



King, D., Delfabbro, P., & Griffiths, M. (2010). The Role of Structural Characteristics in Problem Video Game Playing: A Review. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace*, 4(1), article 6.  
<http://cyberpsychology.eu/view.php?cisloclanku=2010041401&article=6>

## The Role of Structural Characteristics in Problem Video Game Playing: A Review

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### ABSTRACT

*The structural characteristics of video games may play an important role in explaining why some people play video games to excess. This paper provides a review of the literature on structural features of video games and the psychological experience of playing video games. The dominant view of the appeal of video games is based on operant conditioning theory and the notion that video games satisfy various needs for social interaction and belonging. However, there is a lack of experimental and longitudinal data that assesses the importance of specific features in video games in excessive video game playing. Various challenges in studying the structural features of video games are discussed. Potential directions for future research are outlined, notably the need to identify what problem (as opposed to casual) players seek from the video games they play.*

Keywords: video games, structural characteristics, technology-based addiction

### Introduction

Video game playing is an increasingly popular leisure activity around the world. However, for some people, excessive video game playing has various adverse personal and social consequences. Research to date has identified a minority of players who sacrifice sleep, school and job productivity, household chores, time spent with significant others, and other major responsibilities in order to play video games offline (Egli & Myers, 1984; Keepers, 1990; Griffiths & Davies, 2005) and online (Chappell, Eatough, Davies, & Griffiths, 2006; Grüsser, Thalemann, & Griffiths, 2007). For some of these players, it has been argued, video game playing manifests as a form of behavioural addiction, similar to problem gambling (Fisher, 1994; Griffiths, 2000; Salguero & Moran, 2002). This label of video game 'addiction' is not without controversy. Some theorists feel that it does more harm than good to place activities like video game playing, a legal activity enjoyed by millions of people, within a category traditionally linked with substance abuse (Jaffe, 1990; Shaffer, Hall, & Vander Bilt, 2000). However, the lack of agreement as to whether video game playing may be considered an 'addiction' has arguably been a distraction to the greater research question: Why do people play video games excessively?

The study of problem video game play is in its infancy. Numerous survey studies have been conducted which examine the general playing population, including demographic information and playing variables (Griffiths & Hunt, 1995; Griffiths, Davies & Chappell, 2004). It is often reported that the typical player is male, aged in the early twenties, and plays approximately 15 to 20 hours per week. However, there is a paucity of research that (a) attempts to validate excessive video game playing as a primary disorder, like gambling; (b) presents a comprehensive theoretical model for conceptualising problem video game play; and (c) examines the psychological nature and social impact of the activity using quantitative and experimental methods. Thus, the phenomenon of problem video game playing, particularly the psychological context of problem playing, is not well-understood. It is not surprising, then, that the mass media has portrayed video game 'addiction', problem video game playing, and healthy video game playing as differing only in degree, rather than as qualitatively different psychological phenomena.

In the gambling field, a number of studies have established that persistent gambling is maintained not only by complex biological, social and individual psychological factors (Griffiths & Delfabbro, 2001), but also by features of the gambling environment (Griffiths & Parke, 2003) and the gambling activity itself (Griffiths, 1993, Parke & Griffiths, 2006; 2007). In particular, 'structural characteristics', defined as those features that facilitate the acquisition, development, and maintenance of playing behaviour irrespective of the individual's psychological, physiological or socioeconomic status, have been shown to play an important role in explaining the appeal of gambling activities. It has been suggested that, like electronic gambling machines, video games have many structural features that may make them psychologically engrossing. However, there are very few published studies of the effect of particular video game structural characteristics on normal and problem players' persistence in video game playing.

Given the apparent social relevance of video game playing, an activity that involves hundreds of millions of players worldwide, the lack of research on features in games that promote excessive video game play is unusual. It may be due in part to: (a) the highly variable nature of video games compared to the standardised format of games of chance, like blackjack and roulette, (b) the lack of a formal tool for identifying "problem" video game players, and (c) researchers' lack of understanding of what features and content within video games are important to the large community of end users. In addition, the rewards of the video game experience appear to be less tangible and more complex than the

rewards of gambling activities (i.e. money or credits) and thus may be more difficult to measure empirically. From a more pragmatic perspective, there has (a) been a lack of research funding in the area as a whole, and (b) the psychology of video game playing is viewed by many other psychologists to be a somewhat 'trivial' area to study.

This paper presents a review of the limited literature that has discussed or empirically examined the structural characteristics of video games. In addition, we consider some studies of gambling behaviour that have direct applicability to video game playing. Regardless of whether excessive video game playing represents an 'addiction', it is generally agreed by a number of researchers that very high levels of involvement are likely to have deleterious effects on individuals if they are maintained over time. Therefore, for the purpose of this review, the terms 'problem' or 'excessive' video game playing refer simply to an involvement in video games that has negative personal and social consequences. Following this literature review, we refer to the extant gambling literature to identify specific categories of video game structural characteristics that may guide future projects in this emerging field. In addition, this paper provides a brief summary of the prevailing methodological challenges in studying the structural features of video games.

## **Structural characteristics in video games**

Loftus and Loftus' (1983) 'pop' psychology book, *Mind at Play*, is perhaps the earliest psychological text to examine the appeal of video game features in relation to basic structural characteristics. The authors applied the paradigm of operant conditioning to video game structural characteristics, stating that the variable-ratio and fixed-interval schedules in video games were intended by designers to be "addictive". The researchers observed that (i) players are often reinforced almost immediately for correct play, (ii) often these rewards for good game play are of large magnitude (i.e., the provision of 150 points appearing more significant than 15 points), and (iii) the player can be rewarded on numerous concurrent reinforcement schedules. The authors also referred to the notion of "cognitive regret", the idea that when a player loses in a video game, an alternative world (in which the player wins) is mentally constructed in the player's mind. Video game players are thus motivated to realise this imagined scenario by correcting their mistakes in the video game, and reduce the undesirable regret state by immediately playing the game again.

Selnow (1984) theorised that elements of video games may make them attractive as social companions. His study explored the notion of "electronic friendship" in relation to video games, and surveyed adolescent players to determine what types of "gratification needs" video games fulfilled. His survey identified a group of players who preferred playing video games to spending time with human companions. For these individuals, playing video games was reported to be more fun and exciting than being with friends, easier than managing interpersonal relationships and helped to forget feelings of social loneliness. It was not clear whether these individuals were "problem" players, but they did tend to play more frequently and spend more money on video games than the other respondents in the study.

The popularity of video arcade machines throughout the 1980s and 1990s led to the identification of a subgroup of adolescent players who appeared to resemble problem gamblers (Griffiths, 1991; Fisher, 1994; Gupta & Derevensky, 1996). The comparison was anchored by the observation that arcade video game machines and slot machines shared a number of distinct structural features. Griffiths (1991) stated that the main difference between the two types of machines is that "video games are played to accumulate as many points as possible, whereas fruit machines are played to accumulate as much money" (p. 54). Consequently, he argued, video game playing may be considered as a "non-financial form of gambling".

A similar argument was made by Griffiths and Wood (2000), who claimed that the playing philosophy of both arcade video game players and slot machine players was "to stay on the machine for as long as possible using the least amount of money" (p. 209). Their paper listed a number of structural features (first formulated by Fisher and Griffiths, 1995) that arcade video games contained that made them similar to slot machines and, thus, could make them attractive and rewarding to players. These were (a) the requirement of response to stimuli which are predictable and governed by a software loop, (b) the requirement of total concentration and hand-eye coordination, (c) rapid span of play negotiable to some extent by the skill of the player, (d) the provision of aural and visual rewards for a win, (e) the provision of an incremental reward for a winning move, (f) digitally displayed scores of correct behaviour, (g) the opportunity for peer group attention and approval through competition. The researchers also identified the high accessibility of video games and slot machines as being attractive to players. Numerous other authors have linked video game playing to gambling (Griffiths, 1991; Gupta & Derevensky, 1996; Huff & Collinson, 1987; Johansson & Gotestam, 2004; Ladouceur & Dube, 1995; Wood, Gupta, Derevensky, & Griffiths, 2004). However, despite the many theoretical links claimed to exist between gambling machines and video games, these papers contain no empirical evidence that shows that 'problem' video game players, (however this subgroup may be defined) are motivated to play by particular features in games, and non-problem video game players are not.

Recent studies have examined what people tend to enjoy in video games, as a measure of what keeps the general population frequently involved in video games. Griffiths, Davies and Chappell's (2004) study of 540 players of the video game *Everquest* identified a number of features in video games that participants reported to find enjoyable. The most commonly reported "favourite" reasons for playing the online video game were related to social interaction, demonstrated by feedback from players such as "the game is a social game" (24%), "group together with others" (10%), and "being part of a Guild" (10%). Similarly, participants reported their least favourite features of online games as the frustrations associated with the community of other players. In terms of the game's structure, their participants reported to enjoy being able to play the game indefinitely but did not enjoy the lack of progress when playing the game infrequently.

In another study, Wood, Griffiths, Chappell and Davies (2004) surveyed 382 video game players about their preferences for various structural features in video games. Participants were asked to rank a list of features from "most important" to "least important" on a 3-point Likert scale. The results showed that the most important features were: realistic sound, graphics and setting, rapid absorption rate, rapid advancement rate, a "medium" duration, and being able to save one's progress in the game. The researchers also examined in depth the dynamics of game play. Of the 19

characteristics they provided, the five most popular features were "exploring new areas" (rated as "important" by 76% of participants), "elements of surprise" (75%), "fulfilling a quest" (74%), "skill development" (68%), and "sophisticated artificial intelligence interactions" (67%). The least popular features were "linear game format" (rated as "unimportant" by 44% of participants), "mapping" (35%), "building environments" (33%), "solving time-limited problems" (18%), and "avoiding things" (15%). In terms of winning and losing features, 81% of participants rated the ability to save their game regularly as important, which seemed to be consistent with the finding that only 24% of participants thought "having to restart a level" was important for their enjoyment of the game. In terms of gender differences, males tended to prefer the explicit realism of video games that involved skill development, violent actions, survival and controlling vehicles. Similarly, males preferred games that were based on factual events. Such games are usually based upon battles or sports events for which males have traditionally had a preference in 'real life.' In contrast, females were more likely to prefer the non-violent, less competitive, slower paced cartoon-style games, and the types of games that involved a higher degree of fantasy and make-believe. This was demonstrated by the type of game dynamics that females preferred, such as solving puzzles, avoiding dangerous obstacles, and finding and collecting things.

Whilst these studies by Griffiths et al. (2004) and Wood et al. (2004) provide a great deal of insight into the general appeal of video games, including the variety of preferences between particular demographics of players, they are also severely limited by the assumption that what players report to enjoy in video games is equivalent to what keeps players involved in games for long periods. Further, Wood et al. note:

*Other characteristics may be more or less important, over time, due to advances in the design and development of video games and the technologies they utilise. It should also be noted that the importance of such characteristics may vary between individuals, and may vary according to the frequency with which people play video games (p. 7).*

These studies also do not directly measure features related to 'problem' involvement in video games, but appear to infer that the most popular features in video games are associated with excessive playing behaviours. There are a number of problems with this approach. First, if participants are given a list of features in games and are asked to rate how much they enjoy these features, they may tend to overlook the negative aspects of each feature. In addition to general biases in self-reported information, research has shown that accurate memory recall for positive and negative emotions is limited (Thomas & Diener, 1990). Similarly, a typical video game playing experience is not likely to be characterised only by increasing and decreasing states of enjoyment, but also by feelings of frustration, anger, relief and satisfaction. By asking participants to focus on only one phenomenological aspect of playing, important aspects of the playing experience that may contribute to problem involvement may be overlooked. A study by King and Delfabbro (2009a) found that problem video game playing was associated with increased 'amotivation' (playing apathetically or without a sense of purpose). Similarly, gambling research has shown that gamblers will continue to gamble even when they are bored by or no longer enjoy the activity, and report irritation on winning because it sustains a session of play (Błaszczynski, McConaghy, & Frankova, 1990). It is possible, therefore, that problem video game play is characterised by an entirely different emotional relationship to the features in video games than regular video game playing.

The notion of 'unenjoyable' video game playing as a symptom of problem play has been explored qualitatively. An interview study of 38 video game players by King and Delfabbro (2009b) found that players did not necessarily have to enjoy playing a video game to order to play for long periods of time. Their participants reported that concurrent reward structures kept them playing for long periods. Examples included two in-game tasks running simultaneously, being given a new "quest" before the current quest was complete, and multiple "experience bars" or other onscreen meters of player progress. Variable-ratio reinforcement schedules also led participants to engage in what was termed "grinding" behaviour. Grinding refers to repeatedly performing an action or series of actions in a video game in order to obtain a reward. Interestingly, none of the participants who "grinded" reported enjoying the process, but felt it was the only way to feel satisfied when playing the game.

To date, one experimental study has examined the role of reinforcement in video games in player affect. Chumbley and Griffiths (2006) investigated players' affective responses and willingness to continue to play as a function of negative reinforcement in a video game. "Negative reinforcement" was operationally defined in terms of the difficulty of the game. The researchers reported no significant relationship between player excitement and type of reinforcement (high or low difficulty). However, the "low" negative reinforcement group reported a higher degree of willingness to continue playing the video game than the "high" negative reinforcement group. This study suggested that, on a basic level, players are generally more motivated to play a video game that offers frequent rewards and fewer obstacles. However, it cannot be inferred from this study that (a) overcoming adversity is an unimportant part of the video game playing experience, and (b) that games with high or low negative reinforcement schedules promote excessive playing behaviours.

Whilst few studies have investigated the role of reinforcement schedules in video games in developing problem video game behaviour, reinforcement remains one of the most popular explanations. In explaining why people become excessively involved in online video games, like World of Warcraft, Charlton and Danforth (2007) argued:

*First, in MMORPGs players take-on the role of a character in a virtual environment in which a story line evolves over time and the time frame in which an event will occur is unpredictable. Thus, these games may be addictive because they are particularly good at inducing operant conditioning via variable-ratio reinforcement schedules (p. 1534).*

Survey evidence supports the notion that distinct features in MMORPGs (Massively Multiplayer Online Role Playing Games) make them more appealing to players, and therefore more likely to initiate, develop and sustain longer playing behaviours. A study by Ng and Wiemer-Hastings (2005) found that 45% of players of MMORPGs played over 30 hours per week, compared with 6% of non-MMORPG players. In addition, most research studies that have examined the nature of 'problem' video game play have drawn their sample from the population of MMORPG players (e.g., Black,

Belsare, & Schlosser, 1999; Chui, Lee, & Huang, 2004; Chappell et al., 2006). However, this may also be due to the relative ease in accessing this population for the purpose of research (King, Delfabbro, & Griffiths, 2009).

Other researchers have theorised that people may vary greatly in terms of the experiences they seek from video games. Griffiths and Dancaster (1995) showed that, when playing the same video game, participants with Type A personality had significantly higher arousal levels (as measured by heart rate) than participants with Type B personality. More recently, Yee (2006) suggested that there might be various player typologies based on player preferences for certain features in video games (i.e., some features may be more salient for some groups of players than others). Yee surveyed over 30,000 users of online role playing games. He reported that male players were significantly more likely to be driven by the "Achievement" (the desire to obtain in-game rewards) and "Manipulation" (the desire to manipulate and learn about the game world and elements) factors of the game, whereas female players were more likely to be driven by the "Relationship" factor (the desire to initiate and maintain social contacts). However, this research did not examine whether particular player typologies are more prone to engaging in excessive playing behaviours.

## Summary

The literature on video game structural features has a historical link to the gambling literature. However, unlike the gambling field, there have been very few studies that examine the role of structural features in relation to problem video game playing. Despite this lack of research evidence, the dominant view of the appeal of video games appears to be that they offer rewards on concurrent variable-ratio and fixed-interval schedules that lead the player to respond rapidly and with few post-reinforcement pauses. There is also some recognition that video games can offer a range of rewards, including social approval, and players may vary depending on their preference for certain types of rewards. The ways in which specific features in video games affect players have received less attention, perhaps due to the large number of variables in modern games as well as the difficulty in isolating these features for experimental manipulation. To date, there has been no attempt to identify the differences, if any, between normal and problem players with regard to their preferences for, and emotional responses to, the structural features in video games.

## Future challenges

There are various challenges, theoretical and methodological, associated with the study of video game structural features that deserve special mention. In particular, there appears to be significant difficulty in studying video game features within an experimental setting (Wood et al., 2004). It has been suggested that different players seek different experiences from the video games they play. For example, some players may seek out the items and rewards within a video game, whereas others may play the game for social interaction it facilitates. Similarly, there may be additional difficulties in creating an ecologically valid video game playing experience. Like gambling studies that use tokens in a laboratory setting instead of real money at a casino, there is a danger that player motivation may be contaminated by the unfamiliar apparatus and setting of the laboratory setting (Anderson & Brown, 1984). The challenge for researchers is to ensure that the laboratory is conducive to participants playing a video game as they normally would in their usual environment. Alternatively, a naturalistic approach may overcome this problem.

Researchers should also be mindful of the empirical definition of structural characteristics (i.e., features that facilitate the acquisition, development, and maintenance of playing behaviour). When constructing surveys, they should avoid the assumption that those features that players report to enjoy are the same as those features that may play an important role in maintaining their playing behaviour. This is particularly important when considering playing motivations among individuals who are problematically involved in video games. In the gambling literature, it has been argued that there may be additional factors such as dysphoria and frustration that underlie impaired control and thus distinguish regular and problem gamblers (Dickerson, 1993). Finally, and more generally, there is a need for psychologists to more seriously consider the study of technology-based excessive behaviours, rather than dismiss these behaviours as simply reflective of other psychopathologies (Shaffer, Hall & Van de Bilt, 2000; Wood, 2008).

## Future research

Whilst a great deal of research has been conducted outside the field of psychology on the importance of various structural features in video games, less is known regarding the influence of game characteristics on problematic play. King, Delfabbro and Griffiths (2010) recently put forward a five-factor taxonomy of video games, containing (a) social features, (b) manipulation and control features, (c) narrative and identity features, (d) reward and punishment features, and (e) presentation features. These categorisations of video game features suggest multiple avenues for further investigation in this area. For example, the social aspects of video games encompass many types of competitive features, and the ways in which players can form attachments to their playing machine. Many recent social utility features in video games can create a sense of identity and escape for the player. For example, individuals can (a) create personalised avatars and player profiles (from creating a nickname or "handle" to creating a customisable three-dimensional character), (b) purchase special membership accounts with exclusive video game content, (c) personalise various aspects of their video game machine (e.g., the video game browser or "launcher" screen as well as the exterior casing of the video game hardware with familiar characters and logos). In addition, the machine can: (a) act as a "hub" for all kinds of electronically-mediated social interaction and related social functions, (b) include various forms of communication (e.g., text, picture-messaging, recorded speech, real-time speech, webcam, etc.), (c) provide lists of the player's online friends, (d) track playing behaviour in relation to time spent playing and goals achieved relative to others, and (e) link to support websites which can suggest games based on your stated preferences and previous games played. Future research could investigate the importance of these features in the development and maintenance of problem behaviour.

There has been some speculation that online gaming may be more problematic than offline (stand alone) games because of the inherent structural characteristics (Griffiths, 2008). In video games generally, the rewards might be

intrinsic (e.g., improving your highest score, beating your friend's high score, getting your name on the "hall of fame", or mastering the machine) or extrinsic (e.g., peer admiration). In online gaming, there is no end to the game and there is the potential to play endlessly against (and with) other real people. Accessibility is another important aspect of online video games. Online games can be played exclusively within the home environment and have no "opening times" and few "membership rules". They are "permanent" and available to access 24 hours per day, seven days a week and all year round. These aspects of the game may partly explain why some individuals spend long, uninterrupted periods of time in the game.

There may be some value in identifying those features in video games that players do not enjoy but serve to develop and maintain player involvement over time. It is possible that features that players have indicated to be "not important" in survey research (e.g., Wood et al., 2004) play an important role in lengthening a typical session of playing or maintaining a player's long term interest in the game. For instance, (unpublished) pilot research carried out on *Tetris* by one of the authors (MG) found that in a self-report questionnaire, players said they found the *Tetris* music annoying when they played the game. However, in an experiment measuring heart rate (as a measure of excitement and arousal) while playing *Tetris* found significantly higher heart rates playing *Tetris* with the music on compared to playing the game in silent mode with the music off.

Researchers should be cautious of what players claim to be important features in the video games they play and test these statements in ways less fraught with errors of human judgement. There is a certain reliance on self-reported data within the field of psychology, and this research area is no different. There are various limitations associated with self-reported data from players, namely that players do not accurately recall information about their playing behaviour, and instead may report socially held facts or idealised impressions about their playing. For example, Charlton (2002) stated that players often overestimate the amount of time that is spent playing video games although losing track of time playing video games is often seen as an important benefit as to why people play excessively (Wood & Griffiths, 2007; Wood, Griffiths, & Parke, 2007). Asking participants in a survey to indicate their preference for various structural features in video games as opposed to empirically testing this preference is similarly problematic. However, some researchers have tried to overcome this problem by utilising a mixed methods approach. For instance, some researchers have used both an experiment and questionnaire within the same study (Chumbley & Griffiths, 2006). There is also a lack of research on problem video game playing in general that is conducted in naturalistic settings, such as gaming venues or players' home environment. Lastly, there is a lack of longitudinal research to assess the long-term relationship between structural features and problem playing patterns.

## Conclusion

The extant literature on the subject of structural features in video games is quite limited with regard to explaining why some people play video games to excess. This paper suggests that this research area would benefit greatly from a more rigorous study of the features within video games, particularly the reward delivery systems in video games. In addition, it may be worthwhile investigating the social utility functions of video games that foster a sense of community and "electronic friendship" between the player and video game machine. By understanding the structural features in video games that promote excessive playing behaviour, psychologists may be better equipped to manage clients with technology-based problem behaviours. Similarly, it may be beneficial for players to be educated about particularly risky video game features in order to minimise the risk of playing certain video games to excess.

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