Is Game Immersion Just Another Form of Attention?

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ABSTRACT. Despite there being a broad understanding of the term "immersion" amongst gamers it is still not clear what exactly it is and what causes it. In the current research we decided to shed light on immersion by investigating its relationship with a similar concept in the psychology literature, that of selective attention. First a qualitative study was conducted in which gamers were interviewed. The resulting grounded theory suggested that an important feature of immersion is feedback, which leads to a sense of progression. Two experimental studies were then conducted to further validate the grounded theory. An auditory distraction paradigm was created in which participants played a game with distracters present and were later given a surprise recall test. The results revealed that motivation, via feedback, plays an important role in immersion. Furthermore immersion is not just a result of cognitive load. As well as theoretical contributions to HCI, this research could have implications for designers of serious games and also those researchers that are developing measures to limit the immersive experiences of gamers that play too much.

1. Problem & Motivation

Figure 1. Actors arrive dressed as soldiers for the midnight launch of "Call of Duty: Modern Warfare 2" in Leicester Square, London, November 9, 2009. Image from [1].

In November 2009 Leicester Square (UK) hosted a red carpet premiere in which actors dressed as soldiers mingled with the celebrity-studded crowd [2], see Figure 1. However the unusual thing about this premiere was that it was not celebrating the launch of a Hollywood movie; it was celebrating the launch of a video game (Call of Duty). The fact that such an event took place demonstrates that games are no longer viewed as the past time of nerds and geeks, but have become part of mainstream culture. Indeed the Noughties have been described as "the decade when playtime took over" [3]. Innovations in novel controllers (e.g. Guitarhero, Wii sports), online gaming (e.g. World of Warcraft), graphical realism (e.g. Halflife, Grand Theft Auto) and mobile gaming (e.g. iphone apps) have all added to the success of the games market [3]; game sales topping $40 billion in 2008 [2].

One of the reasons why computer games are so appealing is that the world of the game is unlike the real world. It is an alternate reality that the person is free to explore and, if they are willing to put in the time and effort, it is a world which they can conquer. A "good" game can instill feelings of engagement in the player so intense that many gamers report devoting entire nights or weekends to playing games without consciously deciding to do so [4]. At these moments in time almost all of the players' attention is focused on the game, even to the extent that some people describe themselves as being "in the game" [5]. This experience is referred to as "immersion", a term used by gamers and reviewers alike. Immersion is often viewed as critical to game enjoyment. However, despite there being a broad understanding of the term, it is still not clear what exactly is meant by immersion and what causes it.

A well known concept in the psychology literature is that of "selective attention" (SA). SA refers to when a person chooses to attend to one source of information over others [6]. For example, in Cherry's dichotic listening tasks [7] participants were asked to shadow one auditory message while ignoring another. At the end of the task when asked about the content of the unattended message participants could only remember physical features, e.g. "it was a woman's voice". Similarly, immersive gameplay involves a person choosing to attend to the game over other aspects of their environment, e.g. their mother calling their name. Therefore the current research aimed to expand existing immersion knowledge by answering the following question: 'Is immersion just another form of attention?'

As well as theoretical implications, such research could have possible practical applications for a number of different gaming contexts. For example, being able to escape into the game world involves the player being highly engaged. If the processes behind this mental transportation were better understood this could mean that serious games designed for educational and therapeutic contexts could be made more immersive and more appealing for users [4]. There are also situations in which researchers may want to limit a person's immersion. For example, it has been suggested that children spending increasing amounts of time playing games and not being physically active could be linked to the rise in childhood obesity [8]. There have even been reports of some people dying from fatigue as a result of playing for too long without taking a break [9]. If the processes of immersion were better understood this could mean that researchers would have more of an insight into ways in which players can be encouraged to take breaks when playing a game.

2. Background & Related Work

2.1. THE CONCEPT OF IMMERSION. Before describing the current research, first it is necessary to explain why we chose to follow Brown and Cairns' conceptualization of immersion [5], and how this conceptualization relates to the well known concepts of Flow and Presence.

Carr [10] writes that immersion definitions can broadly be classified into two types: perceptual and psychological. Researchers that view immersion as a perceptual phenomenon refer to immersion as the degree to which a technology or experience monopolizes the senses of a user. In contrast, researchers that view immersion as a psychological phenomenon emphasise cognitive rather than sensory features of the game, referring to immersion as involving the player's "mental absorption" in the game world. In order to investigate which of these definitions is closest to gamers' understanding of the term when they refer to immersion in their gameplay, Brown and Cairns [5] conducted an interview study. The resulting grounded theory found that immersion was used to describe a person's degree of involvement with a computer game, thereby supporting the idea of immersion as a cognitive phenomenon. Furthermore, the theory identified a number of barriers that could limit the degree of involvement, and the type of barrier suggested different levels of immersion: engagement, engrossment and total immersion. Total immersion required the highest level of attention and was a rare and rather fleeting experience when gaming, whereas engagement and engrossment were more likely to occur.

Brown and Cairns' conceptualization of immersion [5] differs from that of other game researchers because, rather than investigating the typology of immersion, e.g. Ermi and Mayra [11], they chose to investigate the gradation of immersion. In other words, rather than investigating the differences between gaming experiences, Brown and Cairns [5] focus on the commonalities. They argue that although games may differ slightly in terms of why they are appealing and which features draw you into the gameplay, in terms of the immersive experience itself and the way that it progresses as a person's immersion deepens, all games follow a similar course of events.

Considering this conceptualization of immersion in relation to other relevant concepts, one can argue that the concept of Flow [12] corresponds to the highest level of immersion, "total immersion". Flow is specifically an optimal and therefore an extreme experience. In contrast, game immersion tends to be more of a suboptimal experience: the player is usually immersed in the game to some extent, but they are not immersed to the exclusion of all else and therefore not in Flow [13]. The concept of Presence can also be described as occurring at the highest level of immersion. However Presence does not necessarily equate immersion. For example it is possible to have Presence without being immersed, e.g. carrying out a tedious task in a virtual simulation [13].

2.2. FACTORS OF IMMERSION. Based on Brown and Cairns' conceptualization [5], the Immersive Experience Questionnaire (IEQ) was created. The IEQ aims to measure the general experience of immersion that is common to all games [14]. The questionnaire items refer to the specific experience of gameplay that has just occurred. Respondents are asked about the extent that the game world is more real than the real world, rather than the extent to which the person feels like they are the character, because not all games are character based. Social aspects of gaming are also not measured, because although the presence of other people can add to an immersive experience, they are not necessary for immersion to occur. A factor analytic study provided validation for the IEQ [14] and revealed that the general experience of immersion can be divided into five components: cognitive involvement, emotional involvement, real world dissociation, challenge and control.

3. Uniqueness of the Approach

When considering the relationship between SA and immersion, we recognised that SA was similar to one factor of the immersive experience in particular, the component dubbed "real world dissociation" (RWD). RWD can be defined as the feeling of being mentally transported into the game world and less aware of one's real world surroundings [14]. However, despite RWD being an essential part of the immersive experience, little is known about its characteristics. For example, one may ask to what extent is a person less aware of their real world surroundings as a result of playing a game? Therefore in our first study we wanted to explore the nature of RWD, to find out more about this aspect of the immersive experience. Being an exploratory research question, the first study conducted was qualitative.

The resulting grounded theory gave us an insight into the nature of RWD (as shall be described in the Results section). However it was still unclear as to whether RWD and SA could be differentiated. Therefore several experimental studies were conducted to provide further validation for the grounded theory. Using the SA literature as inspiration for ways in which RWD could be objectively measured, an auditory distraction paradigm was created. Participants were asked to play a game while 18 auditory distracters were played into the room. These were a mixture of game-relevant (6 items), person-relevant (6 items) and irrelevant (6 items). Game-relevant distracters were related to asteroids or spaceships, e.g. "Move the rocket to the right", "Space games are boring". Distractions relevant to the person were relevant to the situation of being in the testing room, e.g. "Tap your fingers to the right", "London is boring". Irrelevant distractions were not related to the game or the person, e.g. "Swing the bat to the right", "Collecting stamps is boring". All participants had been informed beforehand that auditory distracters would be present, however they were not aware that they would later be subjected to a surprise recall test - similar to the method of Cherry's dichotic listening tasks [6]. It was expected that the more immersed the person was in the gameplay, the lower they would score in their recall of the auditory distracters. In this paper the results of two of these experiments will be described. Experiment 1 was designed to test the hypothesis that participants playing games differing in feedback would differ in their recall of auditory distracters. Experiment 2 was designed to test the hypothesis that participants playing rigged games equal in cognitive load [15], a popular theory in the SA literature, would differ in their recall of auditory distracters depending on their perception of their game performance.

This approach to researching immersion is unique because it makes use of a mixed methodology. We viewed it as important not just to create a theory, but to also conduct experimental studies to further validate the theory. Furthermore, we are investigating an aspect of the immersive experience about which little was known before and we demonstrate the use of a new objective measure of RWD, recall of auditory distracters.

4. Results & Contributions

The method and results of the qualitative study and Experiments 1 and 2 will now be described. The contribution of this research to HCI will also be discussed.

4.1. GROUNDED THEORY. The first study conducted was a qualitative study. 13 experienced gamers (8 male, 5 female, mean age = 22 years) were interviewed for 50-60 minutes about their immersive gaming experiences. The data was transcribed and coded as it was collected, using open coding, axial coding and selective coding [16]. Based on these codes, a grounded theory (GT) of RWD was developed. The GT revealed that the sense of progression the player gets from the game-person interaction is key to the level of RWD experienced. The player needs to feel that they are progressing in terms of making sense of the controls and being able to successful act in the game. The player needs to feel that they are progressing in terms of their game performance, doing well in the gameplay and moving forward in the game narrative. If playing a game for a long time, the player also needs to feel that they progressing in terms of skill, being able to overcome obstacles increasing in difficulty. Feedback underpins this sense of progression, as it is feedback that allows a player to assess their performance in the game. Positive feedback motivates the player to keep playing; however some negative feedback is also needed, as this makes the player's success meaningful.

The GT also gave us an insight into the characteristics of RWD. Considering the processing of sounds in particular, gamers described a number of different scenarios. In some situations gamers did not respond to sounds because they were unaware of them. For example when the TV was playing in the background, even if their favourite show came on, a gamer might be oblivious to this; instead they are focused on the game's events. On the other hand, there are other situations in which gamers were aware of a sound but chose to ignore it, e.g. when their mother called their name or something related to the game was mentioned. In these situations a gamer is aware but still does not respond, because they do not want to break their sense of progression in the game. To explain these results, we suggest some kind of an attentional filter is at work. Irrelevant sounds are not processed deeply and so they go by unnoticed. In contrast, game-relevant and person-relevant sounds are processed deeply and so they are noticed. This bears similarities with a well known theory in the SA literature, Treisman's attenuation theory [17].

The GT also suggests that the RWD that occurs in gaming involves processes that are more complex than the contexts in which SA is traditionally considered, because games involve feedback. Such feedback is necessary to keep player engagement. To illustrate this difference, if one considers Lavie's cognitive load theory [16], another well known theory in the SA literature, it suggests that a person is less aware of distracters when they are focusing on a task that is more difficult or has more perceptual features (i.e. greater cognitive load). In contrast, our GT of RWD suggests that for games it is not simply the case that the more difficult the game the more a person is focused; it is how a person perceives their sense of progression that matters most, feedback playing a vital role in this.

4.2. EXPERIMENT 1. The aim of Experiment 1 was to test the hypothesis that participants playing games differing in feedback would differ in their recall of auditory distracters. Two versions of the game "Space Trek" were created, using Flash Professional 8.0 (see Figure 2 for a screenshot). In the "feedback" condition the game was programmed to give visual, auditory and score feedback for game performance. In the "no feedback" condition the game was programmed to give no feedback. For both conditions participants were instructed that the aim of the game was to collect as many stars as possible while avoiding the asteroids. While they played the game for 10 minutes, 18 auditory distracters were played into the room, which they were later asked to recall. There were 18 participants in total (14 female, 4 male, mean age = 23 years), 9 in the "feedback" condition and 9 in the "no feedback" condition.

The results revealed that the recall score of the "feedback" condition was significantly lower than that of the "no feedback" condition (means of 5.39 and 6.67 respectively, $t_{(16)}$ = -2.173, p=.045). In line with our GT we suggest the "feedback" condition were less aware of auditory distracters because they were better able to assess their performance in the game, and so had a greater sense of progression, than the "no feedback" condition. The results also supported the idea of selectivity for relevance. The "feedback" condition had a significantly lower recall score for irrelevant auditory distracters than the "no feedback" condition (means of 0.44 and 1.67 respectively, $t_{(16)}$ = -2.536, p=.022); however the "feedback" and "no feedback" conditions did not significantly differ in their recall scores of game-relevant (means of 2.67 and 3.06) and person-relevant distracters (means of 2.28 and 1.83), see Figure 3.

Figure 2. Screenshot of Space Trek.

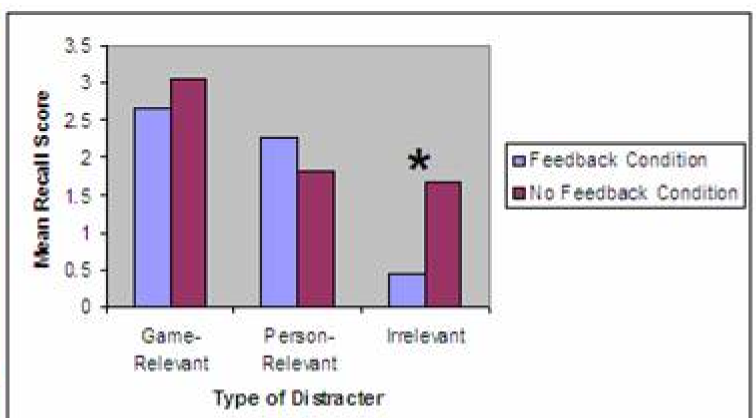

Figure 3. A bar graph showing the mean recall score of game-relevant, person-relevant and irrelevant auditory distracters for the "feedback" and "no feedback" conditions. An asterisk (*) signifies a significant difference between the conditions.

A limitation of this study, however, is that an alternative explanation is possible. As well as sense of progression the games also differed in terms of other game features, such as visuals and sounds. Therefore one can suggest that the differences in recall were due to differences in cognitive load, rather than differences in sense of progression.

4.3. EXPERIMENT 2. The aim of Experiment 2 was to test the hypothesis that participants playing rigged games equal in cognitive load would differ in their recall of auditory distracters depending on their perception of their game performance. In the "Rigged Space Trek" game, like the original "Space Trek" game the player must collect stars and avoid asteroids. However there is also an extra game component, a laser that hits the rocket (see Figure 4 for a screenshot). This laser can not be avoided by the player and serves the function of rigging the game. Two versions of the game were created. In the "high performance" condition the laser was programmed to have a positive impact, adding points to the player's score. In the "low performance" condition the laser was programmed to have a negative impact, deducting points from the player's score. Regarding the cognitive load [15] of the two games, the games' perceptual features are virtually identical. The task difficulty of the games is also equal, as the controls are the same for both games. Like Experiment 1, 18 auditory distracters were played into the room during gameplay, which participants were later asked to recall. There were 41 participants tested in total (31 female, 10 male, mean age = 24 years), 23 in the "high performance" condition and 18 in the "low performance" condition.

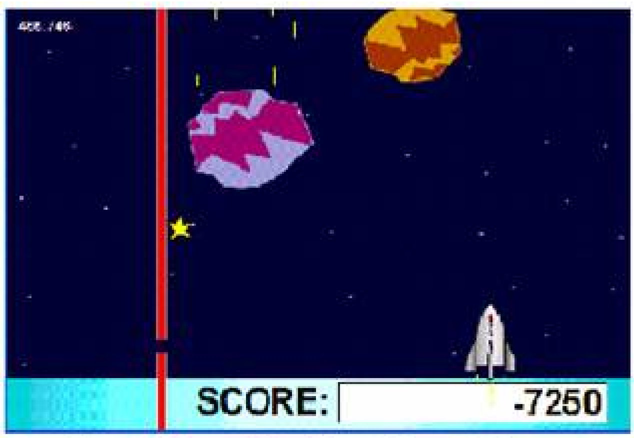

Figure 4. Screenshot of Rigged Space Trek.

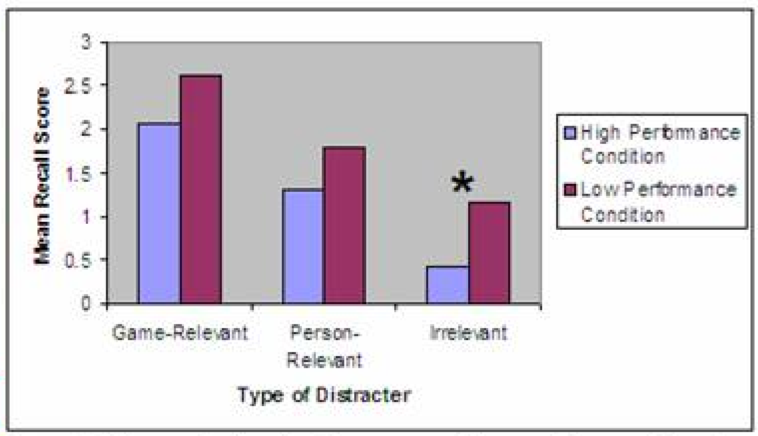

Figure 5. A bar graph showing the mean recall score of game-relevant, person-relevant and irrelevant auditory distracters for the "high performance" and "low performance" conditions. An asterisk (*) signifies a significant difference between the conditions.

The results revealed that the recall score of the "high performance" condition was significantly lower than that of the "low performance" condition (means of 3.78 and 5.54 respectively, $t_{(39)}$ = 4.186, p=.001). In line with our GT we suggest that the "high performance" condition were less aware of auditory distracters because they perceived themselves as performing well in the game, and so had a greater sense of progression, than the "low performance" condition. The results also supported the idea of selectivity for relevance. The "high performance" condition had a significantly lower recall score for irrelevant auditory distracters than the "low performance" condition (means of 0.42 and 1.15 respectively, $t_{(39)}$ = 2.817, p=.008); however the "high performance" and "low performance" conditions did not significantly differ in their recall scores of game-relevant (means of 2.08 and 2.61) and person-relevant distracters (means of 1.31 and 1.80), see Figure 5.

An important implication of Experiment 2 is that it shows a dissociation between immersion and cognitive load. Note that one could argue that rather than task difficulty referring to the controls of the game, it should refer to how difficult it is to gain points. However, under such an interpretation, the results are still not as expected: the "low performance" condition (higher load) recalled significantly more distracters than the "high performance" condition (lower load). This adds further strength to the claims of our GT, as the results suggests that it is purely motivation that is affecting participant recall, not higher load.

As an aside, it is interesting to note that performance of participants in the two conditions did not actually differ: both conditions successfully collected over 60% of stars and successfully avoided over 95% of asteroids. Thus we emphasize again that it was only the perception of performance that differed.

4.4. CONTRIBUTION TO HCI. Overall we conclude that game immersion is not just a form of SA. The two concepts are similar because, like SA, RWD can also be measured via recall of auditory distracters (Exp1, Exp2) and there seems to be an attentional filter for relevance (GT, Exp1, Exp2). However it is also evident that RWD is not just a result of increased cognitive load: motivation plays a hugely important role in a player's allocation of attentional resources (Exp2). This motivation is affected by the feedback that the player receives from the game and their perception of their game performance (GT, Exp1, Exp2). It is also this motivation that causes gamers to choose to ignore sounds that they are aware of, e.g. their mother calling their name, as they do not want to disrupt their sense of progression in the game (GT).

This research allows us to gain a greater theoretical understanding of game immersion and its relationship with SA. Furthermore, we have developed a new paradigm for measuring RWD. Considering the practical applications of this research, we suggest that it is the intrinsically motivational nature of gameplay that makes games special. In future research, by exploring the impact of feedback further we can gain an insight into what it is that changes a task from an activity that somebody is concentrating on, to an immersive activity that somebody feels highly motivated to complete. Such knowledge could have particular relevance for the design of educational games [4]. It could also be useful for researchers developing measures to help gamers limit the time they spend gaming, e.g. Eggen et al. [18].

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