociation ($r_{(n=630)} = -.069, p = .042$)
- A significant correlation between extraversion and control ($r_{(n=630)} = -.403, p = .000$)
- A significant correlation between openness and challenge ($r_{(n=630)} = -.070, p = .040$)
- A significant correlation between agreeableness and IEQ score ($r_{(n=630)}$)

= -.173, $p = .000$)

- A significant correlation between agreeableness and cognitive ($r_{(n=630)} = -.067, p = .045$)
- A significant correlation between agreeableness and emotional involvement ($r_{(n=630)} = -.151, p = .000$)
- A significant correlation between agreeableness and real world dissociation ($r_{(n=630)} = -.092, p = .011$)
- A significant correlation between agreeableness and challenge ($r_{(n=630)} = -.190, p = .000$)
- A significant correlation between agreeableness and control ($r_{(n=630)} = -.138, p = .000$)
- A significant correlation between conscientiousness and real world dissociation ($r_{(n=630)} = -.100, p = .006$)

In addition to the significant negative correlations, there were four significant positive correlations.

- A significant correlation neuroticism and real world dissociation ($r_{(n=630)} = .108, p = .003$)
- A significant correlation extraversion and cognitive involvement ($r_{(n=630)} = .071, p = .038$)
- A significant correlation openness and the IEQ ($r_{(n=630)} = .083, p = .019$)
- A significant correlation openness and real world dissociation ($r_{(n=630)} = .102, p = .005$)

Factor analysis

One out-of-range data was recorded as missing data since the unusual age was identified as well as the response pattern. The final sample size was 630, which satisfied the minimum amount of data for factor analysis.

The factorability of the 60 items in NEO FF-I and the 31 items in IEQ were examined, which satisfied several important criteria for the factorability. Firstly, all of the items correlated higher than .3, which implied the suitability of factor analysis. Secondly, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was .857, above the acceptable value of .6, and Bartlett's test of sphericity was significant ($p < .05$). The on-diagonal values in Anti-image correlation matrix indicated that the inclusion of each item in factor analysis was supported as all the values are above .5. Finally, the communalities were all over .3, which further confirmed that all the items shared some common variance with others. With all these indicators, factor analysis was performed with all 91 items.

Principle component analysis was carried out because the main purpose was to decide how many factors to retain. 21 factors with an eigenvalue of greater than 1.00 were found; however, scree plot (see Figure 1) indicates that there were 11 factors as the steep slope ends at the eleventh factor. Thus, it was suggested that there were 11 co-loaded factors in two measured questionnaires. The initial eigenvalue indicated that the first factor explained 10% of the variance and the second explained 9% of the variance. The third and the fourth factor both explained 5% of the variance. The fifth factor

explained 4% of the variance. The sixth and the seventh factors both explained 3% of the variance. The rest factors, from the eighth to the eleventh, all explained 2% of the variance. The eleven extracted factors together explained 47% of the variance. In addition, no item was omitted as all the items had a KMO value greater than .5.

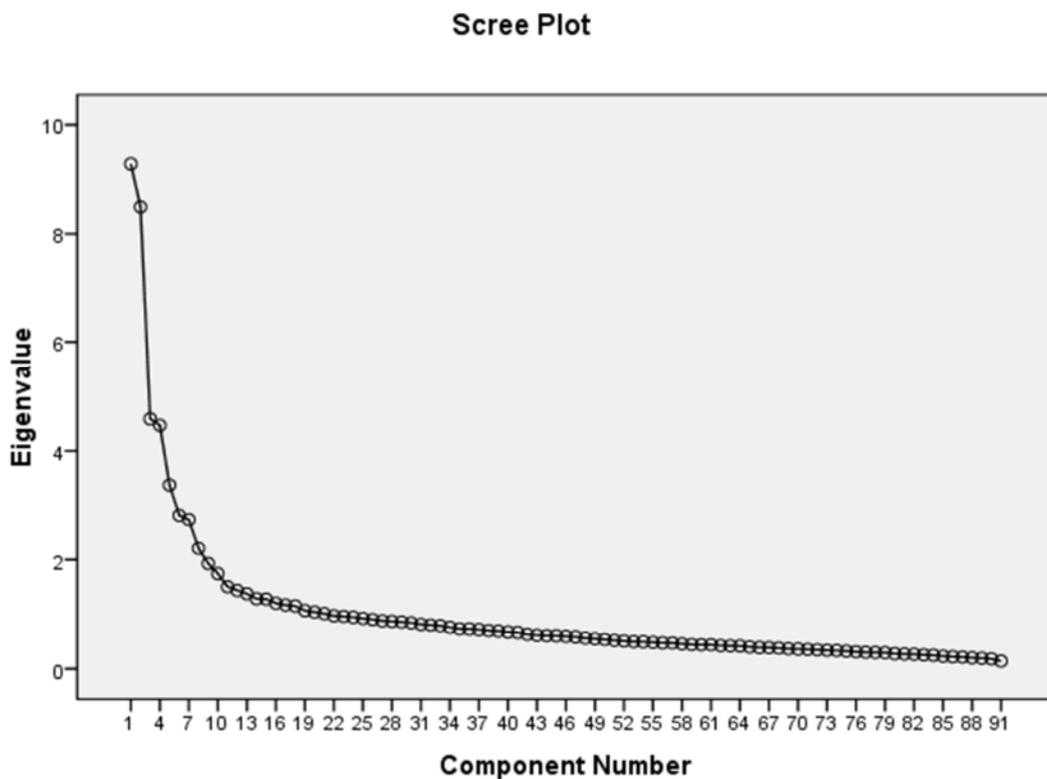


Figure 1. Scree plot for factor analysis

A primary component analysis of all the 91 items, varimax and promax rotations were conducted, with 11 factors explaining 47% of the variance. By comparison, a varimax rotation provided the most clear and the best defined factor structure. The factor loading matrix for final chosen solution is attached

as Appendix K.

The factors were named based on the items that loaded highly onto them:

1. In factor 1, the contributing items were all from the IEQ. The contributed items were mainly from the immersion factors of the IEQ, i.e. cognitive involvement and emotional involvement. Therefore, factor 1 was named '**Game Involvement**'.
2. Factor 2 was all contributed by the items of N factor from the NEO FF-I. As these items were related to negative emotion, such as 'Sometimes I feel completely worthless' and 'I am seldom sad or depressed (negative scoring)', factor 2 was named '**Negative Emotion Experience**'.
3. All the items contributed to factor 3 were from C factor of the NEO FF-I, with 11 items having factor loading higher than .5. Therefore, factor 3 was named '**Conscientiousness**'.
4. Factor 4 was named '**Real World Dissociation**' because most of the items it consisted were from the immersion factor, i.e. real world dissociation, in the IEQ.
5. As the items contributed to factor 5 were from A in the NEO FF-I, it was named as '**Agreeableness**'.

6. Factor 6 was named '**Extraversion**' because it consisted the items of E in the NEO FF-I.

7. Factor 7 consisted the items such as 'sometimes when I am reading poetry or looking at work of art, I feel a chill or wave of excitement', 'poetry has little or no effect on me (negative scoring)' and 'I am intrigued by patterns I find in art and nature'. Thus, factor 7 was named '**Arts Appreciation**'.

8. The items contributed to factor 8 were from both A and E in the NEO FF-I, such as 'I try to be courteous to everyone I meet', 'I generally try to be thoughtful and considerate' and 'Most people I know like me'. Therefore, factor 8 was named '**Pleasant and Positive Personality**'.

9. Factor 9 was named '**Interest I Diverse Knowledge**' because it consisted of the items from O in the NEO FF-I, such as 'I believe letting students hear controversial speakers can only confuse and mislead them', 'I have a lot of intellectual curiosity' and 'I have little interest in speculating on the nature of the universe or the human condition (negative scoring)'.

10. Factor 10 was named '**Game Challenge**' because the items contributed to it were from challenge factor in the IEQ.

11. The items contributed to factor 11 included 'Were you in suspense about whether or not you would win or lose the game', 'At any point did you find yourself become so involved that you wanted to speak to the game directly' and 'Were there any times during the game in which you just wanted to give up', which were from both emotional involvement and challenge factors in the IEQ. Factor 11 was named '**Emotional Engagement**'.

3.3 Discussion

The results from the descriptive data of personality traits showed that the average scores on openness were higher than the British norm (one deviation). The percentage of low scorers on openness (compared with the British norm) was 19.5, whereas 80.5% scored higher on openness. This indicated that the sample in Study 1 is biased in terms of openness. It also suggested that the survey may be a biased sample from Egan et al. (2000)'s British norms as it may exclude lower scorers on openness as Finn (1997) suggested that certain personality traits affect one's preference on media use.

The result from the Pearson correlation showed that personality traits and immersion experience are related. We suggest that it is likely that personality traits affect immersion experience rather than the other way around, because personality is considered as one's stable disposition whereas immersion

experience may be different from game to game and time to time.

The personality trait of neuroticism (N) showed significantly negative correlation with cognitive involvement, which suggests that high scorers on N tend to have less cognitive involvement when playing games. This is coherent with the characteristics of N, e.g. higher self-conscious and sensitive to factors such as environment that affect their concentration. N also showed significantly positive correlation with RWD, which implies high scorers are more likely to experience RWD. Some of the characteristics such as their emotional instability from N may be able to explain such correlation. As they prone to devote more attention toward stimulus, it may make them put less attention to the real world affair, which showed higher score on RWD in the questionnaire result.

Extraversion (E) showed significantly positive correlation with cognitive involvement. As high scorers on E are described as enthusiastic and action-oriented individuals, while playing a game, they may devote more attention to explore the game, compared to low scorers. In addition, E also showed significantly negative correlation with RWD and control. In terms of RWD, their proactive social characteristic may lead them to interact with people in their presence, which affects their dissociation with real world. As for the immersive factor of control, large part of the items that determined challenge factor are related to their awareness of the game environment; for example, 'did you feel the urge at any point to stop playing and see what was happening around you' and 'to what extent did you feel that the game was

something you were experiencing, rather than something you were just doing'. The response to these items from high score may be affected by their tendency of interacting with other people, which causes them more aware of the real world, compared to low scorers.

The significantly positive correlation between openness (O) and IEQ score indicated that people with high score on O tend to score higher in the overall immersion experience. One of the characteristics of O, comparing to low scorer, is that they are more aware of their feeling, which implies that they are more sensitive while reporting their feeling. As the IEQ is a self-reported questionnaire, the result is consistent with the characteristic of high scorer on O. At the same time, there was a significantly positive correlation between O and real world dissociation (RWD), which is also consistent with the characteristic of O. High scorers on O tend to be more imaginative and creative. Therefore, they have the tendency to show appreciation of imaginatively and creativity while being in a fictionalised game.

Agreeableness (A) had significantly negative correlation with all the immersion factors as well as IEQ score. This was an unexpected result as the tendency described about A is to make the respondent good (Graziano & Tobin, 2002), which contradicted with our result. The possible reasons are discussed in Chapter 5.

The significantly negative correlation between Conscientiousness (C) and RWD indicted that one with tendency of high self-discipline is less experience

dissociation with real world. As high scorers on C are more organised and dutiful, they are less likely to neglect the real world affair, which may result in their lower rating on RWD items.

11 factors were retained and named according to the items co-loaded. The items from two questionnaires contributing to the factors did not overlap. That is, 4 out of 11 were immersion factors and 7 were from personality factors. According to Kline (1998)'s approach, if two constructs overlap, it suggests that the constructs are very similar, or even measuring the same thing. However, there is no overlap in two questionnaires from our result, which suggests that personality traits and immersion experience are two distinct and unique constructs.

4. STUDY 2

Study 2 built upon Study 1 to further examine whether openness relates to immersion in narrative games. Study 1 established that personality and immersion are related because the significant correlations were found on statistical analysis. There was a significantly positive correlation between openness (O) and IEQ score, which indicated that people with high score on O tend to score higher in the overall immersion experience. Weibel et al. (2010) also suggested that people with high-scored openness are more likely immersed in narrative game, however it lacked empirically test.

A lab study was conducted to examine whether openness is related to immersion in narrative game. An advantage of a lab study is that we are able to manipulate the games and ensure that all participants respond according the same games. It was predicted that:

H1: When playing a narrative game, openness will be significantly correlated with IEQ scores, where the same will not be found for a non-narrative game.

Since participants were recruited from Study 1 to take part in Study 2, their scores on personality traits were collected from study 1 directly. As in Study 1, the level of immersion in two conditions was measured by IEQ (Jennett et al., 2008). Besides, to examine that the narrative game we defined is perceived as narrative by participants, the INQ (Qin et al., 2009) was used in both conditions.

We made an effort to select appropriate games for our study. We aimed to find two similar games with difference on narrative component, one with narrative and the other without narrative. At the same time, we preferred games for popular consoles such as PlayStation 3 instead of out-dated games. After comparing various games, we decided to compare Call of Duty 4: Modern Warfare (narrative game) and Call of Duty: Modern Warfare 2 (non-narrative game). The narrative one has both components that we defined as narrative in games, i.e. plots and interactivity, and manages to balance them whereas the non-narrative one put more stress on interactivity.

Ideally, we would have tested the significant differences between two groups, high openness versus low openness. However, due to the difficulty in recruiting enough participants, we had to analyse the correlations instead. This meant that we could only uncover a relation between openness and immersion in narrative games, not whether there is a significant difference between high openness versus low openness. The collected data were all analysed on SPSS 17.0 to verify the hypothesis.

4.1 Method

Participants

Participants were identified and recruited from Study 1. They were selected according to their personality trait and their experience of game play. In

addition, participants were required to have previous experience on PS3 since novice participants may spend most of session time on trying the device rather than the game itself. Due to the time constraint, participants with previous experience on PlayStation console were selected to take part, which were identified in Study 1. There were two conditions in this study, narrative game and non-narrative. Each participant required to take part in both conditions. In study 2, there were 18 participants recruited, 17 male and 1 female. Ages ranged from 19 to 45 years, the mean age being 25.17 years (SD=6.10). The incentive prize in Study 2 was free chocolate as well as 25 pounds for two best performers.

Materials

The demographical questionnaire was released before the beginning of the experiment (Appendix G). Besides demographical data, it was also used to understand participants' game hobbies. It contained 8 questions in total.

The level of immersion that participants experienced during game play was measured with the Immersive Experience Questionnaire (IEQ) (Jennett et al, 2008). Participants were asked to fill in the questionnaire after they finished each game session. The IEQ contained 31 items and answered on 5-point Likert scale (Appendix D).

The Immersive Narrative Questionnaire (INQ) (Qin et al., 2009) was used after each game play session as well. The INQ was a 27-item questionnaire used to measure the immersion level in narrative games, answered on 7-point Likert

scale (Appendix E).

A post-study interview was conducted at the end of the experiment (Appendix F). It had two parts, which respectively contained three and four questions. The first part was to understand their preference of two different game genres, narrative and non-narrative. The second part was used to explore the game experience in the experiment from participants.

Apparatus

Two games used in this study were Call of Duty 4: Modern Warfare (CoD4) and Call of Duty: Modern Warfare 2 (MW2). They were played on PlayStation 3 console and the game image was projected on the wall via Optoma PK301 pocket projector. Both games were classified as the First-Person Shooter (FPS) genre. CoD4 was the fourth instalment in Call of Duty series, released 2007. Only single-play mode was used in this study. MW2 was the sixth instalment of the series, released in 2009. The campaign mode was used in this study. Since MW2 was the direct sequel to CoD4, they were based on the same storyline and had high similarity in terms of mechanism and style.

Design

The study was designed as a 2X2 factorial design. Two independent variables were personality trait of openness to experience and game genre. Two levels of openness to experience were high and low scores in the NEO FF-I. The scores were compared with the NEO FF-I norm to define the high and low. Another independent variable, game genre, had two levels as well, which were



Figure 2. Screen shot of Call of Duty 4: Modern Warfare



Figure 3. Screen shot of Call of Duty: Modern Warfare 2

narrative game and non-narrative. The order in which condition presented to participants in two-level openness to experience was counterbalanced in order to avoid order effects. The dependant variable was the level of immersion, which was measured with the IEQ and the INQ.

Procedure

The study was conducted in the UCL Interaction Centre. One usability lab was used for participants to perform the experiments. After participant arrived, they were led to the lab. Participants were presented with the research information (Appendix G) and the consent form (Appendix H). Once they agreed to participate in the experiment, the demographical data will be collected via questionnaire (Appendix I).

Participants were then ready to start the experiment. The game genre order was counterbalanced. To avoid confounding effect, all verbal instructions were substituted with standardised instructions (Appendix J). The investigator explained verbally only when questions arose. After reading the instructions, participants started the first game session. The investigator was in the same lab but stayed at the corner to reduce the inference. Since the light was turned off during game session, participants were less aware the existence of the investigator. Each game session lasted for 45 minutes. When time was up, participants were asked to stop. At the end of the first game session, they were asked to fill out the IEQ and the INQ and had a break, which was 15 minutes. The second game session started with the same instruction as in the first game session and was 45 minutes as well. At the end of the second game

session, participants were asked to fill out the IEQ and the INQ again but based on the experience of the second game session.

After the two sessions of game play and questionnaires filling, the post-study interview was conducted in the same lab. Notes were taken to record the interview. This is the end of the experiment. Participants were thanked and allowed to leave.

Pilot study

Before starting the actual experiment, a pilot study was initially conducted to make sure the process and to identify the potential issues. The main concern of the experiment design was the appropriateness of games in terms of narrative and non-narrative. Such concern was discussed with an expert from Sony Computer Entertainment Europe Limited and three games were tried out as recommended: *Uncharted 2: Among Thieves*, *Crysis 2* and *Tomb Raider*. At the same time, we did research and decided to add *CoD4* and *MW2* to our testing list. Three different experiment designs based on these five games were created and were piloted on four participants. We made the decision according to participants' feedback as well as our personal testing. In addition, participants confirmed the process was smooth and the instruction was understandable.

4.2 Result

IEQ and Personality

IEQ scores were calculated for the narrative and non-narrative games. The mean IEQ score for the narrative game was 110.39 (SD=14.67). The mean IEQ score for the non-narrative game was 114.11 (SD=16.27).

To explore whether there is a positive relationship between personality traits and IEQ scores, Person correlations were performed. As shown in Table 2, there is no significant correlation between openness and games for the narrative game ($r_{(n=18)} = -.017, p = .474$) or the non-narrative game ($r_{(n=18)} = .069, p = .313$). Table 2 also shows there are no significant correlations between IEQ scores and other personality traits in the narrative and non-narrative games.

Table 2

Pearson's Correlation between Personality Traits and the Level of Immersion in Games (N=18)

	Personality traits									
	N		E		O		A		C	
	<i>R</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Narrative game	.032	.450	.073	.387	-.017	.474	-.026	.459	-.013	.480
Non-narrative game	.149	.278	.123	.313	.069	.313	-.008	.487	.198	.216

On the other hand, it was found that the correlation between extraversion and challenge factor in narrative game was negatively significant ($r_{(n=18)} = -.413, p = .044$). The correlation between conscientiousness and the cognitive involvement was positively significant ($r_{(n=18)} = .409, p = .046$).

Order Effects

As the counterbalancing was used in the experiment, an independent sample t-test was conducted to examine whether there were any order effects. The results showed there were no significant differences between two orders ($t_{(17)} = .680, p = .506; t_{(17)} = 1.236, p = .234$).

INQ and Post-Study Interview

To examine whether the narrative game (CoD4) chosen in Study 2 is rated higher than non-narrative one (MW2), INQ scores were calculated for both games. The mean INQ score for the narrative game was 124.89 (SD=17.95). The mean INQ score for the non-narrative game was 134.06 (SD=20.22). Although the average INQ score was higher for CoD4 than MW2, the mean difference between two games was only .277.

A paired *t*-test analysis was used to test if the difference between the two games was significant. The *t*-test result showed that INQ scores of the two games was not significant ($t_{(17)} = .277, p = .785$). This suggests that, according to the INQ measure, the games did not differ significantly in terms of perceived narrative.

In addition, the question in the post-study interview, 'If you have to rate one game higher than the other, which game would it be', was used to understand which game participants perceived as narrative. The results showed that 55.6% (10 out of 18) rated narrative game chosen in Study 2 higher, where

44.4% (8 out of 18) rated the opponent higher. This suggests that although more than half participants rated CoD4 as more narrative, the difference between two games was not as distinct as it should be.

Another finding in the post-study interview was that the definition of narrative each participant gave was different. One participant rated MW2 higher than CoD4 in narrative because he believed it has a more complex story compared CoD4, which is more straightforward. However, another participant argued that CoD4 has strong narrative as its storyline is clear and simple; thus he rated it higher.

4.3 Discussion

It was predicted that openness would be significantly correlated with immersion in the narrative game, but not with immersion in the non-narrative game. This hypothesis was not supported: the correlation between openness and narrative game did not achieve statistical significance. The results also showed that the other personality traits were not significantly correlated with any of the games (narrative or non-narrative). This could suggest that personality is not related to immersion. Alternatively, it may be an artefact of the study that caused the lack of significant findings.

Additional tests revealed that there were no order effects. This suggests that it did not make a difference to IEQ scores which game was played first.

Regarding narrative, tests revealed that INQ scores for the two games were not significantly different. Similarly, post-study interviewed revealed that just over half of participants perceived CoD4, selected as narrative game, was stronger in narrative.

This suggests that two games chosen did not differ strongly enough in terms of narrative; they were both perceived as narrative games.

As explained in the background of Study 2, choosing a narrative game and a non-narrative game that were comparable for experimental testing is a challenge. The issue was how to compare two games that provide payers completely different game experience in terms of mechanism, graphic style and even game genre itself. CoD4 and MW4 were the best comparison available to us in the within the time constraints of this study. As they were the same series, the game mechanism and game genre are the same. One difference was that MW2 has better graphics than CoD4 as it is the newer game. The other difference was the narrative, CoD4 having narrative features such as plots between each chapter. The pilot study confirmed the narrative difference between the two games – therefore we argue that we were justified in choosing and using these games for Study 2. However, as the results indicate, the narrative difference between the two games may not have been distinct enough to give significant results.

Another explanation of not having significant narrative difference may be that the game sessions were not long enough. In a narrative game, it usually takes

longer to introduce payers to realise the narrative in games. If game sessions in the study could be longer (e.g. extend to 1.5 hour) the difference in terms of narrative may be more obvious. However, it was the time constraints as well as the difficulty of recruiting participants that resulted in the method we chose.

Rather than the games not being different enough in terms of narrative, another explanation could be that everyone has their own understanding of narrative. For example, the post-study interview found that some thought MW2 was more narrative as it has more freedom in terms of control and payer's character was shifted between different chapters. One could suggest that if the definition we argued in this study could be provided at the beginning of the experiment, participants may be able to rate the narrative in a way we tried to understand.

In addition, due to the difficulty of recruiting more participants and time constraint, a small sample (N=18) was used in this study which inevitably affects the population validity of the result. Ideally, if we had enough participants, we would have run a mixed design study: high openness scorers versus low openness scorers (between groups), narrative game versus non-narrative game (within groups); which would have been a more ideal experimental design for testing our hypothesis.

5. GENERAL DISCUSSION

The aim of this research is to investigate whether personality traits and immersion experience are related to each other. Furthermore, we aim to investigate whether openness affects one's immersion in narrative games. In Study 1, the results suggest that there is relation between some personality traits and immersion experience, but not all the personality traits were found significantly correlated with immersion experience. In Study 2, no significant result was found for openness being related to narrative games; however, such result provides us a chance to review our experiment design. This chapter discusses the overall findings, limitations and implications of the two studies, as well as the suggestions for future work.

Personality and immersion experience in narrative games

In Study 1, we aimed to test whether there is a relation between personality traits and immersion experience. According to the result from Pearson correlations, it reveals that there is a significant correlation between immersion and some of the personality traits, e.g. IEQ score and openness and IEQ score and agreeableness. Personality is longitudinally stable (Pervin et al., 2004) whereas immersion is an experience that changes from game to game and time to time. Thus, it is less possible that immersion experience has effect on personality traits. Therefore we argue that these results suggest personality traits may have influence on immersion experience.

In addition, the result from factor analysis suggests that personality traits and immersion experience are two distinctly different construct as the items

contributed to the extracted factors had no overlap. According to Kline (1998), if two constructs overlap, the constructs are very similar or even measuring the same thing. This finding is consistent with previous literature that both concepts are unique and exist (Jennett et al., 2008; Costa & McCrae, 1992). It also gives an extra support for the idea that the IEQ is a valid measure, i.e. it is measuring distinct immersion constructs.

In Study 2, we aimed to empirically investigate whether openness is the personality trait that affects one's immersion in narrative games. Pearson correlations reveal that there is no significant relation between openness and narrative game. The result also shows that no personality traits have significant relation with narrative games. Possible reasons for the non-significant results are two chosen games were not distinct enough and participants had different game experience with chosen games. Another possibility is that the determinant of game preference may depend on the combination of personality traits, not a single personality trait. This was not investigated in our study.

In addition, personality may be more related to media preference compared to the narrative component. Past research suggested personality has effect on one's media preference (Finn, 1997; Kraaykamp & Eijck, 2005). It has also been suggested that payers' personality affects their preferences on game genres (Zammitto, 2010). The game components are more than just narrative and non-narrative and they may be important. For example, gaming mechanism and graphical style can also affect one's preference on games. We

suggest that personality may depend on other things rather than just whether the game is narrative or non-narrative.

Overall, the results from the two studies do not support the work of Weibel et al. (2010). Although there are significant relations between some personality traits and immersion experience, we can only suggest that personality could affect immersion experience. In terms of the connection between openness and narrative games, the results do not support Weibel et al. (2010) as well as Finn (1997).

Limitation and possible cofounds

A limitation of Study 1 is that participants were asked to recall a most recent game experience before starting answering the IEQ in the survey. Although the request is an advantage to make sure participants indeed recall a game experience, the recalled game experience cannot be controlled. As game experience can be different from game to game and time to time, it may result in a potential confound that the recalled game experience is only a single experience.

As mentioned in Chapter 3, the average openness score in Study 1 was higher than the British norm whereas scores on other factors were close to the British norm. At the same time, it was found that only 20% of participants were scored lower than the British norm in openness score. This indicated that most of participants scored higher on openness in Study 1. As personality affects one's preference on media (Finn, 1997; Kraaykamp & Eijck, 2005), it implies that

certain personality traits would find games less enjoyable comparing to other media. If one does not prefer playing games, he/she is less likely being recruited in our study. As most recruited participants had long time gaming experience, it may be the cause of our sample being biased.

One of the limitations in Study 2 was the chosen games. As mentioned, although many games were tried as well as piloted on participants, it was found that the difference between two chosen games was not distinct enough. We suggest that there were two possible causes. Firstly, two chosen games are not appropriate for comparison as they are too similar. As mentioned in Chapter 4, they are from the same series, which is an advantage to control other confounding such as different mechanism providing different experience. However, it may be result in two indistinguishable experiences. The second possible cause may be the length of game session was not long enough to provide participants sufficient experience in narrative games. As one of the participants mentioned, when he firstly played Call of Duty 4, he spent hours to get a taste of the game.

Another limitation for Study 2 may be the experience of chosen games. Although we controlled that all participants have experience on the console we used (PS3), we did not manage to control their game experience on our chosen games. Finn (1997) suggested the positive effect of high scorer on openness on the preference for pleasure reading. As openness is considered to relate with creativity, Kraaykamp and Eijck (2005) suggested that high scorer prefers original and serious media content. This implies that if high

scorers on openness have played the chosen games, it may affect their immersion experience as they may feel less interesting compared to their first game play. Although no study shows that game preference has relation with game experience, it may influence one's immersion experience if one has played one of the chosen games before.

Future work and implications

Despite the limitations mentioned, there are still several advantages in our research. First of all, our research was an improvement over Weibel et al. (2010) as it adapted a more appropriate analytical method as well as it conducted a lab study. Secondly, the use of questionnaires provides the study quantitative results, allowing for statistical testing. Thirdly, the large sample size in Study 1 (N=630) increased the predictive validity. Lastly, in Study 2, we conducted an experiment which empirically tests our hypothesis. In sum, we identified various possible improvements from our advantages and limitations, which should inform future work.

To improve the potential confound that arose from only measuring single game experience in the online survey, we would suggest having participants playing several games, which allows them fill in the IEQ more than once. It could be a form of diary report, recording their everyday game play and game experience.

For experiment design, the main issue brought up was the game selection. Although we tried several games as well as experiment designs, it may need more time devoting in testing games as well as experiment design before

actual starting the experiment. In terms of game genre, First-Person Shooter (FPS) would be suggested as it is more immersive (Brown & Cairns, 2004; Nacke & Lindley, 2008), which is an advantage for experiment condition where it has time constraint. We would also suggest that game sessions could be longer, which provides sufficient time for participants to get involved and understand the narrative in games. Although we did put these into consideration with designing the experiment, we did not manage to achieve all these, except for using FPS game, due to the constraints of resources and time.

As the results indicated in Study 1, there is a relation between personality traits and immersion experience. However, we can only hypothesise that personality traits may affect immersion experience as personality is a stable disposition. Thus, the future work could be empirically testing such hypothesis, e.g. having two participants scoring distinctively on personality traits play one game and examining whether their immersion experiences are different.

It has been investigated that one's media preference is affected by personality (Finn, 1997; Kraaykamp & Eijck, 2005). As mentioned, Weibel et al. (2010) suggested the relation between personality and narrative games inferring from Finn (1997)'s work, whereas Finn did not include game in his investigation. Further research could be conducted that bridges this gap, e.g. investigating the relation between personality traits and media use including games, would be informative. We would suggest that for future work, participants could be given the NEO FF-I first and then could rate what they prefer most e.g. novels,

films or games.

In terms of game industry, the current research gives a better understanding of how personality is related to immersion gaming experience. Future research would be needed to understand whether narrative component is the attraction for payers or there are other more influential components.

6. CONCLUSION

Gaming is one of the fastest growing entertainment businesses; however, there is not much research on what affects one's immersion experience in games. Our research provides researchers and the game industry with a better understanding of the relationship between personality traits, immersion experience and narrative games.

In Study 1, it was found that personality traits are related to immersion experience where it is more likely that personality affect immersion experience. It also confirmed that the two constructs, personality and immersion experience, are distinct and unique. In Study 2, the hypothesis, i.e. when playing a narrative game, openness will be significantly correlated with IEQ scores, was rejected. This could imply that narrative and non-narrative may not be the only components that affect one's immersion experience in terms of game components.

This research contributes to Human-Computer Interaction (HCI) in a theoretical way. We started an initial step on investigating the relation between personality and immersion experience. The findings reveal that there could be a relationship between personality, immersion experience and narrative in games as survey suggests; however, it is difficult to detect within the lab. This could suggest that it is more complex than we originally expected as other factors such as game mechanism may also affect the relationship.

In terms of methodological contribution, the scientific method we used to

investigate games is of a benefit to HCI research. In our research, we used both survey and experimental methods. The strength of survey is the large sample which increases the predictive validity and minimises the variable sampling error. In addition, the standardised questionnaires and information in the survey also increases the reliability. The strength of experiment is that we manipulated the games to ensure that participants respond according the same games.

Future research could investigate that whether the personality traits have effect on immersion experience since our findings can only suggest that there is a relation between them. It could also examine that how people's personality affects their preference for game comparing with other media such as films and novels. For game industry, it could investigate that whether narrative us the component that attracts payers in games.

REFERENCES

- Agarwal, R. and Karahanna, E. (2000). Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. *MIS Quarterly*, 24(4):665.
- Bizzocchi, J. (2007). Games and narrative: An analytical framework. *Loading - the Journal of the Canadian Games Studies Association*, 1(1).
- Bono, J. E. and Judge, T. A. (2004). Personality and transformational and transactional leadership: A meta-analysis. *Journal of applied psychology*, 89(5):901–910.
- Brown, E. and Cairns, P. (2004). A grounded investigation of game immersion. In *CHI '04 extended abstracts on Human factors in computing systems*, CHI EA '04, pp. 1297–1300, New York, NY, USA. ACM.
- Caron, F. (2008). Gaming expected to be a \$68 billion business by 2012. From <http://arstechnica.com/gaming/news/2008/06/gaming-expected-to-be-a-68-billion-business-by-2012.ars>
- Costa, P. T. and McCrae, R. R. (1992). *Revised NEO Personality Inventory (NEO PI-R) and NEO Five-Factor Inventory (NEO-FFI)*.
- Csikszentmihalyi, M. (1990). *Flow: The Psychology of Optimal Experience*. Harper Perennial, first edition edition.
- Csikszentmihalyi, M. (1992). Optimal experience: Psychological studies of flow in consciousness. In Csikszentmihalyi, M. and Csikszentmihalyi, I. S., editors, *The flow experience and its significance for human psychology*, pp. 15+. Cambridge University Press.
- Divéky, M. and Bieliková, M. (2009). Generating educational interactive stories in computer Role-Playing games. In *Proceedings of the 4th*

- European Conference on Technology Enhanced Learning: Learning in the Synergy of Multiple Disciplines*, EC-TEL '09, pp. 492–506, Berlin, Heidelberg. Springer-Verlag.
- Egan, V., Deary, I., and Austin, E. (2000). The NEO-FFI: emerging british norms and an item-level analysis suggest n, a and c are more reliable than o and e. *Personality and Individual Differences*, 29(5):907–920.
- Ermi, L. and Mäyrä, F. (2005). Fundamental components of the gameplay experience: Analysing immersion. In *In DIGRA. DIGRA*.
- Fang, X. and Zhao, F. (2010). Personality and enjoyment of computer game play. *Computers in Industry*, 61(4):342–349.
- Finn, S. (1997). Origins of media exposure. *Communication Research*, 24(5):507–529.
- Gerrig, R. J. and Zimbardo, P. G. (2009). *Psychology and Life (19th Edition)*. Allyn & Bacon, 19 edition.
- Grimshaw, M., Lindley, C. A., and Nacke, L. (2008). Sound and immersion in the First-Person shooter: Mixed measurement of the player's sonic experience. In *AUDIO MOSTLY 2008*, pp. 9–15.
- Hyer, L., Braswell, L., Albrecht, B., Boyd, S., Boudewyns, P., and Talbert, S. (1994). Relationship of NEO-PI to personality styles and severity of trauma in chronic PTSD victims. *Journal of Clinical Psychology*, 50(5):699–707.
- Jennett, C., Cox, A. L., and Cairns, P. (2009). Investigating computer game immersion and the component real world dissociation. In *Proceedings of the 27th international conference extended abstracts on Human factors in computing systems*, CHI EA '09, pp. 3407–3412, New

- York, NY, USA. ACM.
- Jennett, C., Cox, A. L., Cairns, P., Dhoparee, S., Epps, A., Tijs, T., and Walton, A. (2008). Measuring and defining the experience of immersion in games. *Int. J. Hum.-Comput. Stud.*, 66:641–661.
- Johnson, D. and Gardner, J. (2010). Personality, motivation and video games. In *Proceedings of the 22nd Conference of the Computer-Human Interaction Special Interest Group of Australia on Computer-Human Interaction*, OZCHI '10, pp. 276–279, New York, NY, USA. ACM.
- Juul, J. (1999). A clash between game and narrative. Master's thesis, Institute of Nordic Language and Literature, University of Copenhagen.
- Juul, J. (2001). Games telling stories? *Game Studies*, 1(1).
- Kline, P. (1998). *The New Psychometrics: Science, Psychology and Measurement*. Routledge, 1 edition.
- Koster, R. (2004). *A Theory of Fun for Game Design*. Paraglyph Press, 1 edition.
- Kraaykamp, G. and Eijck, K. (2005). Personality, media preferences, and cultural participation. *Personality and Individual Differences*, 38(7):1675–1688.
- Lee, F. K., Johnston, J. A., and Dougherty, T. W. (2000). Using the Five-Factor model of personality to enhance career development and organizational functioning in the workplace. *Journal of Career Assessment*, 8(4):419–427.
- Lindley, C. A. (2002). The gameplay gestalt, narrative, and interactive storytelling. In *Proceedings of the Computer Games and Digital Cultures Conference*, pp. 6–8.

- Lombard, M. and Ditton, T. (1997). At the heart of it all: The concept of presence. *Journal of Computer-Mediated Communication*, 3(2):0.
- Mallon, B. and Webb, B. (2005). Stand up and take your place: identifying narrative elements in narrative adventure and role-play games. *Comput. Entertain.*, 3(1):6.
- Malouff, J. M., Thorsteinsson, E. B., Rooke, S. E., and Schutte, N. S. (2007). Alcohol involvement and the Five-Factor model of personality: a meta-analysis. *Journal of drug education*, 37(3):277–294.
- McAdams, D. P. (1992). The five-factor model in personality: a critical appraisal. *J Pers*, 60(2):329–361.
- McCrae, R. and Costa, P. (2004). A contemplated revision of the NEO Five-Factor inventory. *Personality and Individual Differences*, 36(3):587–596.
- McMahan, A. (2003). Immersion, engagement, and presence: A method for analyzing 3D videogames. In Wolf, M. J. P. and Perron, B., editors, *The Video Game Theory Reader*, pp. 67–86. Routledge, New York.
- Murray, J. (2006). From Game-Story to cyberdrama. In Wardrip-Fruin, N. and Harrigan, P., editors, *First Person: New Media as Story, Performance, and Game*. The MIT Press.
- Nacke, L. and Lindley, C. A. (2008). Flow and immersion in first-person shooters: measuring the player's gameplay experience. In *Proceedings of the 2008 Conference on Future Play: Research, Play, Share*, Future Play '08, pp. 81–88, New York, NY, USA. ACM.
- Park, J., Song, Y., and Teng, C.-I. (2011). Exploring the links between personality traits and motivations to play online games. *Cyberpsychology*,

Behavior, and Social Networking.

- Perlin, K. (2006). Can there be a form between a game and a story? In Wardrip-Fruin, N. and Harrugan, P., editors, *First Person: New Media as Story, Performance, and Game*. The MIT Press.
- Pervin, L. A., Cervone, D., and John, O. P. (2004). *Personality: Theory and Research*. Wiley, 9 edition.
- Phillips, J. G., Butt, S., and Blaszczynski, A. (2006). Personality and Self-Reported use of mobile phones for games. *CyberPsychology & Behavior*, 9(6):753–758.
- Podolska, M. Z., Bidzan, M., Majkovicz, M., Podolski, J., Sipak-Szmigiel, O., and Ronin-Walknowska, E. (2010). Personality traits assessed by the NEO Five-Factor inventory (NEO-FFI) as part of the perinatal depression screening program. *Medical science monitor : international medical journal of experimental and clinical research*, 16(9).
- Qin, H., Patrick Rau, P.-L., and Salvendy, G. (2009). Measuring player immersion in the computer game narrative. *International Journal of Human-Computer Interaction*, 25(2):107–133.
- Rentfrow, P. J., Goldberg, L. R., and Zilca, R. (2011). Listening, watching, and reading: The structure and correlates of entertainment preferences. *Journal of Personality*, 79(2):223–258.
- Schmidt, J., Michael Hooten, W., and Carlson, C. (2010). Utility of the NEO-FFI in multi-dimensional assessment of orofacial pain conditions. *Journal of Behavioral Medicine*, pp. 1–12.
- Seah, M. and Cairns, P. (2008). From immersion to addiction in videogames. In England, D. and Beale, R., editors, *Proceedings of BCS*

HCI2008, volume 1, pp. 55–63.

- Slater, M. (1999). Measuring presence: A response to the witmer and singer presence questionnaire.
- Slater, M., Usoh, M., and Steed, A. (1994). Depth of Presence in Virtual Environments. *Presence: Teleoperators and Virtual Environments*, 3.2 MIT Press:130–144.
- Sweetser, P. and Wyeth, P. (2005). GameFlow: a model for evaluating player enjoyment in games. *Comput. Entertain.*, 3(3):3.
- Weaver, J. (1991). Exploring the links between personality and media preferences. *Personality and Individual Differences*, 12(12):1293–1299.
- Weibel, D., Wissmath, B., and Mast, F. W. (2010). Immersion in mediated environments: the role of personality traits. *Cyberpsychology, behavior and social networking*, 13(3):251–256.
- Witmer, B. G. and Singer, M. J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence: Teleoper. Virtual Environ.*, 7(3):225–240.
- Zammitto, V. L. (2010). Gamers' personality and their gaming preferences. Master's thesis, School of Interactive Arts and Technology, SIMON FRASER UNIVERSITY.

APPENDIX A CATTELL'S 16 PERSONALITY FACTORS

Reserved	Outgoing
Less intelligent	More intelligent
Stable, ergo strength	Emotional/neuroticism
Humble	Assertive
Sober	Happy-go -lucky
Expedient	Conscientious
Shy	Venturesome
Tough-minded	Tender-minded
Trusting	Suspicious
Practical	Imaginative
Forthright	Shrewd
Placid	Apprehensive
Conservative	Experimenting
Group-dependent	Self-efficient
Undisciplined	Controlled
Relaxed	Tense

APPENDIX B NEO FIVE-FACTOR INVENTORY (NEO FF-I)

Carefully read all of the instructions before beginning. This questionnaire contains 60 statements. Read each statement carefully. For each statement select the response that best represents your opinion. Make sure your answer is in the correct box.

Select **SD** if you *strongly disagree* or the statement is definitely false.

Select **D** if you *disagree* or the statement is mostly false.

Select **N** if you are *neutral* on the statement, if you cannot decide, or if the statement is about equally true and false.

Select **A** if you *agree* or the statement is mostly true.

Select **SA** if you *strongly agree* or the statement is definitely true.

1. I am not a worrier.
2. I like to have a lot of people around me.
3. I don't like to waste my time daydreaming.
4. I try to be courteous to everyone I meet.
5. I keep my belongings neat and clean.
6. I often feel inferior to others.
7. I laugh easily.
8. Once I find the right way to do something, I stick to it.
9. I often get into arguments with my family and co-workers.
10. I'm pretty good about pacing myself so as to get things done on time.
11. When I'm under a great deal of stress, sometimes I feel like I'm going to pieces.
12. I don't consider myself especially 'light-hearted.'

13. I am intrigued by patterns I find in art and nature.
14. Some people think I 'm selfish and egotistical.
15. I am not a very methodical person.
16. I rarely feel lonely or blue.
17. I really enjoy talking to people.
18. I believe letting students hear controversial speakers can only confuse and mislead them.
19. I would rather cooperate with others than compete with them.
20. I try to perform all the tasks assigned to me conscientiously.
21. I often feel tense and jittery.
22. I like to be where the action is.
23. Poetry has little or no effect on me.
24. I tend to be cynical and sceptical of others' intentions.
25. I have a clear set of goals and work toward them in an orderly fashion.
26. Sometimes I feel completely worthless.
27. I usually prefer to do things alone.
28. I often try new and foreign foods.
29. I believe that most people will take advantage of you if you let them.
30. I waste a lot of time before settling down to work.
31. I rarely feel fearful or anxious.
32. I often feel as if I'm bursting with energy.
33. I seldom notice the moods or feelings that different environments produce.
34. Most people I know like me.
35. I work hard to accomplish my goals.
36. I often get angry at the way people treat me.

37. I am a cheerful, high-spirited person.
38. I believe we should look to our religious authorities for decisions on moral issues.
39. Some people think of me as cold and calculating.
40. When I make a commitment, I can always be counted on to follow through.
41. Too often, when things go wrong, I get discouraged and feel like giving up.
42. I am not a cheerful optimist.
43. Sometimes when I am reading poetry or looking at work of art, I feel a chill or wave of excitement.
44. I'm hard-headed and tough-minded in my attitudes.
45. Sometimes I'm not as dependent or reliable as I should be.
46. I am seldom sad or depressed.
47. My life is fast-paced.
48. I have little interest in speculating on the nature of the universe or the human condition.
49. I generally try to be thoughtful and considerate.
50. I am a productive person who always gets the job done.
51. I often feel helpless and want someone else to solve my problems.
52. I am a very active person.
53. I have a lot of intellectual curiosity.
54. If I don't like people, I let them know it.
55. I never seem to be able to get organised.
56. At times I have been so ashamed I just wanted to hide.
57. I would rather go my own way than be a leader of others.
58. I often enjoy playing with theories or abstract ideas.

59. If necessary, I am willing to manipulate people to get what I want.

60. I strive for excellence in everything I do.

APPENDIX C PAST GAMING QUESTIONNAIRE

Please fill in the following questions.

1. How long have you been playing games?

Less than 6 months/6-12 months/1-2 years/ 3-5 years/more than 5 years

2. How often do you play games?

Once or twice a week/3-5 times a week/ more than 6 times a week

3. How long do you usually play in one gaming session?

Less than 30 minutes/30-60 minutes/1-2 hours/3-5 hours/More than 5 hours

4. What game genre do you usually play?

Action / Adventure / Music / Role-playing game (RPG) / Racing / Shooter /

Sports / Strategy / Other

5. Which platforms do you use to play games?

PC desktop/video game consoles/mobile phone games/other

APPENDIX D IMMERSION EXPERIENCE QUESTIONNAIRE (IEQ)

Your experience of the game

Please answer the following questions by circling the relevant number. In particular, remember that these questions are asking you about how you felt at the end of the game.

1. To what extent did the game hold your attention?
Not at all 1 2 3 4 5 A lot
2. To what extent did you feel you were focused on the game?
Not at all 1 2 3 4 5 A lot
3. How much effort did you put into playing the game?
Very little 1 2 3 4 5 A lot
4. Did you feel that you were trying your best?
Not at all 1 2 3 4 5 Very much so
5. To what extent did you lose track of time?
Not at all 1 2 3 4 5 A lot
6. To what extent did you feel consciously aware of being in the real world whilst playing?
Not at all 1 2 3 4 5 Very much so
7. To what extent did you forget about your everyday concerns?
Not at all 1 2 3 4 5 A lot
8. To what extent were you aware of yourself in your surroundings?
Not at all 1 2 3 4 5 Very aware
9. To what extent did you notice events taking place around you?
Not at all 1 2 3 4 5 A lot

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

Not at all 1 2 3 4 5 Very much so

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

Not at all 1 2 3 4 5 Very much so

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

Not at all 1 2 3 4 5 Very much so

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

Not at all 1 2 3 4 5 Very much so

14. To what extent was your sense of being in the game environment stronger than your sense of being in the real world?

Not at all 1 2 3 4 5 Very much so

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

Not at all 1 2 3 4 5 Very much so

16. To what extent did you feel as though you were moving through the game according to your own will?

Not at all 1 2 3 4 5 Very much so

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

Not at all 1 2 3 4 5 Very difficult

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

Not at all 1 2 3 4 5 A lot

19. To what extent did you feel motivated while playing?
Not at all 1 2 3 4 5 A lot
20. To what extent did you find the game easy?
Not at all 1 2 3 4 5 Very much so
21. To what extent did you feel like you were making progress towards the end of the game?
Not at all 1 2 3 4 5 A lot
22. How well do you think you performed in the game?
Very poor 1 2 3 4 5 Very well
23. To what extent did you feel emotionally attached to the game?
Not at all 1 2 3 4 5 Very much so
24. To what extent were you interested in seeing how the game's events would progress?
Not at all 1 2 3 4 5 A lot
25. How much did you want to "win" the game?
Not at all 1 2 3 4 5 Very much so
26. Were you in suspense about whether or not you would win or lose the game?
Not at all 1 2 3 4 5 Very much so
27. At any point did you find yourself become so involved that you wanted to speak to the game directly?
Not at all 1 2 3 4 5 Very much so
28. To what extent did you enjoy the graphics and the imagery?
Not at all 1 2 3 4 5 A lot
29. How much would you say you enjoyed playing the game?
Not at all 1 2 3 4 5 A lot

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

Not at all 1 2 3 4 5 Very much so

31. Would you like to play the game again?

Definitely not 1 2 3 4 5 Definitely yes

APPENDIX E IMMERSIVE NARRATIVE QUESTIONNAIRE (INQ)

1. I am familiar with the cultural background.
2. I am interested in the style of the game interface.
3. The story quickly grabs my attention at the beginning.
4. Many events in the game story are novel.
5. I want to know the rest of the storyline in the course of playing.
6. The avatar in the game is attractive.
7. I concentrate on the story for a long time.
8. I become less aware of the real world and unhappy things around me when I concentrate on the progress of the game story.
9. When I enter into the game story world, time always flies quickly.
10. I can make sense of the relationship between events.
11. I think the position of the events in the whole story's progress is clear.
12. I know my next goal while finishing an event every time.
13. I can comprehend the game story clearly.
14. The avatar can be located in the interface easily.
15. I can make sense of the relationship between the characters in the game story.
16. The obstacles or tasks do not influence my comprehension of the game story.
17. I can control the character to move according to my arrangement.
18. I can control the game interface.
19. I explore actively what I want to in the game story.
20. Parts of the story are formed by me in the course of playing the game.
21. Some tasks or conflicts in the game story are stimulating and suspenseful.
22. I like the tasks or conflicts, which are difficult in the game story.

23. I feel successful when I overcome the obstacles, tasks, or opponents in the game.
24. Sometimes I think I really am the avatar in the game.
25. My emotion often varies with the story's progress.
26. After finishing the game, it takes a long time for me to return to the real world psychologically and emotionally.
27. I discuss my experiences in the game story with other players.

APPENDIX F POST-STUDY INTERVIEW

A.

1. Which of two games did you prefer? Why?
2. Do you feel like the games differed in narrative? Please describe.
3. If you have to rate one game higher for narrative than other, which game would it be?

B.

1. How do you feel about this experiment?

Boring 1 2 3 4 5 Interesting

2. How do you think about the length of the experiment?

Too long Appropriate Too short

3. Do you think the length of game session is appropriate as a gameplay experience?

Yes No

If 'No', how long do you think it should be?

_____ minutes

4. Is there any comment about this experiment?

APPENDIX G INFORMATION SHEET

Information Sheet for Participants in Research Studies

You will be given a copy of this information sheet.

Title of Project: The relation between personality and narrative games in terms of game immersion

This study has been approved by the UCL Research Ethics Committee [Project ID Number]: MSc/1011/012

Contact Details of Investigators:

Name: Hsin-Ying Kuang

E-mail:

hsin-ying.kuang.10@ucl.ac.uk

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.

The aim of this study is to understand the relation between personality and narrative in terms of game immersion. You will be asked to play two different games and fill in several questionnaires in a laboratory condition. You can withdraw from this experiment at any time for any reasons. This experiment takes up to 120 minutes. You will have chance to earn a full prize.

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.

APPENDIX H CONSENT FORM

Informed Consent Form for Participants in Research Studies

(This form is to be completed independently by the participant after reading the Information Sheet and/or having listened to an explanation about the research.)

Title of Project: The relation between personality and narrative games in terms of game immersion

This study has been approved by the UCL

Research Ethics Committee [Project ID Number]:

MSc/1011/012

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:

APPENDIX I DEMOGRAPHICAL QUESTIONNAIRE

1. Name:
2. Gender: Male Female
3. Age:
4. UCL student Non-UCL student Not a student
5. How many hours do you play video games in a typical week?
 Less than one hour 1-3 hours 3-6 hours 7-10 hours
 More than 10 hours
6. Which consoles?
 PlayStation PlayStation2 PlayStation3 XBOX Wii PC
 Other:
7. Which game genres?
 Action Adventure Music Role-playing games (RPG)
 Racing Shooter Sports Strategy Other:
8. Did you prefer the narrative games more in general?
 Yes No

APPENDIX J STUDY 2 INSTRUCTION SHEET

In this session, you will have 45 minutes to play this game. You should concentrate on playing game. Do not skip any films and instructions during game play. You should follow its flow. At the end of the study, everyone's performance will be compared and the participant who performed the best, making the most progress in the game, will win 25 pounds. The performance will be judged by the number of checkpoints you achieve in each chapter. Therefore, please try your best and follow this instruction.

If you have any questions, please ask without any hesitation.

APPENDIX K FACTOR LOADING MATRIX

Factor loadings and communalities based on a principal components analysis with varimax rotation for 60 items from the NEO FF-I and 31 items from the IEQ (N= 630)

	Component											Communality
	1	2	3	4	5	6	7	8	9	10	11	
	Game involvement	Negative emotion experience	Conscientiousness	Real world dissociation	Agreeableness	Extraversion	Arts appreciation	Pleasant and Positive Personality	Interest in diverse knowledge	Game challenge	Emotional Engagement	
The IEQ												
How much would you say you enjoyed playing the game?	.786											.644
To what extent did the game hold your attention?	.770											.642
To what extent did you feel motivated while playing?	.755											.620
To what extent did you feel you were focused on the game?	.752											.637
How much effort did you put into playing the game?	.729											.597
Did you feel you were trying your best?	.692											.535
To what extent were you interested in seeing how the	.630											.429

game's events would progress?			
To what extent did you feel that you were interacting with the game environment?	.620	.311	.537
To what extent did you enjoy the graphics and the imagery?	.566		.383
How much did you want to 'win' the game?	.546		.466
To what extent did you feel that the game was something you were experiencing, rather than something you were just doing?	.533	.426	.618
To what extent did you feel emotionally attached to the game?	.525		.482
To what extent did you feel like you were making progress towards the end of the game?	.508		.323
Would you like to play the game again?	.467		.322
When interrupted, were you disappointed that the game was over?	.431		.397
To what extent did you feel as though you were moving through the game according to your own will?	.311		.260
The NEO FF-I			
I rarely feel fearful or anxious	.763		.600
Sometimes I feel completely worthless	.738		.593
I often feel tense and jittery	.724		.577

I am seldom sad or depressed	.688			.572
When I'm under a great deal of stress, sometimes I feel like I'm going to pieces	.685			.502
I often feel inferior to others	.671			.513
I rarely feel lonely or blue	.638			.503
I am not a worrier	.604			.410
Too often, when things go wrong, I get discouraged and feel like giving up	.587			.499
I often feel helpless and want someone else to solve my problems	.579	-.337		.489
At times I have been so ashamed I just wanted to hide	.528			.386
I often get angry at the way people treat me	.470		-.437	.451
I am not a cheerful optimist	-.444		.405	.540
I am a productive person who always gets the job done	.750			.614
I work hard to accomplish my goals	.688			.560
I never seem to be able to get organized	.687			.559
I have a clear set of goals and work toward them in an orderly fashion	.658			.485
I'm pretty good about pacing myself so as to get	.623			.450

things done on time		
When I make a commitment, I can always be counted	.598	.436
on to follow through		
I strive for excellence in everything I do	.592	.475
I try to perform all the tasks assigned to me	.591	.478
conscientiously		
I waste a lot of time before settling down to work	.580	.496
Sometimes I'm not as dependable or reliable as I	.574	.470
should be		
I am not a methodical person	.508	.349
I keep my belongings neat and clean	.478	.290
The IEQ		
To what extent were you aware of yourself in your		
surroundings?	-.810	.692
To what extent did you notice events taking place		
around you?	-.798	.678
To what extent did you feel consciously aware of the		
real world while you were playing?	-.791	.655
To what extent did you feel as though you were		
separated from your real-world environment?	.677	.628

To what extent was your sense of being in the game environment stronger than your sense of being in the real world?	.317	.620		.659
To what extent did you forget about your everyday concerns?	.341	.481		.374
At any point did you find yourself become so involved that you were unaware you were even using controls?		.481	.372	.466
Did you feel the urge at any point to stop playing and see what was happening around you?		-.459		.343
To what extent did you lose track of time?	.384	.404		.354
The NEO FF-I				
Some people think I'm selfish or egotistical		.640		.497
Some people think of me as cold and calculating		.611		.460
I tend to be cynical and sceptical of others; intentions		.589		.516
I often get into arguments with my family and co-workers		.551		.389
If necessary, I am willing to manipulate people to get what I want		.546		.376
I'm hard-headed and though-minded in my attitudes		.517		.316
I believe that most people will take advantage of you if		.504		.422

you let them				
If I don't like people, I let them know it		.499		.367
I would rather cooperate with others than compete with them		.392		.280
I like to have a lot of people around me		.736		.557
I like to be where the action is		.649		.524
I really enjoy talking to people		.626		.472
I am a cheerful, high-spirited person	-.310	.532	.355	.630
My life is fast-paced		.531		.478
I usually prefer to do things along		.523		.437
I am a very active person	.328	.510		.489
I would rather go my own way than be a leader of others		.496		.424
I often feel as if I 'm bursting with energy		.438		.426
Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement			.725	.626
Poetry has little or no effect on me		.664		.539
I am intrigued by the patterns I find in art and nature		.622		.466
I often enjoy playing with theories or abstract ideas		.594		.473
I have little interest in speculating on the nature of the		.551	.329	.454

universe or the human condition				
I have a lot of intellectual curiosity		.470	.379	.481
I seldom notice the moods or feelings that different environments produce		.397		.336
I often try new and foreign foods		.342		.190
I try to be courteous to everyone I meet	.366		.490	.438
I generally try to be thoughtful and considerate	.359		.485	.552
I don't consider myself especially light-hearted			.425	.354
I laugh easily	.332		.364	.371
Most people I know like me			.338	.335
I don't like to waste my time day-dreaming				.234
I believe letting students hear controversial speakers can only confuse and mislead them			.554	.359
I believe we should look to our religious authorities for decisions on moral issues			.537	.344
Once I find the right way to do something, I stick to it			.315	.300
The IEQ				
To what extent did you find the game easy?			.761	.644
To what extent did you find the game challenging?	.443		-.630	.653
How well do you think you performed in the game?	.444		.521	.529

Were you in suspense about whether or not you would lose the game?		.587	.518
At any point did you find yourself become so involved that you wanted to speak to the game directly?		.542	.431
Were there any times during the game in which you just wanted to give up?		-.370	.446
			.419

Note. Factor loading < .3 are suppressed