

DOES VIDEO GAME ADDICTION EXIST?

Mark D. Griffiths and Mark N. O. Davies

The rise and popularity of computer games as a leisure phenomenon has become an ever-increasing part of many young people's day-to-day lives. Coupled with the rise in popularity and usage, there have been a growing number of reports in the popular press about excessive use of the video games ("joystick junkies"). Although the concept of "video game addiction" appears to have its supporters in the popular press, there is a form of "knee-jerk skepticism" within the academic community—not least among those working in the field of addiction research.

It is not hard to understand the skepticism. For many people, the concept of video game addiction seems far-fetched, particularly if their concepts and definitions of addiction involve the taking of drugs. Despite the predominance of drug-based definitions of addiction, there is now a growing movement that views a number of behaviors as potentially addictive (e.g., gambling, computer game playing, exercise, sex, and now the Internet). Such diversity has led to new, all encompassing definitions of what constitutes addictive behavior.

Researchers have consistently argued that excessive gambling is no different from (say) alcoholism or heroin addiction in terms of the core components of addiction (i.e., salience, tolerance, withdrawal, mood modification, conflict, relapse). If one can show that a behavior such as pathological gambling can be a bona fide addiction, then there is a precedent that any behavior that can provide continuous rewards in the absence of a psychoactive substance can be potentially addictive (i.e., a behavioral as opposed to a chemical addiction). Such a precedent opens the floodgates for other excessive behaviors to be theoretically considered as potential addictions (such as video games).

In addition to press reports, researchers have alleged for over twenty years that social pathologies are beginning to surface among excessive video game players. For instance, Soper and Miller (1983) claimed "video game addiction" was like any other behavioral

addiction and consisted of a compulsive behavioral involvement, a lack of interest in other activities, association mainly with other addicts, and physical and mental symptoms when attempting to stop the behavior (e.g., the shakes). More recently, such addictions (including addictions to the Internet and slot machines) have been termed "technological addictions" (Griffiths, 1995a, 1996a) and have been operationally defined as nonchemical (behavioral) addictions that involve excessive human-machine interaction. They can either be passive (e.g., television) or active (e.g., computer games), and usually contain inducing and reinforcing features that may contribute to the promotion of addictive tendencies (Griffiths, 1995a). Technological addictions can thus be viewed as a subset of behavioral addictions (Marks, 1990) and feature core components of addiction first outlined by Brown (1993) and modified by Griffiths (1996b), such as salience, mood modification, tolerance, withdrawal, conflict, and relapse.

Research into the area of video game addiction needs to be underpinned by three fundamental questions: (1) What is addiction? (2) Does video game addiction exist? (3) If video game addiction exists, what are people actually addicted to? The first question continues to be a much-debated question both among psychologists within the field of addiction research as well as those working in other disciplines. For many years, this author has operationally defined addictive behavior as any behavior that features all the core components of addiction. It is this author's contention that any behavior (e.g., video game playing) that fulfils these six criteria is therefore operationally defined as an addiction. In the case of video game addiction it would be:

Salience: This occurs when video game play becomes the most important activity in the person's life and dominates their thinking (preoccupations and cognitive distortions), feelings (cravings), and behavior (deterioration of socialized behavior). For instance, even if the

person is not actually playing a video game, they will be thinking about the next time that they will be.

Mood modification: This refers to the subjective experiences that people report as a consequence of engaging in video game play and can be seen as a coping strategy (i.e., they experience an arousing “buzz” or a “high” or paradoxically tranquilizing feel of “escape” or “numbing”).

Tolerance: This is the process whereby increasing amounts of video game play are required to achieve the former mood modifying effects. This basically means that for someone engaged in video game playing, they gradually build up the amount of the time they spend online engaged in the behavior.

Withdrawal symptoms: These are the unpleasant feeling states and/or physical effects which occur when video game play is discontinued or suddenly reduced, e.g., tremors, moodiness, irritability.

Conflict: This refers to the conflicts between the video game player and those around them (interpersonal conflict), conflicts with other activities (job, schoolwork, social life, hobbies and interests) or from within the individual themselves (intrapsychic conflict and/or subjective feelings of loss of control) that are concerned with spending too much time engaged in video game play.

Relapse: This is the tendency for repeated reversions to earlier patterns of video game play to recur and for even the most extreme patterns typical of the height of excessive video game play to be quickly restored after periods of abstinence or control.

Having operationally defined addiction, it is this author’s belief that video game addiction does indeed exist, but that it affects only a very small minority of players. There appear to be many people who use video games excessively but are not addicted as measured by these (or any other) criteria. The third question is perhaps the most interesting and the most important when it comes to researching in this field. What are people actually addicted to? Is it the interactive medium of playing? Aspects of its specific style (e.g., an anonymous and disinhibiting activity)? The specific types of games (aggressive games, strategy games, etc.)? This has led to much debate amongst those of us working in this field. Research being carried out into Internet addiction may lead to insights about video game addiction. For instance, Young (1999) claims Internet addiction is a broad term that covers a wide variety of behaviors and impulse control problems. This is categorized by five specific subtypes:

Cybersexual addiction: compulsive use of adult websites for cybersex and cyberporn.

Cyber-relationship addiction: over-involvement in online relationships.

Net compulsions: obsessive online gambling, shopping, or day-trading.

Information overload: compulsive web surfing or database searches.

Computer game addiction: obsessive computer game playing (e.g. *Doom*, *Myst*, *Solitaire*, etc.).

In reply to Young, Griffiths (1999, 2000a) argued that many of these excessive users are not “Internet addicts” but just use the Internet excessively as a medium to fuel other addictions. Put very simply, a gambling addict or a computer game addict who engages in their chosen behavior online is not addicted to the Internet. The Internet is just the place where they engage in the behavior. However, in contrast to this, there are case study reports of individuals who appear to be addicted to the Internet itself (e.g., Young, 1998; Griffiths, 1996a, 1998, 2000b). These are usually people who use Internet chat rooms or play fantasy role playing games—activities that they would not engage in except on the Internet itself. These individuals to some extent are engaged in text-based virtual realities and take on other social personas and social identities as a way of making themselves feel good about themselves. In these cases, the Internet may provide an alternative reality to the user and allow them feelings of immersion and anonymity that may lead to an altered state of consciousness. This in itself may be highly psychologically and/or physiologically rewarding. Obviously for those playing online computer games, these speculations may provide insights into the potentially addictive nature of computer games for those playing in this medium.

Other insights into the potentially addictive nature of video games has come from research into slot machines. Both video game machines and slot machines fall under the generic label of “amusement machines” (Griffiths, 1991a). The main difference between video game machines and slot machines are that video games are played to accumulate as many points as possible, whereas slot machines are played (i.e., gambled upon) to accumulate money. Griffiths (1991a) has suggested that playing a video game could be considered as a non-financial form of gambling. Both types of machine (in the case of arcade games) require inserting a coin to play, although the playing time on a slot machine is usually much less than on a video game machine. This is because on video games the outcome is almost solely

due to skill, whereas on slot machines the outcome is a product of chance. However, the general playing philosophy of both slot machine players and video game players is to stay on the machine for as long as possible using the least amount of money (Griffiths, 1990a, 1990b). Griffiths has argued that regular slot machine players play with money rather than for it and that winning money is a means to an end (i.e., to stay on the machine as long as possible).

Besides the generic labelling, their geographical juxtaposition, and the philosophy for playing, it could be argued that on both a psychological and behavioral level, slot machine gambling and video game playing share many similarities (e.g., similar demographic differences such as age and gender breakdown, similar reinforcement schedules, similar potential for “near miss” opportunities, similar structural characteristics involving the use of light and sound effects, similarities in skill perception, similarities in the effects of excessive play, etc.). The most probable reason the two forms have rarely been seen as conceptually similar is because video game playing does not involve winning money (or something of financial value) and therefore cannot be classed as a form of gambling. However, the next generation of slot machines are starting to use video game graphics and technology. Although many of these relate to traditional gambling games (e.g. roulette, poker, blackjack), there are plans for developing video gambling games in which people would win money based on their game scores. This obviously gives an idea of the direction that slot machines and the gaming industry are heading.

Furthermore, there are a growing number of researchers who suggest that arcade video games share some common ground with slot (gambling) machines, including the potential for dependency (e.g., Brown & Robertson, 1992; Griffiths, 1991a, 1993, 1997a; Fisher, 1994; Gupta & Derevensky, 1997). As Fisher and Griffiths (1995) point out, arcade videogames and slot machines share some important structural characteristics, these being:

- The requirement of response to stimuli which are predictable and governed by the software loop.
- The requirement of total concentration and hand-eye coordination.
- Rapid span of play negotiable to some extent by the skill of the player (more marked in video games).
- The provision of aural and visual rewards for a winning move (e.g., flashing lights, electronic jingles).

- The provision of an incremental reward for a winning move (points or cash) that reinforces “correct” behavior.
- Digitally displayed scores of “correct behavior” (in the form of points or cash accumulated).
- The opportunity for peer group attention and approval through competition.

As with excessive slot machine playing, excessive video game playing partly comes about by the partial reinforcement effect (PRE) (Wanner, 1982). This is a critical psychological ingredient of video game addiction whereby the reinforcement is intermittent—people keep responding in the absence of reinforcement hoping that another reward is just around the corner. Knowledge about the PRE gives the video game designer an edge in designing appealing games. Magnitude of reinforcement is also important. Large rewards lead to fast responding and greater resistance to extinction—in short to more “addiction.” Instant reinforcement is also satisfying.

Video games rely on multiple reinforcements (i.e., the “kitchen sink” approach), in that different features might be differently rewarding to different people. Success on video games comes from a variety of sources and the reinforcement might be intrinsic (e.g., improving your highest score, beating your friend’s high score, getting your name on the “hall of fame,” mastering the machine) or extrinsic (e.g., peer admiration). Malone (1981) reports that video games are positively correlated to a presence or absence of goals, the availability of automatic computer scores, the presence of audio effects, the random quality of the games, and the degree to which rapid reaction times enhance game scores.

Empirical Research on Video Game Addiction

To date, there has been very little research directly investigating video game addiction. Furthermore, almost all of it has concentrated on adolescents only. Shotton (1989) carried out a study specifically on “computer addiction” using a sample of 127 people (half children, half adult; 96 percent male) who had been self-reportedly “hooked” on home video games for at least five years. Seventy-five of these were measured against two control groups, and Shotton reported that the computer dependent individuals were highly intelligent, motivated, and achieving people but often misunderstood. After a five-year followup, Shotton found that the younger cohort had done well educationally, gone on to university, and then into high ranking jobs.

However, Shotton's research was done with people who were familiar with the older generation of video games that were popular in the earlier part of the 1980s. The video games of the 1990s onwards may in some way be more psychologically rewarding than the games of a decade ago in that they require more complex skills, improved dexterity, and feature socially relevant topics and better graphics. Anecdotal accounts of greater psychological rewards could mean that the newer games are more "addiction inducing," although such an assertion needs empirical backing.

Griffiths and Hunt (1995, 1998) undertook a more recent questionnaire study with almost four hundred adolescents (twelve–sixteen years of age) to establish the level of "dependence" using a scale adapted from the DSM-III-R criteria for pathological gambling (American Psychiatric Association, 1987). Eight questions relating to the DSM-III-R criteria were adapted for computer game playing and examined a number of addiction components including:

1. salience ("Do you frequently play most days?")
2. tolerance ("Do you frequently play for longer periods of time?")
3. euphoria ("Do you play for excitement or a 'buzz'?")
4. chasing ("Do you play to beat your personal high score?")
5. relapse ("Do you make repeated efforts to stop or decrease playing?")
6. withdrawal ("Do you become restless if you cannot play?")
7. conflict ("Do you play instead of attending to school related activities?")
8. conflict ("Do you sacrifice social activities to play?")

A cut off point of four was assumed to indicate a participant was playing at dependent (i.e., addictive) levels at the time of the study. Scores on the adapted DSM-III-R scale indicated that sixty-two players (19.9 percent) were dependent on computer games (i.e., scored four or more on the scale). Furthermore, 7 percent of the sample claimed they played over thirty hours a week. The dependence score correlated with gender, as significantly more males than females were dependent. Dependence score also correlated with how often they played computer games, the mean session length playing time, and the longest single session playing time. Further analysis indicated that those dependent were significantly more likely to have started playing computer games to impress friends, because there was nothing else to do, for a challenge, and to

meet friends. Dependent players were also significantly more likely to report aggressive feelings as a direct result of their computer game playing. There are a number of problems with the findings of this study. Although the criteria for the scale were all based on the different components of dependence common to other addictive behaviors (e.g., salience, euphoria, tolerance, withdrawal, conflict, etc.) it could be that these are less relevant for excessive computer game playing. There was also an assumption made that computer game playing was similar to gambling in terms of the consequences of excessive behavior. Alternative explanations could be that excessive computer game playing cannot be conceptualized as an addiction at all or that the scale is more a measure of preoccupation rather than dependence. A replication study found very similar results (Griffiths, 1997b). It is also worth noting that 7 percent of the sample in Griffiths and Hunt's (1995, 1998) study claimed to play computer games for over thirty hours a week. Other studies have reported similar findings (Fisher, 1994; Parsons, 1995; Phillips et al., 1995; Griffiths, 1997b).

There is no doubt that for a minority of children and adolescents video games can take up considerable time. Whether these studies suggest video games may be addictive is perhaps not the most salient issue here. The question to ask is what the longitudinal effect of any activity (not just video game playing) that takes up thirty hours of leisure time a week has on the educational and social development of children and adolescents? At present we do not know the answer to such a question. However, it is this author's contention that any child who engaged in any activity excessively (whether defined as an addiction or not) every day over a number of years from a young age, would have their social and/or educational development negatively affected in some way.

There is also the question, "If video games are addictive, what is the addictive process?" One potential way of answering this question is to produce possible theoretical accounts of video addiction and test the hypotheses empirically. McIlwraith (1990) proposed four theoretical models of television addiction in the popular and psychological literature that would seem good models to test the boundaries of video game addiction. Substituting "video game" for "television" in McIlwraith's account would leave the four explanations as thus:

1. Video game addiction is a function of the video game's effects on imagination and fantasy life, i.e.,

people who play video games to excess have poor imaginations.

2. Video game addiction is a function of the video game's effects on arousal level, i.e., people who play video games to excess either do so for its arousing or tranquillizing effects.

3. Video game addiction is a manifestation of oral, dependent, or addictive personality, i.e., people who play video games to excess do so due to their inner personality as opposed to the external source of the addiction.

4. Video game addiction is a distinct pattern of uses and gratifications associated with the video game medium, i.e., people who play video games to excess enjoy the physical act of playing or play only when they are bored, etc.

Few of these explanations for home video game playing have been empirically studied, although some empirical evidence by Griffiths and Dancaster (1995), and evidence from arcade video game addiction (Fisher, 1994) appear to support the second theoretical orientation, that video game addiction is a function of the video game's effects on arousal level. Recent research by Koepp et al. (1998) demonstrated dopaminergic neurotransmission during video game playing. This may have implications for understanding the underlying addictive process in playing video games. If it is accepted that video game playing can be addictive, then it is appropriate to look for the neural foundation of such behavior. Over recent years, the role of the mesotelencephalic (nucleus accumbens) dopaminergic system that is constructed as a circuit between the midbrain and the forebrain (within the medial forebrain bundle) has been widely accepted as the neural substrate of reinforcement (Julien, 1995). The work has until now focused on modeling the psychopharmacological process of drug-seeking behavior.

Koepp et al. (1998) have clearly demonstrated an increase in the release of dopamine within the ventral striatum (nucleus accumbens) as a function of video game playing. This parallels evidence of a similar activity with the mesotelencephalic dopaminergic system that is thought to underpin the addictive properties of drugs such as morphine (Glick et al., 1992), alcohol (Harris, Brodie, & Dunwiddie, 1995), and cocaine (Volkow, 1997)—although recent evidence has begun to illuminate the multifaceted nature the psychopharmacology of drug addiction (Rocha et al., 1998). It would therefore seem reasonable to propose that the mesotelencephalic dopaminergic system may well underlie what has been referred to as behavioral addiction

(Griffiths, 1996b), with video game playing being one example. Consequently, a way forward in studying behavioral addiction is to incorporate within a single model, psychological evidence on the behavioral repertoire of game addicts with the evidence concerning *in vivo* changes in the functional neurochemistry of the brain. Out of such collaboration a model similar to Stolerman's psychopharmacological model of drug addiction (Stolerman, 1992) may well be possible in the near future with respect to behavioral addiction.

In addition to neurochemical research, there are further reports of behavioral signs of video game dependency among adolescents. Dependency signs reported include stealing money to play arcade games or to buy new games cartridges (Klein, 1984; Keepers, 1990; Griffiths & Hunt, 1995, 1998), truancy from school to play (Keepers, 1990; Griffiths & Hunt, 1998), not doing homework/getting bad marks at school (Griffiths & Hunt, 1998; Phillips et al., 1995), sacrificing social activities to play (Egli & Meyers, 1984; Griffiths & Hunt, 1998), irritability and annoyance if unable to play (Griffiths & Hunt, 1998; Rutkowska & Carlton, 1994), playing longer than intended (Egli & Meyers, 1984; Griffiths & Hunt, 1998), and an increase in self reported levels of aggression (Griffiths & Hunt, 1995). There is no doubt that for a minority of people (particularly adolescents) that video games can take up considerable time and that to all intents and purposes they are "addicted" to them. However, the prevalence of such an addiction is still of great controversy, as is the mechanism by which people may become addicted. This is one area where research appears to be much needed. The need to establish the incidence and prevalence of clinically significant problems associated with video game addiction is of paramount importance. There is no doubt that clearer operational definitions are required if this is to be achieved.

As argued above, the only way of determining whether nonchemical (i.e., behavioral) addictions (such as video game addiction) are addictive in a nonmetaphorical sense is to compare them against clinical criteria for other established drug-ingested addictions. However, most researchers in the field have failed to do this, which has perpetuated the skepticism shown in many quarters of the addiction research community. The main problems with the addiction criteria suggested by most researchers is that the measures used a) have no measure of severity, b) have no temporal dimension, c) have a tendency to over-estimate the prevalence of problems, and d) take no account of the context of video game use. There are also concerns

about the sampling methods used. As a consequence, none of the surveys to date conclusively show that video game addiction exists or is problematic to anyone but a small minority. At best, they indicate that video game addiction may be prevalent in a significant minority of individuals but that more research using validated survey instruments and other techniques (e.g., in-depth qualitative interviews) are required. Case studies of excessive video game players may provide better evidence of whether video game addiction exists by the fact that the data collected are much more detailed. Even if just one case study can be located, it indicates that video game addiction actually does exist—even if it is unrepresentative. There are case study accounts in the literature that appear to show that excessive video game players, including those that play online (e.g., Griffiths, 2000b), display many signs of addiction (e.g., Keepers, 1992). These case studies tend to show that the video games are used to counteract other deficiencies and underlying problems in the person's life (e.g., relationships, lack of friends, physical appearance, disability, coping, etc.). Again, further work of a more in-depth qualitative nature is needed to confirm the existence of video game addiction.

Excessive Video Game Play—Other Negative Consequences

Other indirect evidence of addictive and excessive play comes from the many health consequences reported in the literature. The risk of epileptic seizures while playing video games in photosensitive individuals with epilepsy is well established (e.g., Maeda et al., 1990; Graf et al., 1994; Harding & Jeavons, 1994; Quirk et al., 1995; Millett et al., 1997). Graf et al. (1994) report that seizures are most likely to occur during rapid scene changes, and high-intensity repetitive and flickering patterns. However, for many individuals, seizures during play will represent a chance occurrence without a causal link. Furthermore, there appears to be little direct link to excessive and/or addictive play as occasional players appear to be just as susceptible.

In addition to photo-sensitive epilepsy, the medical profession for over twenty years voiced a number of concerns about video game playing. As early as the 1980s, rheumatologists described cases of “Pac-Man's Elbow” and “Space Invaders' Revenge,” in which players have suffered skin, joint, and muscle problems from repeated button hitting and joystick pushing on the game machines (Loftus & Loftus, 1983). Early research by Loftus and Loftus indicated that two-thirds of (arcade) video game players examined complained of

blisters, calluses, sore tendons, and numbness of fingers, hands, and elbows directly as a result of their playing. There have been a whole host of case studies in the medical literature reporting some of the adverse effects of playing video games. These have included auditory hallucinations (Spence, 1993), enuresis (Schink, 1991), encoprisis (Corkery, 1990), wrist pain (McCowan, 1981), neck pain (Miller, 1991), elbow pain (Miller, 1991), tenosynovitis—also called “nintendinitis” (Reinstein, 1983; Brasington, 1990; Casanova & Casanova, 1991; Siegal, 1991), hand-arm vibration syndrome (Cleary, McKendrick, & Sills, 2002), repetitive strain injuries (Mirman & Bonian, 1992), and peripheral neuropathy (Friedland & St. John, 1984). Admittedly, some of these adverse effects are quite rare and “treatment” simply involved not playing the games in question. In fact, in the cases involving enuresis and encoprisis, the children were so engaged in the games that they did not want to go to the toilet. In these particular cases they were simply taught how to use the game's “pause” button!

There has also been some speculation that excessive play may have a negative effect on both heart rate and blood pressure, and one study (Gwinup, Haw, & Elias, 1983) suggested that some individuals with cardiovascular disease could experience adverse effects. More recent research has highlighted both gender and ethnic differences in cardiovascular activity during game play (Murphy et al., 1995). Although some authors (e.g., Segal & Dietz, 1991) have suggested that game playing may lead to increased energy expenditure when compared with activities such as watching television, the energy increase identified is not sufficient to improve cardiorespiratory fitness.

Other speculative (i.e., not empirically tested) negative aspects of video game playing that have been reported include the belief that video game play is socially isolating and prevents children from developing social skills (Zimbardo, 1982). For instance, Selnow (1984) reported that video game players use the machine as “electronic friends.” However, this does not necessarily mean that players play the machines instead of forming human friendships and interacting with their peer groups. Further to this, Colwell, Grady, and Rhaiti (1995) reported that heavy video game players see friends more often outside school (and have a need for friends) more than nonheavy players. Rutkowska and Carlton (1994) reported there was no difference in “sociability” between high and low frequency players and reported that games foster friendship. This finding was echoed by Phillips, Rolls, Rouse, and Griffiths (1995),

who found no difference in social interactions between players and nonplayers.

It has also been suggested that video game playing may prevent children and adolescents from participating in more educational or sporting pursuits (Egli & Meyers, 1984; Professional Association of Teachers, 1994). In this context, it is worth noting that childhood obesity has also been linked with video games. For instance, Shimai, Yamada, Masuda, and Tada (1993) found that obesity was correlated with long periods of video game playing in Japanese children. This has also been found in young French children (Deheger, Rolland-Cachera, & Fontvielle, 1997). In the UK, Johnson and Hackett (1997) reported that there was an inverse relationship between physical activity and playing video games in schoolgirls.

What is clear from the case studies displaying the more negative consequences of playing is that they all involved people who were excessive users of video games. From prevalence studies in this area, there is little evidence of serious acute adverse effects on health from moderate play. Adverse effects are likely to be relatively minor and temporary, resolving spontaneously with decreased frequency of play, or to affect only a small subgroup of players.

Excessive players are the most at-risk from developing health problems, although more research appears to be much needed. The need to establish the incidence and prevalence of clinically significant problems associated with video game play is of paramount importance. There is also no doubt that clearer operational definitions are required if this is to be achieved.

Taking all factors and variables into account and by considering the prevalence of play, the evidence of serious adverse effects on health is rare. An overview of the available literature appears to indicate that adverse effects are likely to affect only a very small subgroup of players and that frequent players are the most at-risk from developing health problems. Those that it does affect will experience subtle, relatively minor, and temporary effects that resolve spontaneously with decreased frequency of play. However, the possible long-term effects and its relationship to conditions such as obesity have not been fully examined and must remain speculative.

Conclusion

This chapter has demonstrated that research into video game addiction is a little studied phenomenon. Obviously more research is needed before the debate on whether video game addiction is a distinct clinical entity

is decided. From the sparse research, it is evident that video games appear to be at least potentially addictive. There is also a need for a general taxonomy of video games, as it could be the case that particular types of games are more addictive than others. Another major problem is that video games can be played in many different ways, including on hand held consoles, on a personal computer, home video game consoles, on arcade machines, and on the Internet. It may be the case that some of these media for playing games (such as in an arcade or on the Internet) may be more addictive because of other factors salient to that medium (e.g., disinhibition on the Internet). Therefore, future research needs to distinguish between excessive play in different media.

Research also demonstrates that males are the most excessive users of video games (Kaplan, 1983; Griffiths, 1991b, 1993, 1997a), and this again mirrors many other youth addictions (Griffiths, 1995b). Reasons as to why males play video games significantly more than females have been generally lacking. Explanations may include:

1. the content of the games—most video games have traditionally contained masculine images (Braun et al., 1986) although this is changing with the introduction of strong female lead characters such as Lara Croft. Furthermore, video games are designed by males for males (Gutman, 1982) although there have been “female” forms of game hardware and software introduced, e.g., *Ms. Pac-Man*, Nintendo’s *GameGirl*.
2. socialization—women are not encouraged to express aggression in public and feel uncomfortable with games of combat or war (Surrey, 1982). It could be that male domination of video games is due more to the arcade atmosphere, its social rules, and socialization factors than the games themselves.
3. sex differences—males on average perform better in visual and spatial skills (particularly depth perception) (Maccoby & Jacklin, 1974) that are essential to good game playing, e.g., hand-eye coordination (Keisler, Sproull, & Eccles, 1983). Therefore, the average male player would be more likely to score higher than the average female player and thus be more likely to persist in playing.

It is also apparent that there are gender differences between the types of game played. For example, Griffiths and Hunt (1995) reported that males preferred beat ’em ups and puzzlers and that females preferred platform games. Another study by Griffiths (1997b) reported that males play more beat ’em ups and sport

simulations, and that females play more puzzlers and platformers. Although there are some slight differences in these findings, they do seem to suggest that males prefer the more aggressive type of games. In fact, Griffiths (1997b) went on to report that 42 percent of boys' favorite games were violent, whereas only 9 percent of the girls' were. This was also echoed by Parsons (1995), who reported that females prefer less aggressive games than males, and that males prefer violence. More research is therefore needed into the relationship (if any) between violent video games and potential addictiveness. There is also the question of developmental effects—do video games have the same effect regardless of age? It could well be the case that video games have a more pronounced addictive effect in young children but less of an effect (if any) once they have reached their adult years. There is also the social context of playing: does playing in groups or individually, with or against each other, affect potential addictiveness of games in any way? These all need further empirical investigation.

It does appear that excessive video game playing can have potentially damaging effects upon a minority of individuals who display compulsive and addictive behavior, and who will do anything possible to feed their addiction. Such individuals need monitoring. Using these individuals in research would help identify the roots and causes of addictive playing and the impact of such behavior on family and school life. It would be clinically useful to illustrate problem cases, even following them longitudinally and recording developmental features of the adolescent video game addict. This would help determine the variables that are salient in the acquisition, development, and maintenance of video game addiction. It may be that video game addiction is age-related, like other more obviously “deviant” adolescent behaviors (e.g., glue sniffing) because there is little evidence to date of video game addiction in adults.

There is no doubt that video game play usage among the general population will continue to increase over the next few years and that if social pathologies (including video game addiction) do exist, then this is certainly an area for development that should be of interest and concern to all those involved in the addiction research field. Real life problems need applied solutions and alternatives, and until there is an established body of literature on the psychological, sociological, and physiological effects of video game playing and video-game addiction, directions for education, prevention, intervention, and treatment will remain limited in scope.

References

- American Psychiatric Association. (1987). *Diagnostic and Statistical Manual for Mental Disorders (Third Edition)*. Washington, DC: American Psychiatric Association.
- Brasington, R. (1990). Nintendinitis. *New England Journal of Medicine*, 322, 1473–1474.
- Braun, C.M.J., Goupil, G., Giroux, J., & Chagnon, Y. (1986). Adolescents and microcomputers: Sex differences, proxemics, task and stimulus variables. *Journal of Psychology*, 120, 529–542.
- Bright, D. A., & Bringham, D. C. (1992). Nintendo elbow. *Western Journal of Medicine*, 156, 667–668.
- Brown, R.I.F. (1993). Some contributions of the study of gambling to the study of other addictions. In W. R. Eadington & J. A. Cornelius (Eds.), *Gambling Behavior and Problem Gambling* (pp. 241–272). Reno: University of Nevada Press.
- Brown, R.I.F., & Robertson, S. (1993). Home computer and video game addictions in relation to adolescent gambling: Conceptual and developmental aspects. In W. R. Eadington & J. A. Cornelius (Eds.), *Gambling Behavior and Problem Gambling* (pp. 451–471). Reno: University of Nevada Press.
- Casanova, J., & Casanova, J. (1991). Nintendinitis. *Journal of Hand Surgery*, 16, 181.
- Cleary, A. G., Mckendrick, H., & Sills, J. A. (2002). Hand-arm vibration syndrome may be associated with prolonged use of vibrating computer games. *British Medical Journal*, 324, 301.
- Colwell, J., Grady, C., & Rhaiti, S. (1995). Computer games, self-esteem, and gratification of needs in adolescents. *Journal of Community and Applied Social Psychology*, 5, 195–206.
- Corkery, J. C. (1990). Nintendo power. *American Journal of Diseases in Children*, 144, 959.
- Deheger, M., Rolland-Cachera, M. F., & Fontvielle, A. M. (1997). Physical activity and body composition in 10 year old French children: Linkages with nutritional intake? *International Journal of Obesity*, 21, 372–379.
- Egli, E. A., & Meyers, L. S. (1984). The role of video game playing in adolescent life: Is there a reason to be concerned? *Bulletin of the Psychonomic Society*, 22, 309–312.

- Fisher, S. E. (1994). Identifying video game addiction in children and adolescents. *Addictive Behaviors, 19*, 5, 545–553.
- Friedland, R. P., & St. John, J. N. (1984). Video-game palsy: Distal ulnar neuropathy in a video game enthusiast. *New England Journal of Medicine, 311*, 58–59.
- Glick, S. D., Merski, C., Steindorf, S., Wank, R., Keller, W., & Carlson, J. N. (1992). Neurochemical predisposition to self-administer morphine in rats. *Brain Research, 578*, 215–220.
- Graf, W. D., Chatrian, G. E., Glass, S. T., & Knauss, T. A. (1994). Video-game related seizures: A report on 10 patients and a review of the literature. *Pediatrics, 3*, 551–556.
- Griffiths, M. D. (1990a). The acquisition, development and maintenance of fruit machine gambling in adolescence. *Journal of Gambling Studies, 6*, 193–204.
- Griffiths, M. D. (1990b). The cognitive psychology of gambling. *Journal of Gambling Studies, 6*, 31–42.
- Griffiths, M. D. (1991a). The observational analysis of adolescent gambling in UK amusement arcades. *Journal of Community and Applied Social Psychology, 1*, 309–320.
- Griffiths, M. D. (1991b). Amusement machine playing in childhood and adolescence: A comparative analysis of video games and fruit machines. *Journal of Adolescence, 14*, 53–73.
- Griffiths, M. D. (1993). Are computer games bad for children? *The Psychologist: Bulletin of the British Psychological Society, 6*, 401–407.
- Griffiths, M. D. (1995a). Technological addictions. *Clinical Psychology Forum, 76*, 14–19.
- Griffiths, M. D. (1995b). *Adolescent gambling*. London: Routledge.
- Griffiths, M. D. (1996a). Internet “addiction”: An issue for clinical psychology? *Clinical Psychology Forum, 97*, 32–36.
- Griffiths, M. D. (1996b). Behavioral addictions: An issue for everybody? *Journal of Workplace Learning, 8*(3), 19–25.
- Griffiths, M. D. (1997a). Video games and children’s behavior. In T. Charlton & K. David (Eds.), *Elusive links: Television, video games, cinema and children’s behavior* (pp. 66–93). Gloucester: GCED/Park Publishers.
- Griffiths, M. D. (1997b). Computer game playing in early adolescence. *Youth and Society, 29*, 223–237.
- Griffiths, M. D. (1998). Internet addiction: Does it really exist? In J. Gackenbach (Ed.), *Psychology and the Internet: Intrapersonal, Interpersonal and Transpersonal Applications* (pp. 61–75). New York: Academic Press.
- Griffiths, M. D. (1999). Internet addiction: Internet fuels other addictions. *Student British Medical Journal, 7*, 428–429.
- Griffiths, M. D. (2000a). Internet addiction—Time to be taken seriously? *Addiction Research, 8*, 413–418.
- Griffiths, M. D. (2000b). Does internet and computer “addiction” exist? Some case study evidence. *Cyber-Psychology and Behavior, 3*, 211–218.
- Griffiths, M. D., & Dancaster, I. (1995). The effect of Type A personality on physiological arousal while playing computer games. *Addictive Behaviors, 20*, 543–548.
- Griffiths, M. D., & Hunt, N. (1995). Computer game playing in adolescence: Prevalence and demographic indicators. *Journal of Community and Applied Social Psychology, 5*, 189–194.
- Griffiths, M. D., & Hunt, N. (1998). Dependence on computer games by adolescents. *Psychological Reports, 82*, 475–480.
- Gupta, R., & Derevensky, J. L. (1997). The relationship between gambling and video-game playing behavior in children and adolescents. *Journal of Gambling Studies, 12*, 375–394.
- Gutman, D. (1982). Video games wars. *Video Game Player*, fall 1982.
- Gwinup, G., Haw, T., & Elias, A. (1983). Cardiovascular changes in video game players: Cause for concern? *Postgraduate Medicine, 74*, 245.
- Harding, G.F.A., & Jeavons, P. M. (1994). *Photosensitive Epilepsy*. London: Mac Keith Press.
- Harris, R. A., Brodie, M. S., & Dunwiddie, T. V. (1995). Possible substrates of ethanol reinforcement: GABA and dopamine. *Annals for the New York Academy of Sciences, 654*, 61–69.
- Hart, E. J. (1990). Nintendo epilepsy. *New England Journal of Medicine, 322*, 1473.
- Johnson, B., & Hackett, A. F. (1997). Eating habits of 11–14-year-old schoolchildren living in less affluent

- areas of Liverpool, UK. *Journal of Human Nutrition and Dietetics*, *10*, 135–144.
- Julien, R. M. (1995). *A primer of drug action: A concise, nontechnical guide to the actions, uses and side effects of psychoactive drugs*. Oxford: Freeman.
- Kaplan, S. J. (1983). The image of amusement arcades and differences in male and female video game playing. *Journal of Popular Culture*, *16*, 93–98.
- Keepers, G. A. (1990). Pathological preoccupation with video games. *Journal of the American Academy of Child and Adolescent Psychiatry*, *29*, 49–50.
- Keisler, S., Sproull, L., & Eccles, J. S. (1983). Second class citizens. *Psychology Today*, *17*(3), 41–48.
- Klein, M. H. (1984). The bite of Pac-Man. *Journal of Psychobiology*, *11*, 395–401.
- Koepp, M. J., Gunn, R. N., Lawrence, A. D., Cunningham, V. J., Dagher, A., Jones, T., Brooks, D. J., Bench, C. J., & Grasby, P. M. (1998). Evidence for striatal dopamine release during a video game. *Nature*, *393*, 266–268.
- Loftus, G. A., & Loftus, E. F. (1983). *Mind at play: The psychology of video games*. New York: Basic Books.
- Maccoby, E. E., & Jacklin, C. N. (1974). *The psychology of sex differences*. Stanford, CA: Stanford University Press.
- Maeda, Y., Kurokawa, T., Sakamoto, K., Kitamoto, I., Kohji, U., & Tashima, S. (1990). Electroclinical study of video-game epilepsy. *Developmental Medicine and Child Neurology*, *32*, 493–500.
- Malone, T. W. (1981). Toward a theory of intrinsically motivating instruction. *Cognitive Science*, *4*, 333–369.
- Marks, I. (1990). Non-chemical (behaviorial) addictions. *British Journal of Addiction*, *85*, 1389–1394.
- McCowan, T. C. (1981). Space Invaders wrist. *New England Journal of Medicine*, *304*, 1368.
- McIlwraith, R. (1990). Theories of television addiction. Paper presented at the American Psychological Association, Boston.
- Miller, D.L.G. (1991). Nintendo neck. *Canadian Medical Association Journal*, *145*, 1202.
- Millett, C. J., Fish, D. R., & Thompson, P. J. (1997). A survey of epilepsy-patient perceptions of video-game material/electronic screens and other factors as seizure precipitants. *Seizure*, *6*, 457–459.
- Mirman, M. J., & Bonian, V. G. (1992). “Mouse elbow”: A new repetitive stress injury. *Journal of the American Osteopath Association*, *92*, 701.
- Murphy, J. K., Stoney, C. M., Alpert, B. S., & Walker, S. S. (1995). Gender and ethnicity in children’s cardiovascular reactivity: 7 years of study. *Health Psychology*, *14*, 48–55.
- Parsons, K. (1995). Educational places or terminal cases: Young people and the attraction of computer games. Paper presented at the British Sociological Association Annual Conference, University of Leicester.
- Phillips, C. A., Rolls, S., Rouse, A., & Griffiths, M. (1995). Home video game playing in schoolchildren: A study of incidence and patterns of play. *Journal of Adolescence*, *18*, 687–691.
- Phillips, W. R. (1991). Video game therapy. *New England Journal of Medicine*, *325*, 1056–1057.
- Professional Association of Teachers. (1994). *The street of the Pied Piper: A survey of teachers’ perceptions of the effects on children of the new entertainment technologies*. Derby: Author.
- Quirk, J. A., Fish, D. R., Smith, S.J.M., Sander, J. W., Shorvon, S. D., & Allen, P. J. (1995). First seizures associated with playing electronic screen games: A community based study in Great Britain. *Annals of Neurology*, *37*, 110–124.
- Reinstein, L. (1983). De Quervain’s stenosing tenosynovitis in a video games player. *Archives of Physical and Medical Rehabilitation*, *64*, 434–435.
- Rocha, B. A., Fumagalli, F., Gainetdinov, R. R., Jones, S. R., Ator, R., Giros, B., Miller, G. W., & Caron, M. G. (1998). Cocaine self-administration in dopamine-transporter knockout mice. *Nature Neuroscience*, *1*, 132–137.
- Rushton, D. N. (1981). “Space Invader” epilepsy. *The Lancet*, *1*, 501.
- Rutkowska, J. C., & Carlton, T. (1994). Computer games in 12–13 year olds’ activities and social networks. Paper presented at the British Psychological Society Annual Conference, University of Sussex.
- Schink, J. C. (1991). Nintendo enuresis. *American Journal of Diseases in Children*, *145*, 1094.
- Segal, K. R., & Dietz, W. H. (1991). Physiologic responses to playing a video game. *American Journal of Diseases of Children*, *145*, 1034–1036.

- Selnow, G. W. (1984). Playing video games: The electronic friend. *Journal of Communication*, 34, 148–156.
- Shimai, S., Yamada, F., Masuda, K., & Tada, M. (1993). TV game play and obesity in Japanese school children. *Perceptual and Motor Skills*, 76, 1121–1122.
- Shotton, M. (1989). *Computer addiction? A study of computer dependency*. London: Taylor and Francis.
- Siegel, I. M. (1991). Nintendonitis. *Orthopedics*, 14, 745.
- Soper, W. B., & Miller, M. J. (1983). Junk time junkies: An emerging addiction among students. *School Counselor*, 31, 40–43.
- Spence, S. A. (1993). Nintendo hallucinations: A new phenomenological entity. *Irish Journal of Psychological Medicine*, 10, 98–99.
- Stolerman, I. (1992). Drugs of abuse: Behavioral principles, methods and terms. *Trends in Pharmacological Sciences*, 13, 171.
- Surrey, D. (1982). “It’s like good training for life.” *Natural History*, 91, 71–83.
- Volkow, N. D. (1997). Relationship between subjective effects of cocaine and dopamine transporter occupancy. *Nature*, 386, 827–830.
- Wanner, E. (1982). The electronic bogeyman. *Psychology Today*, 16(10), 8–11.
- Young, K. (1998). *Caught in the net: How to recognize the signs of internet addiction and a winning strategy for recovery*. New York: Wiley.
- Young, K. (1999). Internet addiction: Evaluation and treatment. *Student British Medical Journal*, 7, 351–352.
- Zimbardo, P. (1982). Understanding psychological man: A state of the science report. *Psychology Today*, 16, 15.

