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Time Loss Whilst Playing Video Games: Is there a Relationship to Addictive Behaviours?

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Abstract At present, little is known about why subjective time loss occurs whilst playing video games other than that it may relate to features of escape, immersion and arousal—all of which have been implicated in the development of addictive behaviours. This study examined subjective time loss of 40 undergraduate students (26 males and 14 females with a mean age of 21.4 years) whilst playing one of two video games in an experimental setting. Mood state before and after game playing was also examined using the Profile of Mood States—Short Form (POMS-SF, Grove & Prapavessis, 1992). Results found that, females significantly underestimated the time that they were playing compared to males. Total Mood Disturbance increased after playing one of the games, but only for participants who reported that they would liked to have continued playing for longer. There were no gender differences in relation to mood state. It is concluded that time loss is not (in itself) a precipitating or facilitating factor relating to addictive behaviour patterns.

Keywords Video games playing · Time loss · Addiction · Mood states · Escape · Arousal

Introduction

To date there has been relatively little psychological research examining video game playing. Furthermore, research that has been published tends to focus on specific issues such as the relationship between video game violence and 'real world' violence (e.g., Anderson & Dill, 2000; Griffiths, 1998; Wiegman & Schie, 1998). Furthermore, most published studies have focused on children and adolescents (Griffiths & Wood, 2000). One of the more consistent findings in video game research is the marked gender difference in relation to patterns of video game playing behaviour. Males have been found to play video games significantly more regularly than females (e.g., Griffiths, 1997a, b; Griffiths & Hunt

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(1998); Griffiths & Hunt, 1995, Gupta & Derevensky, 1996; McNamee, 1995; Phillips, Rolls, Rouse & Griffiths, 1995; Wood, Gupta, Derevensky & Griffiths, 2004).

Several researchers have noted that video game playing and some forms of gambling (e.g., slot machines) share many common features (e.g., Brown & Robertson, 1993; Fisher, 1994; Griffiths, 1991, 1993, 1997a, b; Griffiths & Wood, 2000; Gupta & Derevensky, 1997). High frequency video game playing behaviour also appears to share certain characteristics with problem gambling behaviour, in particular, losing track of time whilst playing (Wood, Gupta et al., 2004, Wood, Griffiths, Chappell, & Davies, 2004). According to Jacobs's *General Theory of Addictions* (1986), the relationship between the individual and their addictive behaviour is rooted in a need to increase or decrease arousal levels. Put simply, an addicted person takes part in their chosen activity (or consumes a particular substance) to escape from the reality of their existence. Therefore, any activity that has the capacity to be either arousing and/ or relaxing, and that can allow a person to be distracted from their normal lives, is likely to be participated in excessively by some individuals.

Both gambling and video game playing fall into this category of activity. Whilst most video game players are unlikely to develop problems with their game playing behaviour, it is interesting to note that they may experience time loss in the same way as a problem gambler who is engaged in a gambling activity (Wood, Gupta et al., 2004). Brown (1989) has argued that video gaming is an exercise in fantasy and that this can have an important effect on outcomes in reality. According to Brown, these biological functions include the regulation of arousal, (i.e., a decrease through escape or recreation or an increase through competition). Wood, Gupta et al. (2004) also showed that video game playing may be used by some players as a means of mood modification. They found that significantly more males (61.6%) than females (34.0%) reported that they played video games for excitement. Males (55.9%) also reported playing video games for purposes of relaxation more so than females (37.1%). Wood, Gupta et al. (2004) also found that significantly more 'high frequency'[1] video game players (78%) reported losing track of time when playing video games than 'low frequency' players (46%). It would appear that there are features of video game playing that have the potential to absorb some player's attention to the extent that their perception of time is altered. Previous studies have found that regular video game players often report playing for longer periods than they intended (e.g., Griffiths & Hunt, 1995; Phillips et al., 1995). Wood, Gupta et al. (2004) found that 18% of males in their sample were concerned about how much time they spent playing video games compared to only 3.7% of females.

A recent study examining the structural characteristics of video games (Wood, Griffiths et al., 2004) identified a number of features of games that contribute toward how rewarding a player perceives the activity to be. These characteristics included elements such as sound, graphics, background and setting, duration of game, rate of play, advancement rate, use of humour, control options, game dynamics, winning and losing features, character development, brand assurance and multi-player features. Therefore, it seems likely that video games may differ widely in terms of the potential for either inducing time loss in the player, and/or influencing their mood states. However, there are currently no studies (that the authors are aware of) that have attempted to objectively measure time loss whilst playing video games, or the affect that video game playing may have on mood states.

[1] High frequency players were defined as playing video games at least five times a week for a minimum of 1.5 h per session. Low frequency players were defined as playing video games two days a week or less, and an hour or less during each playing session.

At present, little is known about why subjective time loss occurs whilst playing video games other than that it may relate to features of escape, immersion and arousal. Furthermore, we do not know if different types of video games (e.g., simulations, platform games, role playing games, etc.) lead to varying degrees of subjective time loss. This study aimed to examine participants' perceptions of time whilst engaged in video game playing, and whether or not there would be differences in mood state before and after playing one of two distinctly different video games. Based on previous literature there were a number of hypotheses. These were that:

H1—There will be a significant difference in participants' time estimates according to how frequently they report playing video games.
H2—Male video game players will be significantly less accurate at estimating how long they have been playing video games compared to female video game players.
H3—There will be a significant difference in participants' time estimates according to the type of video game that is played.
H4—Total Mood Disturbance (TMD) will differ significantly before and after playing either of the video games.

Materials and Methods

Participants

The total sample comprised 26 males and 14 females with a mean age of 21.4 years (S.D.= 4.0 years).

Materials

Video Games Two video games were used for participants to play. These were Unreal[2] (played on a PC game with keyboard controls) and Ico[3] (played on a *Sony PlayStation 2* using a game pad).

Profile of Mood States (POMS-SF) Participants' mood state before and after playing was measured using the POMS-SF (Grove & Prapavessis, 1992). This consists of eight negative mood adjectives (angry/hostile, irritated, frustrated, guilty, stressed, depressed, unhappy, and anxious) and six positive mood states (happy, pleased, energetic, joyful, relaxed and having fun). Participants indicate on a series of five-point Likert scale statements ranging from 'not at all' to 'extremely' the extent to which they were experiencing each mood state. Each mood state subscale is measured using between five and seven of these statements. It is has been asserted that these mood states represent the dimensions of positive and negative affect (Diener & Emmons, 1985; Gauvin & Szabo, 1992; Szabo & Parkin, 2001). Each mood state subscale can be measured separately by totalling the scores generated. Total Mood Disturbance (TMD) is calculated by summing the totals for the negative subscales and then subtracting the totals for the positive subscales.

[2] *Unreal* is a first person shooter where the character runs around an arena shooting at other characters (in this case non-player characters), whilst trying to avoid being shot him/herself.

[3] *Ico* is a third person perspective adventure game where the character is a small boy who must rescue a girl and escape from a castle avoiding various black shadowy ghosts.

Pre- and Post-Experiment Questionnaires Participants were given a pre-experimental questionnaire to fill out before playing the game which asked about basic demographics, playing experiences, game playing preferences, and reasons for playing video games. After they had played the video game participants were given a post-experimental questionnaire asking for their overall assessment of the game, and general experience of playing the game.

Procedure

Participants were recruited through opportunity and snowball sampling and were largely self-selecting. Advertisements were posted around Nottingham Trent University (NTU) campus and e-mails were sent to NTU students. Respondents from a previous online survey study by the authors were also contacted. Participants were informed that they would be paid (£5) to take part in a psychological study of video game playing examining perceptions and experiences of playing. They were told the study varied in completion time but that they should allow 1 h to complete the study.

The experiment was conducted in a dedicated Gaming Laboratory using either a PC with keyboard controls (to play the video game *Unreal*) or a *Sony PlayStation 2* with a gamepad (to play the video game *Ico*). Participants completed the short form version of the Profile of Mood States (POMS-SF) before and after playing the video game along with pre- and post-experimental questionnaires (see Materials). The study took place over a period of 2 months, during which participants arranged a convenient appointment to take part in the study. Each participant completed the study alone. Participants were given a choice of which game to play (if they had a preference).

Once the basic nature of the study had been explained and a consent form had been completed, the study began. Participants completed the first POMS-SF and the pre-experimental questionnaire, and then played their video game of choice. After playing the game for 13 min they were interrupted and asked to estimate how long they had been playing for, this was repeated after 37 min and finally after 45 min. A stopwatch was used to time the three intervals at which the experimenter would ask them to estimate how long they had been playing. Straight after the playing period, they filled out a second POMS-SF and the post-experimental questionnaire. They were then interviewed about their experience of the game and the study, and their everyday experiences of time loss whilst playing video games.

Results

Play Frequency and Gaming Preferences The mean number of times that participants reported playing video games per week was 8.22 (S.D.=8.40) and the mean number of minutes that they reported an average gaming session lasted was 121 min (SD=137 min). The most popular format for playing games was on a dedicated gaming console with 62.5% of participants reporting that they played on one at least once a week. This was followed by a stand alone PC (47.5%), mobile phone (27.5%), online PC (25%), and a portable games console (17.5%).

Time Loss/Gain When asked in the pre-experimental questionnaire how often they found themselves losing track of time whilst playing video games, 67.5% said that they did either ‘frequently’ or ‘always,’ and there were no significant gender differences. Findings from

the experiment showed a significant gender difference in time estimates (t=2.02, d.f.=38, p<0.05). More females (79%) underestimated time compared to males (58%) However, overall time estimates varied considerably between participants. These ranged from a loss of −45 min to a gain of +40 min, and a mean of −3.8 min (S.D.=22.1 min). Results from an independent t-test showed no significant differences in the reported frequency of game playing per week between those who either over or underestimated time in the study (t= 0.831, d.f.=38, p<0.41). There were also no significant differences in time loss/gain according to the type of game that was played during the study (t=−1.004, d.f.=38, p<0.32).

Mood States A series of related t-tests showed that there was a significant increase in Total Mood Disturbance (TMD) as measured by the POMS-SF after playing the games compared to before playing the games (see Table 1). However, this was only significant for those participants who answered that they would have liked to continue playing the game after the experiment had ended. "Wanting to play longer" was not significantly related to either specific game. However, when controlling for the type of game that was played, TMD only increased significantly for those participants who played *Ico* (t=−3.431, d.f.=20, p=0.003). Overall, two of the subscales independently showed significant results. There was a decrease in 'confusion' (t=−3.13, d.f.=38, p=0.003), and also a decrease in 'self-esteem' (t=20.21, d.f.=38, p=0.001). This was found to be significant for both games (see Table 1). There were no gender differences related to the POMS-SF scores.

Post-Experimental Questionnaire The majority of participants suggested that they thought that the game they played during the experiment was enjoyable (57.5%) and just over a third (37.5%) rated that the game was "average." These figures did not differ significantly for either game. The majority of participants (80%) said that they found the controls easy to use and there was no significant difference between the games in this respect. Males were significantly more likely to have been playing games for longer than females (12.4 years vs. 9.21 years) (t=2.263, d.f.=38, p=0.029).

Post Experimental Interview Participants were asked about their experiences of playing the games and whether or not they (generally) used any strategies to avoid time loss whilst playing video games. Several participants reported that they set alarms, had clocks in view and/or instructed a friend or relative to interrupt them after they had been playing for a certain length of time.

Table 1 Means, Standard Deviations, and t Values for the Measure of the POMS Inventory

Poms Inventory	Pre VG Playing	Post VG Playing	t (40)	P <
Anger	7.450	7.725	−0.391	0.698
Confusion	8.025	6.750	3.135	0.003*
Depression	8.575	8.150	0.652	0.519
Esteem	20.425	13.150	20.218	0.001*
Fatigue	9.850	9.175	1.070	0.291
Tension	9.350	10.225	−1.682	0.101
Vigour	11.775	12.125	−0.516	0.609
TMD	11.050	16.750	−2.433	0.020*

*Significant difference at the 5% level at least.

Discussion

Hypothesis four (Total Mood Disturbance will differ significantly before and after playing either of the video games) was partially supported. Total Mood Disturbance differed significantly before and after playing the video game *Ico*, but only for those players who suggested that they would have liked to have played for longer. Hypothesis two (male video game players will be significantly less accurate at estimating how long they have been playing video games compared to female video game players) was not supported. However, there was a significant difference in time estimates between genders but not in the direction predicted. Females significantly underestimated the time that they had been playing compared to males. Hypotheses one (there will be a significant difference in participants' time estimates according to how frequently they report playing video games) and three (there will be a significant difference in participants' time estimates according to the type of video game that is played) were not supported. There was no significant difference in participants' time estimates according to how frequently they reported playing video games. There was no significant difference in participants' time estimates according to the type of video game that was played.

However, the majority of the participants did experience time loss—particularly females. The results suggest that this may be a fairly normal occurrence for such activities. As a consequence, time loss, in itself, may not be a cause of addictive behaviours, as it appears to be present in non-problematic populations. Whether or not time loss is more pronounced in people with addictive behaviour problems remains to be seen. Time loss may be an appealing feature for a person who wishes to escape from reality and may, therefore, be a feature of games that is more rewarding to problematic players than non-problematic players. Why females underestimated the time more than males is also not clear unless it relates to females relative lack of experience in playing video games. If this was the case then it may be that time loss can be countered through increased experience. However, further research is needed to confirm or refute this suggestion.

From the post-experimental interviews, it was clear that most players were aware of time loss when playing video games, had experienced it before, and several took measures to guard against it. For example, one player had his girlfriend monitor how long he had been playing, and on occasion instructed her that she should only let him play once he had done his college work for that day. These types of strategies may be indicative of healthy coping styles and warrant further investigation. Furthermore, it is interesting to note that although time loss was more pronounced in female participants, it is typically males who develop problem behaviours in relation to similar activities such as slot machine gambling. This may be further evidence that time loss is not (in itself) a precipitating or facilitating factor relating to addictive behaviour patterns. However, the sample was not taken from a clinical population and care should be taken before generalising this information to clinical samples. Furthermore time estimates in general varied considerably across the sample, although overall most participants lost time rather than gained time.

It was interesting to note the significant increase in TMD before and after playing the game *Ico.* This may relate to the nature of the game itself with the main character a small boy entombed in a gothic style castle, haunted by black shadowy ghouls. This is a very atmospheric game with quite realistic graphics and eerie sound effects. The main character is initially alone in this setting until he is joined by 'Yonda' a frail looking girl who he has to protect and take with him wherever he goes. It is then perhaps not surprising that these features affected the participants' mood states.

In contrast, *Unreal* is fast moving, full of action, and involves many non-player characters. The music is upbeat and the atmosphere is one of competition rather than

mystery. It could also be that the dynamics of the games are such that in the limited time period it may have been easier for those participants who played *Unreal* to be absorbed into the game than those who played *Ico*. *Unreal* begins with lots of action whereas *Ico* requires more time to explore the game and to solve puzzles. Furthermore, TMD only increased significantly for those participants who said they would have liked to have played for longer. It could be that the increase in TMD related to the frustration at having to end the game at a point where they would have liked to continue. This would be particularly true of *Ico* as it requires some time to solve problems and advance forward in the game. It might also be the case that some participants may have been disturbed at the prospect of having to return to 'reality' and face the rest of the working day. The study was conducted at a time when students were working to fairly imminent coursework deadlines.

The reduction in self-esteem may relate to the fact that participants only played the game for 45 min. This may not be enough time for them to properly master the game, particularly as the vast majority of participants reported that they would have liked to have played the game for longer. This again highlights the importance of the absorption rate, that is, how quickly someone can get into the game. If absorption rate is slow, then it may be that self-esteem would initially decrease until the game has been played for long enough for the player to become proficient. More research is needed to confirm any possible relationship between self-esteem, length of time playing a video game, and the absorption rate of the game.

The study also found a significant reduction in 'confusion' between the start of the study and the end of the study. However, it is likely that this was due to the participants' uncertainty about the study, what exactly it entailed, and suspicion of psychological tests in general. Once the study was over, participants were a lot clearer about the nature of the study and would have presumably been less confused.

Finally, it is worth mentioning the nature of the study itself and some of the weaknesses of the experimental method for examining psychological aspects of video game playing. It is difficult to simulate a social activity such as video game playing in a laboratory setting as people usually play games as a leisure activity, often in the company of friends, and they play games over time. They gradually master the skills required and they either become more absorbed by the game or they lose interest and cease to play. In contrast, our participants were required to turn up at a pre-arranged time, to fill out various forms, to be interrupted constantly, and to play only once. They performed this task on their own in a small laboratory with no windows and no distractions such as mobile phones, other people, television etc.

Initially, it seemed as though just sitting in the room for almost an hour might have increased TMD. However, this seems unlikely as there was only a significant increase for those participants who played *Ico*. Nevertheless, it should be noted that time loss, may very well have a completely different meaning in this kind of artificial setting compared to real life. Participants knew that the study would last for approximately 1 h and most of them had things to do after the study (such as attend a lecture). This is very different situation from someone who is playing at home at night, is relaxed, may have had a few drinks, and then suddenly realises that it is actually 3 A.M. in the morning and they have been playing all night.

In addition, when people are playing for their own entertainment they may choose very different games to the ones used in this study. Wherever possible, participants were given a choice between the two games but there are so many different types of games that it is possible that they would not usually play the games supplied in the study. However, participants were still engaged by the games, and most of them experienced time loss. To

examine time loss as normally experienced by gamers, research of a qualitative nature is needed. This would allow the examination of video game playing in a more naturalistic context. A useful follow-up to the study would be to use in-depth interviews investigating gamers' personal experiences of time loss and the social context within which their gaming takes place.

Research into subjective time loss whilst playing video games offers the potential to help understand a phenomenon that may be one of the basic processes underlying addictive behaviours patterns. Such information could be used to help develop safeguards designed to raise an individual's awareness of time whilst engaged in activities such as video game playing, gambling and other immersive activities.

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