The Effect of Time Manipulation on Immersion in Digital Games

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Abstract. Many empirical studies look into identifying factors that influence the quality of experience in video games. In this paper, we present research into the effect of playing time and players' perception of the time on their immersion in the game. We invited 20 participants to play a puzzle game *Bejeweled 2* for 7 minutes. They played the game in two conditions, namely, correct time (timer was programmed to be exactly 7 minutes) and wrong time (the countdown was set to be for 6 minutes, but was presented as a 7 minute timer to the player). Players' immersion scores were measured after the game using the IEQ. The results show no significant difference in immersion scores between the two conditions and participants' comments also revealed that they perceived no difference in playing time between the conditions. This suggests that there is a dissociation between gaming time and subjective experience of gaming. Further research is required to investigate the relationship between playing time and positive gaming experiences.

Keywords: Player Experience, Immersion, Playing Time, Digital Games, User Experience.

1 Introduction

Video games are now one of the most popular types of entertainment since the first video game was introduced several decades ago. The Electronic Software Association (ESA) reported that 65% of U.S. households own a device used to play videogames (ESA, 2016). Similarly, the Association for UK Interactive Entertainment (UKIE) reported that in the year 2016, the overall UK games market value was GBP4.33 billion (UKIE, 2017). Similar pattern can be seen in the Asia where the revenue from the games market in 2017 is calculated to be amounted USD51.2 billion (ISFE, 2017).

This wide acceptance of video games has opened the opportunity for researchers to further investigate the use and application of video games in other fields, such as healthcare (Kato, 2010), education (Griffiths, 2002), and military (Smith, 2009)

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amongst other fields. Moreover, research into player experience (PX) has become more prominent in recent years, focusing not only on what makes games attractive to the players, but also how positive experiences are formed.

Several terms have been used to describe positive experiences of playing video games. These terms include fun (Huizinga, 2003), flow (Chen, 2007), presence (Slater et al.,1994), and immersion (Brown and Cairns, 2004) amongst others. These experiences are often used interchangeably to discuss the experience of playing digital games. In this paper, we do not aim to push the boundaries of distinguishing these experiences, instead we focus on the widely-used term, namely, immersion to describe players' involvement with video games that results in real world dissociation and loss of time- and self-awareness.

Although fun, flow, presence, and immersion are distinct experiences in theory, there is a common element that connects these experiences. This element is time. Gamers feel that they lose track of time (Luthman et al., 2009), they experience time distortion (Rau et al., 2006), and frequently underestimate the time they spend playing the games (Tobin and Grondin, 2009). This has been looked as an important factor in gaming in order to understand how video game players perceive time allows game designers and game user researchers to gain deeper insight into player experience (Nordin, 2014).

2 Relevant Studies

2.1 Experiences of Playing Videogames

Huizinga (2003) argues that the element of fun is important in video games – games allow players to make believe of another reality whilst playing. Juul (2001) adds that the agency in video games allows players to interact with the games, which is not typical of other types of entertainment, for example watching a film or reading a book. Having this agency while interactive with a game world allows players to experience fun.

Moreover, Chen (2007) had concluded four-step methodology to provide an enjoyable interactive experience for the widest variety and number of users, a game's, and more generally any end-user technology's based on the psychology theory of flow that has been investigated by Nakamura and Csikszentmihalyi (2009). The theory of flow can be described as an optimal state in which the player experiences total absorption and enjoyment while interacting with the game. The theory of flow is important as it has been used as a base platform specifically to understand more of a player's interaction with a game (Cowley et al., 2008).

Presence in gaming has also been discussed to be one of the engagement experiences in playing videogames. Slater et. al (1994) defined presence as a player's

psychological sense of being in a virtual environment while realizing that they physically remain in the real world. Presence can be divided into six different forms (Lombard and Ditton, 1997). According to Nordin (2014), the first three forms of presence are related to social presence and the other three forms relate to spatial presence. The interaction between players with other players or in a team when playing games creates an experience of social presence while the games that the players play especially games that provides a high sense of realism in graphics creates a spatial presence that has been define as sense of realism, sense of "transportation" (otherwise described as the sense of "being there"), and the psychological and sensory immersion (Nordin, 2014). Hudson and Cairns (2016) investigate on this further and suggest that players can either be competitively or collaboratively present in video games.

In addition, immersion is also frequently used to describe a positive experience of playing video games. The term "immersion" is used to describe a person's degree of involvement with a computer game. (Jennet et al., 2008). Immersion is a commonly used term by gamers, as well as game designers and developers to describe the experience of playing digital games. Brown and Cairns (2004) has conducted a grounded theory that suggested different level of immersion: engagement, engrossment and total immersion.

2.2 Immersion and Time

Immersion lead to loss of one's awareness of their surroundings and decreased awareness of time. The player becomes so involved with the game that the game becomes the only thing that matters (Brown and Cairns, 2004). Brown and Cairns (2004) describe immersion as a graded experience with three stages. The first stage is engagement, which is achieved if the player likes the game and the controls and the feedback provided by the game correspond in an appropriate manner. The second stage is engrossment. To enter this stage, players need to like the atmosphere of the game and to empathize with the characters in the game. Once on this stage, they can enter the final total immersion stage. Total immersion leads to the separation between the real and virtual worlds, much like presence – at this stage the game is all that matters to the player.

Based on the theory of flow, cognitive absorption, and presence, Jennett et. al (2008) have developed a questionnaire to measure immersion, which is based on five constructs, namely, cognitive involvement, emotional involvement, real world dissociation, challenge, and control. It is used to measure the immersive experience of players in a game. This self-reported measurement tool has been used widely for research on immersion in games. Drachen et. al (2000) has been using this measurement tools in validate good gameplay experiences (GX) while Molins et. al (2014) had conducted experiments to increase motivation and learning rate of students using games as new platforms in learning.

Looking at specific studies on immersion and time, Sanders and Cairns (2010) conducted an experiment that suggests that players underestimate the amount of time they engage in the game for when there are immersed in the game. Nordin (2014) extend this study to further investigate the relationship of immersion and time perception. However, Nordin (2014) argues that time has no direct effect to immersion during short playing sessions.

In a Flow theory, players were having a distortion of temporal experience – a sense that time has passed faster than normal when the players were being "in flow". (Nakamura and Csikszentmihalyi, 2009). To gain further insight into why players lose track of time while gaming, Wood et al. (2007) conducted a study, which reports that 99% of the players' experiencing "time loss" whilst playing video games while Luthman et al., (2009) reported that gamers claimed to "lose track of time" in the studies conducted. Tobin and Grondin (2009) also observed players reporting that their perception of session duration was shorter than the actual time they played the game for. These studies provide some evidence that suggests that time, as perceived by players, is not always accurate and appears to be distorted when being engaged in video game playing. However, outside Nordin (2014), little research has gone into studying how time perception influences player experience, such as immersion. Therefore, we aim to gather some preliminary results that would allow us to shed some light on this interesting problem.

3 Methodology

3.1 Aim

The study is aimed at researching the effect of time and time perception on immersion whilst playing a video game. Our hypothesis is that the players experience the second gaming session to be longer than the first session while playing the same game. In this study, which was a within-subject design, we also explore whether players' perception of time differs based on the perceived length of the gaming session, i.e. playing a game with a timer displaying real time vs. playing the game when the countdown is deceptively sped up.

3.2 Experimental Design

This experiment is within-subject design, where playing time is the independent variable (IV) and immersion scores, as measured by the IEQ (Jennett et al., 2008) is the dependent variable (DV). Using a psychometric questionnaire allows for the rigorous measurement and assessment of players' subjective emotion and cognition during game play by asking them structured questions post-gaming (Nacke and Lindley, 2010).

3.3 Participants

20 participants were recruited for the study (9 male, 11 female) from the student population at UNITAR International University, Malaysia. The age range was between 19 and 25 years (mean = 22.05, SD = 7.58). All participants played video games at least once a week and all of them were familiar with *Bejeweled* – the game we used for this study.

3.4 Game: Bejeweled 2

For this study, we chose *Bejeweled 2* – a sequel to a tile-matching puzzle game *Bejeweled*, which was developed and published by PopCap Games. The main objective of the game is to gain points by 'popping' as many jewels on the screen within a certain timeframe by forming 'chains' of jewels. The player can form a chain of three or more gems of the same color by swapping one gem with an adjoining one. The game was chosen due to its relative popularity, ease of controls, and relatively steep learning curve.

3.5 Materials

The time was displayed to the players during the game on a separate screen next to the screen on which the players interacted with the game during the experiment. Two versions of the timer were used: both were set to display 7 minutes to the player, however one of them was modified to count down faster than the other. To be specific, one timer had a countdown of 7 minutes (real-time) and the other one 6 minutes (sped up). Participants were not aware of the modifications. Participants also did not have any personal items on them during the experiment that would allow them to track the time in real time.

3.6 Procedure

At the start of the experiment, each participant was briefed about the aim of the experiment. After that they read and signed an informed consent form if they agreed with all the terms. After that, they received an instruction sheet detailing the experiment procedure. Participants then played the first level of Bejeweled 2 to familiarize themselves with the controls and the environment. At this point, no timer had yet been set. When the player was comfortable with the controls, they played bejeweled for 6 minutes, which was displayed real time on the timer. They were then interrupted and given a demographics and immersive experience questionnaires to fill out.

After completing the questionnaires, each participant engaged with the game once again, but this time the modified timer was set. The players were interrupted once the

timer stopped, followed by another set of the IEQ with two additional questions about players' perception of time while playing the game in the second session compared to the first session, as well as some open questions asking to elaborate on that comparison. Each participant was then debriefed and provided with a Kinder Bueno chocolate bar as a token of appreciation.

4 Results

Table 1: Mean and standard deviation values for immersion scores for each condition.

	Correct Time	**Wrong Time**
Immersion Score	103.65 (19.92)	103.70 (21.43)
Game Scores	5347.56 (9361.13)	2137.70 (1521.81)
Did the first session feel longer than second session	3.00 (1.07)	

Table 1 shows the means and standard deviations of the immersion scores in the two conditions. Interestingly, the results from paired-sample t-test shows no significant difference in immersion scores between the conditions $t(19) = -0.21$, $p > 0.05$ with effect size Cohen's $d = -0.002$. Participants' answers gathered using additional questions at the end of the second session suggest that participants perceived no difference between the two sessions in terms of time they spent playing them: $t(19) = 0.00$, $p < 0.05$. Participants' scores achieved in the game while playing for 6 and 7 minutes were not significantly different: $t(19) = 1.586$, $p > 0.05$ with medium effect size Cohen's $d = 0.48$.

5 Discussion

The results show no significant effect of time and time perception of players on their levels of immersion whilst playing a video game. Brown and Cairns (2004) argue that participants need to achieve three level of involvement in order to get a total immersion in playing games: engagement, engrossment, and total immersion. However, the data shows that participants most probably lost of interest towards the genre of the games hence effecting the results. From out of 20 participants, the data showed only four indicated liking casual games, such as Bejeweled, while the rest of the participants stated their interest in playing other genres, such as Role-Playing Games (RPG), First Person Shooters (FPS), online or multi-player games, sports and action games.

Seven players out of the 20 stated that they did not notice or paid attention to the time difference between sessions, because they felt that they were enjoying playing the game and invested much effort into achieving higher scores in the second session. Whereas two players reported feeling no time difference at all between the two sessions. Both were regular gamers usually playing games that require much longer time investment, such as multi-player and RPG games. Interestingly though, one player reportedly experienced the time differences between the two sessions, which they explained as feeling unmotivated due to the repetitive nature of the game.

6 Conclusion

The aim of the paper was to investigate the effect of play duration and players' time perception on their immersion in the game. According to our data, there was no significant effect of time on players' levels of immersion when playing a casual video game, *Bejeweled 2*. It is an interesting finding, considering that the difference in time was substantial for a video game of this kind. However, more research needs to be done using different video games genres in order to explore whether the amount of time players engage with a game for have an effect on their immersive experience, and whether their perception of the time differs based on the different lengths of gaming sessions and video game genres.

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