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INTERNET AND VIDEO-GAME ADDICTION

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The popularity of video-game and Internet use as a leisure phenomenon has led to them becoming an ever-increasing part of many people's lives. Coupled with this, there is a growing number of reports in the media about excessive use of both the Internet and video-games. Although the concept of an addiction to the Internet or video-games appears to have its supporters in the media, there is much skepticism amongst the academic community – not least among those working in the field of addiction research. It is not hard to understand such attitudes. For many, the concept of Internet or 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 which views a number of behaviors as potentially addictive, including many behaviors which do not involve the ingestion of a psychoactive drug (e.g., gambling, computer game playing, exercise, sex, Internet use) (Griffiths, 2005a). Such diversity has led to new all-encompassing definitions of what constitutes addictive behavior.

DEFINITION

This author has consistently argued that excessive gambling is no different from (say) alcoholism or heroin addiction in terms of the core components of addiction (Griffiths, 2007). If it can be shown that a behavior such as excessive gambling can be a *bona fide* addiction, then there is a precedent that any behavior

which 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 Internet and video-game use) (Griffiths, 2005a).

It has been alleged for many years that social pathologies exist among excessive Internet users and 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"). Young (1998) argued a similar case for excessive Internet users. Such addictions have been termed "technological addictions" (Griffiths, 1995a, 1996a), and have been operationally defined as non-chemical (behavioral) addictions that involve excessive human–machine interaction. They can either be passive (e.g., television), or active (e.g., video-games), and usually contain inducing and reinforcing features which 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, 2005a) – i.e., salience, mood modification, tolerance, withdrawal, conflict and relapse.

Research into the area of video-game and Internet addiction needs to be underpinned by three fundamental questions:

1. What is addiction?
2. Does Internet or video-game addiction actually exist?
3. If Internet and video-game addiction exists, what are people actually addicted to?

The first question continues to be much debated, both amongst psychologists within the field of addiction research and among 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, Internet use) that fulfils these six criteria is therefore operationally defined as an addiction. In the case of Internet or video-game addiction, criteria would be:

1. *Salience*. This occurs when Internet use or video-game play becomes the most important activity in a person's life, dominating their thinking (preoccupations and cognitive distortions), feelings (cravings) and behavior (deterioration of socialized behavior). For instance, even if not actually on the Internet or playing on a video-game, the individual will be thinking about the next time that he or she will be.

2. *Mood modification*. This refers to the subjective experiences that people report as a consequence of engaging in Internet use or video-game play, and can

be seen as a coping strategy (i.e., they experience an arousing "buzz" or a "high" or, paradoxically, a tranquilizing feel of "escape" or "numbing").

3. *Tolerance.* This is the process whereby increasing amounts of Internet use or video-game play are required to achieve the former mood-modifying effects. This basically means that people gradually build up the amount of the time they spend engaged in Internet use or video-gaming.

4. *Withdrawal symptoms.* These are the unpleasant feeling states and/or physical effects that occur when Internet use or video-game play is discontinued or suddenly reduced (e.g., the shakes, moodiness, irritability).

5. *Conflict.* This refers to the conflicts between the Internet user or 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) which are concerned with spending too much time engaged in Internet use or video-game play.

6. *Relapse.* This is the tendency for repeated reversions to earlier patterns of Internet use or video-game play, and for even the most extreme patterns typical of the height of excessive Internet use or video-game play to be quickly restored after periods of abstinence or control.

Having operationally defined addiction, it is this author's belief that, in answer to the second question, Internet and video-game addictions do indeed exist, but that they affect only a very small minority of users and players (including adolescents). There appear to be many people who use the Internet or play 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 this field. What are people actually addicted to when they use the Internet or play video-games excessively? Is it the interactive medium of playing? Is it aspects of its specific style (i.e., an anonymous and disinhibiting activity)? Is it the specific types of games (aggressive games, strategy games, etc.)? This has led to much debate amongst those working in this field. Research being carried out into Internet addiction may lead to insights regarding video-game addiction, and *vice versa*. For instance, Young (1999) has claimed that Internet addiction is a broad term covering a wide variety of behaviors and impulse control problems. This is categorized by five specific subtypes:

1. Cybersexual addiction: compulsive use of adult websites for cybersex and cyberporn.
2. Cyber-relationship addiction: over-involvement in online relationships
3. Net compulsions: obsessive online gambling, shopping or day-trading
4. Information overload: compulsive web surfing or database searches
5. Computer addiction: obsessive computer game playing (e.g., *Doom*, *Myst*, *Solitaire*, etc.).

In reply to Young, this author has argued that many of these excessive Internet users are not "Internet addicts" but just use the Internet excessively as a medium

to fuel other addictions (Griffiths, 1999, 2000a). Put very simply, gambling addicts or a video-game addicts who engage in their chosen behavior online are 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 (including adolescents) who appear to be addicted to the Internet itself (e.g., Griffiths, 1996a, 1998, 2000b; Young, 1998). These are usually people (and very often adolescents in their late teenage years) 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 them feel good about themselves. In such cases, the Internet may provide an alternative reality to users 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 (theoretically a combination of both Internet use and video-game play) these speculations may provide insights into the potentially addictive nature of video-games for those playing in this medium.

VIDEO-GAME ADDICTION: A BRIEF OVERVIEW

Research has shown that males are the most excessive users of video-games (Kaplan, 1983; Griffiths, 1991, 1993, 1997a), and this mirrors many other youth addictions (Griffiths, 1995b). Reasons why males play video-games significantly more than females have been generally lacking, but explanations may include the following:

- The content of the game – most video-games have traditionally contained masculine images (Braun *et al.*, 1986), although this is changing with the introduction of strong female lead characters like Lara Croft. Furthermore, video-games are designed by males for males (Gutman, 1982), although some "female" forms of game hardware and software have been introduced (e.g., *Ms Pac-man*, Nintendo's *Game Girl*). However, these are often seen as patronizing by female gamers.
- 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 the male domination of video-games is due more to its social rules and socialization factors (e.g., arcade atmosphere and subculture) than to the games themselves.
- Sex differences – males, on average, have better visual and spatial skills (for example, hand–eye co-ordination), particularly depth perception (Maccoby and Jacklin, 1974), which are essential to good game playing (Keisler *et al.*, 1983). Therefore, the average male player is more likely to score higher than the average female player and thus to persist in playing.

It is also apparent that there are gender differences between the types of games played. For example, Griffiths and Hunt (1995) reported that males preferred "beat 'em ups" and "puzzlers" and 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, as opposed to only 9 percent of the girls'. This was echoed by Parsons (1995), who reported that females prefer less aggressive games than males, while males prefer violence.

Insights into the potentially addictive nature of video-games have come from research into slot-machine gaming. For instance, both video-game machines and slot machines may be considered under the generic label of "amusement machines" (Griffiths, 1991). The main difference between video-game machines and slot machines are that video-games are (usually) played to accumulate as many points as possible, whereas slot machines are played (i.e., gambled upon) to accumulate money. It has been suggested that playing a video-game could be considered to be a non-financial form of gambling (Griffiths, 1991). Both types of machine (in the case of arcade games) require insertion of 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 more likely to be a product of chance. However, the general playing philosophy of both slot-machine players and (arcade) video-game players is to stay on the machine for as long as possible, using the least amount of money (Griffiths, 1990a, 1990b) – playing *with* money rather than *for* it.

Besides the generic labeling, their geographical juxtaposition and the philosophy for playing, it could be argued that, on both psychological and behavioral levels, 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.) (Griffiths, 2005b). The most probable reason the two forms have rarely been seen as conceptually similar is because video-game playing does not involve the winning of money (or something of financial value), and therefore cannot be classed as a form of gambling. However, the next generation of slot machines is starting to use video-game graphics and technology (Griffiths, 2006). While many of these relate to traditional gambling games (e.g., roulette, poker, blackjack, etc.), 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 in which slot machines and the gaming industry are heading.

Furthermore, there is a growing number of researchers who suggest that arcade video-games share some common ground with slot (gambling) machines,

including the potential for dependency (see, for example, Griffiths, 1991, 1993, 1997a, 2005b; Brown and Robertson, 1992; Fisher, 1994; Gupta and Derevensky, 1997; Wood *et al.*, 2004). As Fisher and Griffiths (1995) pointed out, arcade video-games and slot machines share some important structural characteristics, these being:

- The requirement for response to stimuli which are predictable and governed by the software loop
- The requirement for total concentration and hand–eye coordination
- A 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), which 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 – i.e., 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 a fast response 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).

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 being children, half adult; 96% male) who had been self-reportedly "hooked" on home video-games for at least 5 years. Of these, 75 were measured against two control groups, and it was reported that the computer-dependent individuals were highly intelligent, motivated and achieving people, but were often misunderstood. After a 5-year follow-up, 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 carried out with people who were familiar with the older generation of video-games that were

popular in the earlier part of the 1980s. Video-games from 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 and 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.

A questionnaire study undertaken by Griffiths and Hunt (1995, 1998) with almost 400 adolescents (12–16 years of age) attempted 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:

- Salience ("Do you frequently play most days?")
- Tolerance ("Do you frequently play for longer periods of time?")
- Mood modification ("Do you play for excitement or a 'buzz'?")
- Chasing ("Do you play to beat your personal high score?")
- Relapse ("Do you make repeated efforts to stop or decrease playing?")
- Withdrawal ("Do you become restless if you cannot play?")
- Conflict ("Do you play instead of attending to school related activities?", "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 62 players (19.9%) were dependent on computer games (i.e., scored four or more on the scale). Furthermore, 7 percent of the sample claimed they played for over 30 hours a week. The dependence score correlated with gender – significantly more males than females were dependent – and with how often individuals played computer games, the mean session length playing time, and the longest single-session playing time. Further analysis indicated that those who were 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. However, there are several 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 (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 part replication study found very similar results (Griffiths, 1997b). It is also worth noting that 7 percent of the sample in the study by Griffiths and Hunt (1995, 1998) claimed

to play computer games for over 30 hours a week. Similar findings have also been reported in other studies (see, for example, Fisher, 1994; Parsons, 1995; Phillips *et al.*, 1995; Griffiths, 1997b; Tejeiro-Delguero and Moran, 2002). However, it is worth noting that Charlton's (2002) factor analytic study of computer addiction showed a blurring of distinction between non-pathological high engagement and addiction. Therefore, it could alternatively be the case that there are very excessive gamers who show few negative consequences in their life.

There is no doubt that, for a minority of adolescents, video-games can take up considerable time. Whether these studies suggest video-games are truly addictive is perhaps not the most salient issue here. The question to ask is, what does the longitudinal effect of any activity (not just video-game playing) that takes up 30 hours of leisure time a week have on the educational and social development of children and adolescents? At present we do not know the answer. However, it could be argued any child who engages in any activity excessively (whether defined as an addiction or not) every day over a number of years from a young age will have his or her social and/or educational development negatively affected in some way.

There is also the question raised earlier: if video-games are addictive, then what is the addictive process? One potential way of answering this question is to produce possible theoretical accounts of video-game 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. That 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 a poor imagination
2. That 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. That 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. That 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 regarding arcade video-game addiction (Fisher, 1994) appears to support the second theoretical orientation – i.e., that video-game addiction is a function of the video-game's effects on arousal level. Research by Koepp *et al.* (1998) demonstrated dopaminergic neurotransmission during the playing of a video-game. This may have implications for understanding the underlying addictive process in the playing of such 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 the last decade, 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).

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 and Hunt, 1995, 1998), truanting from school to play (Keepers, 1990; Griffiths and Hunt, 1998), not doing homework/getting bad marks at school (Phillips *et al.*, 1995; Griffiths and Hunt, 1998), sacrificing social activities to play (Egli and Meyers, 1984; Griffiths and Hunt, 1998), irritability and annoyance if unable to play (Rutkowska and Carlton, 1994; Griffiths and Hunt, 1998), and playing longer than intended/time loss (Egli and Meyers, 1984; Griffiths and Hunt, 1998; Wood and Griffiths, 2007; Wood *et al.*, 2007). There is no doubt that, for a minority of people (particularly adolescents), video-games can take up considerable time, and to all intents and purposes they are "addicted" to them. However, the prevalence of such an addiction is still a matter 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.

It has been argued that the only way of determining whether non-chemical (i.e., behavioral) addictions (such as video-game addiction) are addictive in a non-metaphorical sense is to compare them against clinical criteria for other established drug-ingested addictions. However, most people researching 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 in the field is that the measures used (i) have no measure of severity, (ii) have no temporal dimension, (iii) have a tendency to over-estimate the prevalence of problems, and (iv) take no account of the context of video-game use. There are also concerns about the sampling methods employed. As a consequence, none 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 (usually adolescents), 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 could be located, it would indicate that video-game addiction actually does exist – even if it were unrepresentative. There are case-study accounts in the literature which appear to show that excessive video-game players display many signs of addiction (see, for example, Keepers, 1992) including those that play online (Griffiths, 2000b; Griffiths *et al.*, 2003, 2004a, 2004b). These case studies tend to show that the video-games are used to counteract other deficiencies and underlying problems in a person's life (e.g., relationships, lack of friends, dissatisfaction with 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.

There has been speculation that online gaming may be more problematic and/or addictive than offline (stand alone) games (Griffiths *et al.*, 2004a). For instance, Grüsser and colleagues (2007) investigated the addictive potential of online video-gaming. A self-selected sample comprising 7069 gamers, mostly male (94%), with an average age of 21 years, answered two online questionnaires. One in nine of them (840 gamers) fulfilled at least three diagnostic criteria of addiction concerning their gaming behavior. Addictive signs were modeled on key symptoms of the dependence syndrome outlined by the World Health Organization, and included craving, tolerance, withdrawal symptoms, loss of control, neglect of other activities, and other negative consequences. Those gamers who displayed at least three addictive signs were then compared with the remaining gamers. The "addicted" gamers predictably played for significantly longer daily periods of time. They were also significantly more likely to report withdrawal symptoms and craving. Although these gamers show some signs of addiction normally found in other more traditional addictions, the results did not conclusively show that the gamers are genuinely addicted. Many gamers play excessively and display few negative consequences. However, the 24-hours-a-day never-ending online games may provide a potentially addictive medium for those with a predisposition to excessive game playing.

Other indirect evidence of addictive and excessive play comes from the many health consequences that have been reported in the literature. The risk of epileptic seizures while playing video-games in photosensitive individuals (usually adolescents) with epilepsy is well established (see, for example, Maeda *et al.*, 1990; Graf *et al.*, 1994; Harding and Jeavons, 1994; Quirk *et al.*, 1995; Millett *et al.*, 1997). Graf *et al.* (1994) reported that seizures are most likely to occur during rapid scene changes, and with 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 photosensitive epilepsy, the medical profession has, for over 25 years, voiced a number of concerns about excessive video-game playing. Back in the early 1980s, rheumatologists described cases of "*Pac-man's* Elbow" and "*Space Invaders'* Revenge", in which players suffered skin, joint and muscle problems from repeated button-hitting and joystick-pushing on the game machines (Loftus and 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 (see Griffiths, 2003a, 2005c). 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 and Casanova, 1991; Siegal, 1991), hand–arm vibration syndrome (Cleary *et al.*, 2002), repetitive strain injuries (Mirman and Bonian, 1992), and peripheral neuropathy (Friedland and St John, 1984). Admittedly, some of these adverse effects are quite rare, and "treatment" simply involved non-playing of 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 lavatory. In these particular cases, they were simply taught how to use the game's "pause" button!

Other negative aspects of video-game playing that have been reported include the belief that it is socially isolating, causes social anxiety and prevents children from developing social skills (see, for example, Zimbardo, 1982; Lo *et al.*, 2005). For instance, Selnow (1984) reported that some 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 *et al.* (1995) reported that heavy video-game players see friends more often outside school (and have a need for friends) more than non-heavy 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 and colleagues (1995), who found no difference in social interactions between players and non-players.

It has also been suggested that video-game playing may prevent children and adolescents from participating in more educational or sporting pursuits (Egli and 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 and colleagues (1993) found that obesity was correlated with long periods of video-game playing in Japanese children. This finding has also been found in young French children (Deheger *et al.*, 1997) and US children (Vandewater *et al.*, 2004). In the UK, Johnson and Hackett (1997) reported that there was an inverse relationship between physical activity and playing video-games in schoolgirls.

TREATMENT

To date there have been very few accounts of treating video-game addiction, although there are many overviews providing advice to parents (see, for example, Griffiths, 2002, 2003b). Kuczmierczyk and colleagues (1987) reported the case of an 18-year-old college student who had been playing video-games for 3–4 hours a day at an average cost of $5 a day over a 5-month period. They assumed that compulsive video-game playing was conceptually similar to pathological gambling, and used a cognitive-behavioral modification approach in their treatment. Using a combination of self-monitoring, GSR biofeedback assisted relaxation training, *in vivo* exposure and response prevention, a 90 percent reduction of playing was observed and continued at 6- and 12-month follow-up. In addition, the patient reported a more satisfying interpersonal life, had developed an interest in the martial arts, and was significantly less anxious and withdrawn.

The only other reported case of treating a video-game addict was that of Keepers (1990). A 12-year-old boy was brought in by his mother for psychiatric help because he had been playing video-games for 4–5 hours a day at an average cost of $30–50 a day over a 6-month period. The amount was far beyond the boy's means, and he had been stealing and truanting from school in order to play. Keepers reported that the boy was physically abused by his father (as was the mother), and was placed in a residential treatment centre and given family therapy. During therapy, the boy remained reluctant to discuss his home situation or his parents. In an effort to uncover some of his feelings, the boy was asked to design his own video-game. Using video-games as a vehicle for communication, the boy was gradually able to talk about his fear of his father and his feelings of helplessness. Family therapy was again undertaken, with the eventual outcome of parental separation and return of the boy to his mother. At 6-month follow-up, no recurrence of the boy's difficulty was noted. Keepers also considered his patient's behavior to be reminiscent of pathological gambling.

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 of 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 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 of developing health

problems. Those that it does affect will experience subtle, relatively minor and temporary effects that resolve spontaneously with decreased frequency of play.

INTERNET ADDICTION: A BRIEF OVERVIEW

Unlike the research on video-game play, the vast majority of research on excessive Internet use has concentrated on undergraduate students and other adult populations. The extent to which excessive Internet use is a problem in adolescence thus remains somewhat speculative. As noted above, this author has argued (Griffiths, 2000a) that many excessive Internet users are not "Internet addicts", but just use the Internet excessively as a medium to fuel other addictions. Therefore, there is a need to distinguish between addictions *to* the Internet and addictions *on* the Internet. We will return to this later in the chapter. As we shall see, there have been increasing numbers of academic papers about excessive use of the Internet. These can roughly be divided into five categories:

1. Survey studies that compare excessive Internet users with non-excessive users
2. Survey studies that have examined groups that are vulnerable to excessive Internet use, most notably students
3. Studies that examine the psychometric properties of excessive Internet use
4. Case studies of excessive Internet users and treatment case studies
5. Correlational studies examining the relationship of excessive Internet use with other behaviors (e.g., psychiatric problems, depression, self-esteem, etc.).

Therefore, each of the areas outlined above will be briefly reviewed in turn, although it must be reiterated that very few of these studies have specifically examined adolescent Internet addiction.

COMPARISON SURVEY STUDIES OF INTERNET ADDICTION AND EXCESSIVE INTERNET USE

The earliest empirical research study to be carried out looking into excessive Internet use was by Young (1996a). The study addressed the question of whether or not the Internet can be addictive, and the extent of problems associated with its misuse. The DSM-IV criteria for pathological gambling were modified to develop an eight-item questionnaire, as pathological gambling was viewed to be the closest in nature to pathological Internet use. Participants who answered "yes" to five or more of the eight criteria were classified as being addicted to the Internet (i.e., "dependents"). A self-selected sample of 496 people responded to the questionnaire, with the vast majority ($n = 396$) being classed as dependents. The majority of respondents were female (60%), and none of the sample were adolescents.

It was found that dependents spent more time online (38.5 hours a week) compared with non-dependents (4.9 hours a week), and mostly used the more interactive functions of the Internet, such as chat rooms and forums. Dependents also reported that their Internet use caused moderate to severe problems in their family, social and professional lives. Young concluded that (i) the more interactive the Internet function, the more addictive it is, and (ii) while normal users reported few negative effects of Internet use, dependents reported significant impairment in many areas of their lives, including health, occupational, social and financial.

However, there were many limitations to the study, including the (relatively) small self-selected sample. Furthermore, the dependents and non-dependents had not been matched in any manner. Moreover, Young advertised for "avid Internet users" to take part in her study, which would have biased her results. There was also an assumption that excessive Internet use was akin to pathological gambling, and that the criteria used to operationalize excessive Internet use were reliable and valid. Despite the methodological shortcomings of Young's study, it could be argued that she kick-started a new area of academic enquiry.

Egger and Rauterberg (1996) also conducted an online study by asking similar questions to those asked by Young, although their categorization of addiction was based purely on whether the respondents themselves felt they were addicted. Using an online survey, they gathered 450 participants, 84 percent of whom were males. Again, there were no adolescents in the sample, and the researchers reached similar conclusions to Young. Respondents who self-reported as "addicts" reported negative consequences of Internet use, complaints from friends and family over the amount of time spent online, feelings of anticipation when going online, and feeling guilty about their Internet use. As with Young's study, it suffered from similar methodological limitations. Furthermore, most of the participants were males from Switzerland.

Brenner (1997) devised an instrument called the Internet-Related Addictive Behavior Inventory (IRABI), consisting of 32 dichotomous (true/false) items. These items were designed to assess experiences comparable to those related to Substance Abuse in the DSM-IV. Of the 563 adult respondents, the majority were male (73%), and they used the Internet for (a mean average) of 19 hours a week. All 32 items seemed to measure some unique variance, as they were all found to be moderately correlated with the total score. Older users tended to experience fewer problems compared with younger users despite spending the same amount of time online (which may have implications for adolescents). No gender differences were reported. The data appeared to suggest that a number of users experienced more problems in role performance because of their Internet usage. Brenner concluded that the skewed distribution was consistent with the existence of a deviant subgroup of people who experiences more severe problems due to Internet use. He also claimed there was evidence of tolerance, withdrawal and craving. The major limitation to the study was that it was not clear whether

items in the IRABI really tapped into behaviors that indicated genuine signs of addiction (Griffiths, 1998).

In a much bigger study – the Virtual Addiction Survey (VAS) – Greenfield (1999) conducted an online survey with 17 251 (mostly adult) respondents. The sample was mainly Caucasian (82%) and male (71%), with a mean age of 33 years. The VAS included demographic items (e.g., age, location, educational background, etc.), descriptive information items (e.g., frequency and duration of use, specific Internet usage, etc.) and clinical items (e.g., disinhibition, loss of time, behavior online). It also included 10 modified items from DSM-IV criteria for pathological gambling. Approximately 6 percent of respondents met the criteria for addicted Internet usage patterns. Tentative *post hoc* analysis proposed several variables that made the Internet attractive:

- Intense intimacy (41% of total sample, 75% of dependents)
- Disinhibition (43% of total sample, 80% of dependents)
- Loss of boundaries (39% of total sample, 83% of dependents)
- Timelessness (most of the sample replied "sometimes", most of the dependents replied "almost always")
- Out of control (8% of total sample, 46% of dependents).

One of the additional areas examined was whether Internet addiction shared the same characteristics as other forms of addiction, including substance-based addictions. Early analysis revealed numerous symptoms, which Greenfield viewed as being consistent with the concept of tolerance and withdrawal in dependents, including preoccupation with going online (58%), numerous unsuccessful attempts to cut back (68%), and feeling restless when attempting to cut back (79%). Despite the large sample size, only a very preliminary analysis was conducted. Therefore, results should be interpreted with caution. Furthermore, it is hard to make generalizations to adolescents, as there were very few people under the age of 20 years in the study.

SURVEY STUDIES OF INTERNET ADDICTION IN VULNERABLE GROUPS

A number of other studies have highlighted the danger that excessive Internet use may pose to students as a population group. This population is deemed to be vulnerable and at risk, given the accessibility of the Internet and the flexibility of their schedules (Moore, 1995). For instance, Scherer (1997) studied 531 students at the University of Texas at Austin. Of these, 381 students used the Internet at least once per week and were further investigated. Based on the criteria paralleling chemical dependencies, 49 students (13%) were classified as "Internet dependent" (71% male; 29% female). Dependent users averaged 11 hours/week online as opposed to the average of 8 hours for non-dependents. Dependents were three times more likely to use interactive synchronous applications. The major weakness of this study appears to be that dependents only averaged 11 hours a week online (i.e., just over an hour a day). This could hardly be called excessive or addictive (Griffiths, 1998).

Morahan-Martin and Schumacher (2000) conducted a similar online study. Pathological Internet Use (PIU) was measured by a 13-item questionnaire assessing problems due to Internet use (e.g., academic, work, relationship problems, tolerance symptoms, and mood-altering use of the Internet). Those who answered yes to four or more of the items were defined as pathological Internet users. They recruited 277 undergraduate Internet users, of whom 8 percent were classed as pathological users. Pathological Internet users were more likely to be male and to use technologically sophisticated sites. On average, they spent 8.5 hours a week online. It was also found that pathological users used the Internet to meet new people, for emotional support and to play interactive games, and were more socially disinhibited. Again, an average of 8.5 hours a week online does not appear excessive, although the authors argued that it was indicative of problems surfacing in relatively short periods of being online. Furthermore, the items used to measure dependency were similar to Brenner's IRABI items. Therefore, the results claimed to be indicative of Internet addiction without substantiating its existence (Griffiths, 1998).

Anderson (1999) collected data from a mixture of colleges in the US and Europe, yielding 1302 respondents (with an almost 50–50 gender split). On average, his participants used the Internet 100 minutes a day, and roughly 6 percent of the participants were considered to be high users (above 400 minutes a day). The DSM-IV substance-dependence criteria were used to classify participants into dependents and non-dependents. Those endorsing more than three of the seven criteria were classified as being dependent. Anderson reported a slightly higher percentage of dependent student users (9.8%), most of whom were those majoring in hard sciences. Of the 106 dependents, 93 were males. They averaged 229 minutes a day compared with non-dependents who averaged 73 minutes a day. The participants in the high-user category reported more negative consequences compared with the low-user participants.

Kubey and colleagues (2001) surveyed 576 students in Rutgers University. Their survey included 43 multiple-choice items on Internet usage, study habits, academic performance and personality. Internet dependency was measured with a five-point Likert-scale item, asking participants how much they agreed or disagreed with the following statement: "I think I might have become a little psychologically dependent on the Internet". Participants were categorized as being Internet dependent if they chose "agree" or "strongly agree" as the answer to the statement. Of the 572 valid responses, 381 (66%) were females; the age ranged between 18 and 45 years old, with a mean age of 20.25 years. Fifty-three participants (9.3%) were classified as Internet dependent, and males were more prevalent in this group. Age was not found to be a factor, but first-year students (mean age not reported) were found to make up 37.7 percent of the dependent group. Dependents were four times more likely than non-dependents to report academic impairment due to their Internet use, and they were significantly "more lonely" than other students. In terms of their Internet usage, dependents who were also academically impaired were found to be nine times as likely to use

synchronous functions of the Internet (MUDs and IRC/chat programs). The authors proposed that these types of applications are an important outlet for lonely people (especially students who have just moved away to college), as they can keep in touch with family and friends, and find someone to chat with at anytime. No other medium can offer such an opportunity. The results suggest that the younger the user is, the more problems he or she may have as a result of Internet use – which again may have implications for adolescent Internet usage.

Niemz and colleagues (2005) surveyed 371 British students. In a questionnaire which included the pathological Internet use (PIU) scale (Morahan-Martin and Schumacher, 2000), the General Health Questionnaire (GHQ-12), a self-esteem scale and two measures of disinhibition. Results showed that 18.3 percent of the sample were considered to be pathological Internet users whose excessive use of the Internet was causing academic, social and interpersonal problems. Other results showed that pathological Internet users had lower self-esteem and were more socially disinhibited. However, there was no significant difference in GHQ scores. There are methodological concerns, though, as the study used the PIU Scale and relied on a self-selected sample.

Other studies, such as those by Kennedy-Souza (1998), Chou (2001), Tsai and Lin (2003), Chin-Chung and Sunny (2003), Nalwa and Anand (2003). Kaltiala-Heino *et al.* (2004) and Wan and Chiou (2006), which surveyed very small numbers of students and adolescents have simply been too small and/or methodologically limited to make any real conclusions. From the studies so far discussed (in this section and the preceding one, on comparison studies), it is clear that most of these "prevalence type" studies share common weaknesses. Most use convenient, self-selected participants who volunteer to respond to the survey. It is therefore difficult to plan any kind of comparable groups. Most studies did not use any type of validated addiction criteria (such as withdrawal symptoms, salience, tolerance, relapse, etc.), and those that did assumed that excessive Internet use was akin to other behavioral addictions like gambling, and/or used very low cut-off scores which would increase the percentage of those defined as addicted. As Griffiths (2000a) observed, the instruments (like those in video-game play) used have no measure of severity, no temporal dimension, they have a tendency to over-estimate the incidence of the problems, and they do not consider the context of Internet use (for example, it is possible for some people to be engaged in very excessive use because it is part of their job or they are in an online relationship with someone geographically distant).

It is perhaps worth noting that in addition to direct studies of Internet addiction, there have been a number of longitudinal studies examining the relationship between general Internet use (including heavy use) and various aspects of psychosocial well-being (Kraut *et al.*, 1998, 2002; Wästlund *et al.*, 2001; Jackson *et al.*, 2003). However, none of these studies show consistent findings, and none specifically investigated Internet addiction or attempted to measure it. Furthermore, none of them have examined the relationships among adolescent Internet users.

PSYCHOMETRIC STUDIES OF INTERNET ADDICTION

As can be seen from early studies, a number of differing diagnostic criteria have been used in "Internet addiction" studies. One of the most commonly used criteria was that used by Young (1996a) and subsequently by others. The diagnostic questionnaire consisted of eight items modified from the DSM-IV criteria for pathological gambling (see Table 8.1). She maintained the cut-off score of five, according to the number of criteria used to diagnose pathological gambling, although the latter had two additional criteria. Even with the more rigorous cut-off score, it was found that almost 80 percent of the respondents in her study were classified as dependents.

Beard and Wolfe (2001) attempted to modify Young's criteria, based on concerns about the objectivity and the reliance on self-report. Some criteria can easily be reported or denied by a participant, whose judgment might be impaired, thus influencing the accuracy of the diagnosis. Secondly, some of the items were deemed to be too vague, and some terminologies needed to be clarified (for example, what exactly is meant by "preoccupation"?). Thirdly, they questioned whether or not the criteria for pathological gambling are the most accurate to use as a basis for identifying Internet addiction. Beard and Wolfe therefore proposed modified criteria (see Table 8.2). It was recommended that all of the former five criteria be required for a diagnosis, since they could be met without any impairment in the person's daily functioning. Furthermore, at least one of the latter three criteria should be required for diagnosis, as these criteria impact the person's ability to cope and function.

Another attempt at formulating a set of diagnostic criteria for Internet addiction was made by Pratarelli and colleagues (1999). Factor analysis was employed in this research to examine possible constructs underlying computer/Internet addiction. There were 341 completed surveys with 163 male and 178 female participants (mean age of 22.8 years) recruited from Oklahoma State University.

TABLE 8.1 Young's (1996) Diagnostic Criteria for Internet Addiction

1. Do you feel preoccupied with the Internet (think about previous online activity or anticipation of next online session)?
2. Do you feel the need to use the Internet with increasing amounts of time in order to achieve satisfaction?
3. Have you repeatedly made unsuccessful efforts to control, cut back, or stop Internet use?
4. Do you feel restless, moody, depressed, or irritable when attempting to cut down or stop Internet use?
5. Do you stay online longer than originally intended?
6. Have you jeopardized or risked the loss of a significant relationship, job, educational or career opportunity because of the Internet?
7. Have you lied to family members, therapist, or others to conceal the extent of involvement with the Internet?
8. Do you use the Internet as a way of escaping from problems or of relieving a dysphoric mood (e.g., feelings of helplessness, guilt, anxiety, depression)?

TABLE 8.2 Criteria for Identifying Internet Addiction (Beard and Wolfe, 2001)

All the following 1–5 must be present
1. Is preoccupied with the Internet (think about previous online activity or anticipate next online session)
2. Needs to use the Internet with increased amounts of time in order to achieve satisfaction
3. Has made unsuccessful efforts to control, cut back or stop Internet use
4. Is restless, moody, depressed, or irritable when attempting to cut down or stop Internet use
5. Has stayed online longer than originally intended

and at least one of the following:
1. Has jeopardized or risked the loss of a significant relationship, job, educational or career opportunity because of the Internet
2. Has lied to family members, therapist, or others to conceal the extent of involvement with the Internet
3. Uses the Internet as a way of escaping from problems or of relieving a dysphoric mood (e.g., feelings of helplessness, guilt, anxiety, depression)

A questionnaire consisting of 93 items was constructed, 19 of which were categorical demographic and Internet-use questions, and 74 dichotomous items. Four factors were extracted from the 93 items; two principal and two minor.

- Factor 1 focused on problematic computer-related behaviors in heavy users of the Internet. This factor was characterized by reports of loneliness, social isolation, missing appointments, and other general negative consequences of their Internet use.
- Factor 2 focused on the use and usefulness of computer technology in general, and of the Internet in particular.
- Factor 3 focused on two different constructs that concerned the use of the Internet for sexual gratification and shyness/introversion.
- Factor 4 focused on the lack of problems related to Internet use, coupled with mild aversion/disinterest in the technology.

The data collected in this study supported the idea that a mixture of obsessive-like characteristics are present in some individuals in terms of their Internet use, and that they prefer online interactions rather than face-to-face. Although this study used a more statistically tested instrument in measuring Internet addiction, some of the factors extracted (e.g., Factors 2 and 4) did not seem to indicate components of addiction in general. Furthermore, the sample consisted mainly of young adults. Generalization to adolescents or older groups was not confirmed.

More recently, Shapira and colleagues (2003) proposed a revised classification and diagnostic criteria for problematic Internet use. Furthermore, Black and colleagues (1999) pointed out that Internet Addiction Disorder (IAD) seemed to have high comorbidity with other psychiatric disorders. Because of this, the criteria need to be unique in order to evaluate the validity of Internet abuse as a distinct disorder. Shapira and colleagues discussed the concept of Glasser's (1976) work on "positive addiction". However, the concept has been questioned,

as the criteria for positive addiction do not resemble many of the components of more established addictions – such as tolerance and withdrawal (Griffiths, 1996b). Moreover, in terms of Internet dependency, negative consequences have been reported along with the amount of time spent online.

Internet dependency has most commonly been conceptualized as a behavioral addiction which operates on a modified principle of classic addiction models, but the validity and clinical usefulness of such claims have again been questioned (Holden, 2001). Other studies have also supported the concept that problematic Internet use might be associated with features of DSM-IV impulse control disorder (Shapira *et al.*, 2000; Treuer *et al.*, 2001), at least in adult populations.

However, other researchers have questioned the existence of PIU and IAD itself. Mitchell (2000) does not believe it deserves a separate diagnosis, as it is still unclear whether it develops of its own accord or is triggered by an underlying comorbid psychiatric illness. It has become virtually impossible to make the distinction as to which develops first, especially considering how integrated the Internet has become in people's lives. It is therefore difficult to establish a clear developmental pattern, especially as there is very little research specifically on excessive adolescent usage. In addition, behavioral patterns of individuals with problematic Internet use are varied and hard to identify. The only general agreement seems to be that it can be associated with material and psychological consequences. Shapira *et al.* (2003) suggested that future research should delineate problems – for example, some individuals may have problems during a manic episode only, some because of the demographics of choosing the Internet as a medium to shop or to gamble. Once these factors are extricated, the individuals who are left can be assessed regarding addiction and impulsivity purely in terms of their Internet use.

Based on the current (yet limited) empirical evidence, Shapira *et al.* (2003) proposed that problematic Internet use be conceptualized as an impulse control disorder. They admitted that although the category is already a heterogeneous one, over time, specific syndromes have been indicated as clinically useful. Therefore, in the style of DSM IV-TR's impulse-control disorder criteria, and in addition to the proposed impulse-control disorder of compulsive buying, Shapira and colleagues proposed broad diagnostic criteria for problematic Internet use (see Table 8.3).

TABLE 8.3 Diagnostic Criteria for Problematic Internet Use (Shapira *et al.*, 2003)

A. Maladaptive preoccupation with Internet use, as indicated by at least one of the following:
   - Preoccupations with use of the Internet that are experienced as irresistible
   - Excessive use of the Internet for periods of time longer than planned

B. The use of the Internet or the preoccupation with its use causes clinically significant distress or impairment in social, occupational, or other important areas of functioning

C. The excessive Internet use does not occur exclusively during periods of hypomania or mania and is not better accounted by other Axis I disorders

Rotunda and colleagues (2003) used an instrument they simply called the Internet Use Survey. It contained three formal components that explored (i) demographic data and Internet usage, (ii) the negative consequences and experience associated with Internet use, and (iii) personal history and psychological characteristics of participants. Components (ii) and (iii) included several items from DSM-IV criteria for pathological gambling, substance use dependence, and a particular personality disorder (e.g., schizoid). Their sample consisted of 393 students, 53.6 percent females ($n = 210$) and 46.4 percent males ($n = 182$). The age range was between 18 and 81 years, with a mean of 27.6 years. The average use was 3.3 hours a day, with 1 hour for personal use (the other time on the Internet being spent for work-related purposes). The most common usage was e-mail, surfing the web for information and news, and chat rooms. The negative consequences included 18 percent of participants reporting preoccupation with the Internet, 25 percent sometimes feeling excited or euphoric when online, 34 percent admitting to going online to escape other problems to some degree, and 22.6 percent reporting socializing online more than in person. Staying online longer than planned and losing track of time were also found to be common reports.

Factor analysis revealed four main factors. The first was labeled "absorption" (i.e., over-involvement with the Internet, time management failure), the second "negative consequences" (i.e., distress or problematic behavior such as preferring to be online rather than spending time with the family), the third "sleep" (i.e., sleep-pattern disruption, such as scheduling sleep around online time), and the fourth "deception" (i.e., lying to others online about identity, or how long is spent online). Internet-related impairment was conceptualized based on user absorption and negative consequences instead of frequency of use. The authors concluded by stating that in order to assume frequent Internet use is excessive, pathological or addictive is potentially misleading, as it ignores contextual and dispositional factors associated with this behavior. Again, the data were collected from adult users rather than adolescents.

INTERNET ADDICTION, COMORBIDITY AND RELATIONSHIP WITH OTHER BEHAVIORS

Previous studies have found that problematic Internet use in adults co-occurs with other psychiatric disorders (Black *et al.*, 1999, Shapira *et al.*, 2000). Griffiths (2000a) has postulated that in the majority of the cases the Internet seems to act as a medium for other excessive behaviors, and the Internet is largely being used only to carry out these behaviors – in other words, the Internet is acting as a medium and not a causal factor (Shaffer *et al.*, 2000). Some of the factors found to be associated with IAD are personality traits, self-esteem and other psychiatric disorders.

Young and Rodgers (1998) examined the personality traits of individuals who were considered dependent on the Internet using the Sixteen Personality Factor

Inventory (16 PF). Dependent users were found to rank highly in terms of self-reliance (i.e., they did not feel the sense of alienation others feel when sitting alone, possibly because of the interactive functions of the Internet), emotional sensitivity and reactivity (i.e., they are drawn to mental stimulation through endless databases and information available online), vigilance, low self-disclosure, and non-conformist characteristics (i.e., they might be drawn to the anonymity of the Internet). The findings of this study seem to suggest that specific personality traits may predispose individuals to develop PIU. Similar findings were obtained by Xuanhui and Gonggu (2001), examining the relationship between Internet addiction and the 16 PF. Whether such findings can be generalized to adolescents remains to be seen.

Armstrong and colleagues (2000) investigated the extent to which sensation seeking and low self-esteem predicted heavier Internet use, using the Internet Related Problem Scale (IRPS). The IRPS is a 20-item scale covering factors such as tolerance, craving and negative impacts of Internet use. Results indicated that self-esteem is a better predictor of "Internet addiction", compared with impulsivity. Individuals with low self-esteem seem to spend more time online, and had higher scores on the IRPS. Although this study yielded some interesting results, it should be interpreted with caution due to the small number of participants ($n = 50$). Moreover, Armstrong and colleagues maintained that the 20 items indicated 9 different symptoms without any statistical evidence. It would be interesting to investigate whether the items really did measure the symptoms they claimed to. Other studies have looked at the relationship between Internet addiction and self-esteem (see, for example, Widyanto and McMurran, 2004), but again the very low sample sizes make it hard to generalize findings.

Lavin and colleagues (1999) also tested sensation seeking and Internet dependence in college students ($n = 342$). Of the total participants, 43 were defined as dependents and 299 as non-dependents. Dependents had a lower score on the Sensation Seeking Scale, which contradicted their hypothesis. The authors explained by stating that dependents tended to be sociable in their Internet usage but not to the point of sensation seeking, as it differed from the traditional concept. The traditional form of sensation seeking involves more physical activities, such as sky-diving and other thrill-inducing activities, while Internet users are less physical in their sensation seeking. It is possible that the scale used to measure sensation seeking touched more on the physical sensations rather than the non-physical sensations.

Petrie and Gunn (1998) examined the link between Internet addiction, sex, age, depression and introversion. One key question was whether participants defined themselves as Internet addicts or not. Of the 445 participants (roughly equal gender split), nearly half (46%) stated that they were addicted to the Internet. This group was the Self-Defined Addicts (SDAs) group. No gender or age differences were found between SDAs and non-SDAs. The 16 questions that had the highest factor analytical loadings were used to construct an Internet Use and Attitudes Scale (IUAS). Respondents' scores on this scale ranged from

5 to 61, with high scores indicating high use of and positive attitudes towards the Internet. SDAs scored significantly higher than non-SDAs, with SDAs having a mean IUAS score of 35.6 and non-SDAs a mean IUAS score of 20.9. SDAs were also found to have higher levels of depression, and they were more likely to be introverted. The main problem with the study was the fact that addiction was self-defined and not assessed formally.

Shapira and colleagues (2000) employed a face-to-face standardized psychiatric evaluation to identify behavioral characteristics, family psychiatric history, and comorbidity of adult individuals with problematic Internet use. The study sample consisted of 20 participants (11 men and 9 women) with an average age of 36 years. Problems associated with Internet use were: significant social impairment (in 19 of the participants), marked personal distress over their behaviors (in 12 of the participants), vocational impairment (in 8 of the participants), financial impairment (in 8 participants), and legal problems (in 2 participants). It was found that every participant's problematic Internet use met DSM-IV criteria for an Impulse Control Disorder Not Otherwise Specified, while only three participants' Internet use met DSM-IV criteria for Obsessive-Compulsive Disorder. All participants met criteria for at least one lifetime DSM Axis I diagnosis. The limitations to the study include the small sample size, self-reported interviews, the possible existence of experimenter's bias, the lack of a control group, and the possibility of overestimating certain psychiatric disorders – especially bipolar disorders.

More recently, Mathy and Cooper (2003) measured the duration and frequency of Internet use across five domains, namely past mental health treatments, current mental health treatments, suicidal intent, and past and current behavioral difficulties. It was found that the frequency of Internet use was related to past mental health treatments and suicidal intent. Participants who acknowledged them spent significantly greater number of hours a week online. Duration of Internet use was related to past and current behavioral difficulties. Participants who admitted to past and current behavioral problems with alcohol, drugs, gambling, food or sex also reported being relatively new Internet users.

Black and colleagues (1999) attempted to examine the demographic and clinical features and psychiatric comorbidity in adult individuals reporting compulsive computer use ($n = 21$). They reported spending between 7 and 60 hours a week on non-essential computer use (mean, 27 hours a week). Nearly 50 percent of the participants met the criteria for a current disorder, with the most common being substance use (38%), mood (33%), anxiety (19%) and psychotic disorders (14%). Nearly 25 percent of the sample had current depressive disorder (depression or dysthymia). Results showed that eight participants (38%) had at least one disorder, with the most common being compulsive buying (19%), gambling (10%), pyromania (10%) and compulsive sexual behavior (10%). Three of the participants reported physical abuse and two reported sexual abuse during childhood. Other results showed that 11 participants met the criteria for at least one personality disorder, with the most frequent being borderline (24%), narcissistic (19%)

and antisocial (19%) disorders. Perhaps it was due to the sensitive nature of this particular study that there were a very small number of participants. However, caution is advised when interpreting the results. Other studies have postulated relationships between Internet addiction, shyness (Chak and Leung, 2004), depression (Morgan and Cotton, 2003) and attention deficit hyperactivity disorder (Yoo *et al.*, 2004). Furthermore, none of these studies examined adolescent populations.

INTERNET ADDICTION CASE STUDIES

This author has stressed the importance of case studies in the study of Internet addiction (Griffiths, 2000a, 2000b), and his operational definition of addictive behavior is any behavior (including Internet use) that includes the six core components of addiction outlined earlier – namely salience, mood modification, tolerance, withdrawal symptoms, conflict and relapse. Using these criteria, this author has consistently asserted that Internet addiction exists in only a very small percentage of users, and most of the individuals who use the Internet excessively just use it as a medium through which they can engage in a chosen behavior (Griffiths, 2000a, 2000b). Most studies to date have failed to show that Internet addiction exists outside a small minority of users. It is suggested, therefore, that case studies might help in indicating whether or not Internet addiction exists, even if these are unrepresentative.

The current author outlined five case studies of excessive users that were gathered over the space of 6 months (Griffiths, 2002b). Of the five case studies discussed, only two were "addicted" according to the components criteria. In short, these two case studies ("Gary" and "Jamie", both adolescent males) demonstrated that the Internet was the most important thing in their lives, that they neglected everything else in their lives to engage in the behavior, and that it compromised most areas of their lives. They also built up tolerance over time, suffered withdrawal symptoms if they were unable to engage in using the Internet, and showed signs of relapse after giving up the behavior for short periods.

In the other cases of very excessive Internet use, this author claimed that the participants had used the Internet as a way to cope with and counteract other inadequacies (such as lack of social support in real life, low self-esteem, physical disability, etc.). It was also observed that all of the participants seemed to be using the Internet mainly for social contact, and the author postulated that it was because the Internet could be an alternative, text-based reality where users are able to immerse themselves by taking on another social persona and identity to make them feel better about themselves, which in itself would be highly rewarding psychologically (Griffiths, 2000b).

Young (1996b) highlighted the case of a 43-year-old homemaker who appeared to be addicted to the Internet. This particular case was chosen because it was contrary to the stereotype of a young, computer-savvy male online user as an Internet addict. The woman was not technologically oriented, had reported

a contented home life, and had no prior psychiatric problems or addictions. Due to the menu-driven and user-friendly nature of the web browser provided by her service provider, she could navigate the Internet easily despite referring to herself as being "computer-phobic and illiterate". She initially spent a few hours a week in various chat-rooms, but within 3 months she reported the need to increase her online time to up to 60 hours a week. She would plan to go online for 2 hours, but often stayed there longer than she intended, reaching up to 14 hours a session. She started withdrawing from her offline social involvements, stopped performing household chores in order to spend more time online, and reported feeling depressed, anxious and irritable when she was not online.

She denied that the behavior was abnormal, as she did not see it as a problem. Regardless of her husband's protests about the financial cost and her daughter's complaints that she was ignoring them, she refused to seek treatment and had no desire to reduce her online time. Within a year of getting her computer, she was estranged from her two daughters and was separated from her husband. An interview took place 6 months later, and she admitted that the loss of her family resulted in her successfully cutting down her online time without any therapeutic intervention. However, Young stated that she could not eliminate her online use completely, nor re-establish relationship with her family, without intervention. It was also suggested that this case indicated that certain risk factors, such as the type of function used and the level of excitement experienced while being online, may be associated with the development of addictive Internet use.

Black and colleagues (1999) also outlined two case studies. The first was of a 47-year-old man who reported spending 12–18 hours a day online. He owned three personal computers and was in debt from purchasing the associated paraphernalia. He admitted to developing several romantic relationships online, despite being married with three children. He had been arrested several times for computer hacking, he spent little time with his family, and he reported feeling powerless over his usage. The second case was of a 42-year-old divorced man who admitted to wanting to be online all day. He admitted to spending 30 hours a week online, mostly in chat rooms to make new friends and meet potential partners. He had dated several women he met online, and had made no attempt to cut back despite his parents' complaints over his "addiction". While these cases may be excessive, and there were negative consequences in the first case, the users do not seem to be addicted but rather to use the Internet excessively for functional purposes (for example, to engage in online relationships).

More interestingly, Leon and Rotunda (2000) reported two contrasting case studies of individuals who used the Internet for 8 hours or more a day. Both were college students, and neither was seeking treatment. The first was the case of Neil, a 27-year-old white male who was described as being outgoing and sociable by his college friends. He discovered an online computer game called *Red Alert* during his third year of college. The game began to replace his social activities, and he changed his sleeping patterns so he could play online with the other "good players". He also reported dropping all but two of his classes and spending

up to 50 hours a week online. Friends reported that his personality changed. He became short-tempered and overly sensitive, especially when it came to the time he spent online. Eventually he stopped all his social activities and skipped classes, his grades deteriorated, he slept all day and played all night. He did not go out to buy food, as he used his grocery money to buy a faster modem. The connection speed was extremely important to him, and he would become upset and angry if the game server went offline. Due to his excessive online time, he was also close to being evicted from his apartment and he constantly lied about the extent of his involvement with the Internet. All this happened within a year of Neil discovering the online game.

The second case was Wu Quon, a 25-year-old male foreign exchange student from Asia who had very few friends in North America. He stated that it was due to cultural differences, and the lack of other Asian students in college. He bought a personal computer and used the Internet to make contact with people globally, read news about his home country, and listen to radio broadcasts from Asia. He also used Internet-Relay Chat (IRC) to keep in touch with friends and family in China. He stated that the Internet occupied his life outside of study and college time, spending 8 hours a day online. He said that being able to contact his family and friends daily relieved his depression and homesickness. He claimed that he was not addicted to the Internet; it had simply become an important part of his life and routine. He admitted feeling uncomfortable when he was offline, but said that it was due to feeling disconnected and out of touch with what was happening at home. Overall, he rated his experience on the Internet as being positive.

Leon and Rotunda (2000) concluded that only Neil seemed to be dependent on the Internet, as his personal and occupational life was problematic due to the time he spent online. Moreover, it was argued that Neil met the criteria for Schizoid Personality Disorder and Circadian Rhythm Disorder. Both of these were the result of his Internet use. In contrast, Wu Quon's Internet use could be seen as a remedy for his homesickness. His online time seemed to make him a happy and functional individual, although it could also be seen as a mechanism that caused him further isolation. In summary, Leon and Rotunda contended that to assume that frequent Internet use is excessive, pathological or addictive was simplistic and ignored the contextual and dispositional factors associated with the behavior. This author (Griffiths, 2000a) would argue that Neil was a computer game addict and not an Internet addict, as the Internet was clearly being used to fuel his gaming behavior. However, gaming is increasingly moving online and the immersive nature of the Internet may facilitate excessive play, leading to increased addiction in some players.

TREATMENT

Another indirect indicator that Internet addiction may exist, from a case-study perspective, comes from the few reports of its treatment. Most of these have used a cognitive-behavioral approach therapy to treat IAD, although these accounts

usually contain some commonsense elements (see, for example, Orzack and Orzack, 1999; Young, 1999; Hall and Parsons, 2001; Yu and Zhao, 2004). None of these treatment accounts show that the people treated were definitely addicts, although all those under treatment certainly felt they had a problem with their excessive Internet use. Young and colleagues (1999) also conducted a survey among therapists who had treated clients suffering from cyber-related disorders. The sample consisted of 23 female and 12 male therapists, with an average of 14 years of clinical practice experience. They reported an average caseload of 9 clients that they would classify as being Internet addicts treated within the past year, with a range of 2–50 patients. The patients were more likely to complain about direct compulsive Internet use (CIU), along with its negative consequences and prior addictions, rather than psychiatric illness. Almost all the therapists (95%) felt that the problem of CIU was more widespread than the number of cases indicated.

WHY DOES EXCESSIVE INTERNET USE OCCUR?

Most of the research that has been discussed appears to lack theoretical basis, as surprisingly few researchers have attempted to propose a theory of the cause of Internet addiction despite the number of studies conducted in the field. Davis (2001) proposed a model of the etiology of pathological Internet use (PIU) using the cognitive-behavioral approach. The main assumption of the model was that PIU resulted from problematic cognitions coupled with behaviors that intensify or maintain maladaptive response. It emphasized the individual's thoughts/cognitions as the main source of abnormal behavior. Davis stipulated that the cognitive symptoms of PIU might often precede and cause the emotional and behavioral symptoms, rather than *vice versa*. Similar to the basic assumptions of cognitive theories of depression, it focused on maladaptive cognitions associated with PIU.

Davis described Abramson and colleagues' (1989) concepts of *necessary*, *sufficient* and *contributory* causes. A necessary cause is an etiological factor that must be present or must have occurred in order for symptoms to appear. A sufficient cause is an etiological factor whose presence/occurrence guarantees the occurrence of symptoms, while a contributory cause is an etiological factor that increases the likelihood of the occurrence of symptoms, but is neither necessary nor sufficient. Abramson also distinguished between *proximal* and *distal* causes. In an etiology chain that results in a set of symptoms, some causes lie toward the end of the chain (proximal) and others towards the beginning (distal). In the case of PIU, Davis claimed that the distal cause was underlying psychopathology (e.g., depression, social anxiety, other dependence, etc.), while the proximal cause was maladaptive cognitions (i.e., negative evaluation of oneself and the world in general). The main goal of the paper was to introduce maladaptive cognitions as proximal sufficient cause of the set of symptoms for PIU.

Distal contributory causes of PIU were discussed. It was explained using a diathesis–stress framework, whereby an abnormal behavior was caused by a predisposition/vulnerability (diathesis) and a life event (stress). In the cognitive-behavioral model of PIU, existing underlying psychopathology was viewed as the diathesis, as many studies had shown the relationship between psychological disorders such as depression, social anxiety and substance dependence (Kraut *et al.*, 1998). The model suggested that psychopathology was a distal necessary cause of PIU – i.e., psychopathology must be present or must have occurred in order for PIU symptoms to occur. However, in itself, the underlying psychopathology would not result in PIU symptoms, but was a necessary element in its etiology.

The model assumed that although a basic psychopathology might predispose an individual to PIU, the set of associated symptoms was specific to PIU and therefore should be investigated and treated independently. The stressor in this model was the introduction of the Internet, or the discovery of a specific function of the Internet. Although it might be difficult to trace back an individual's encounter with the Internet, a more testable event would be the experience of a function found online – for example, the first time the person used an online auction, found pornographic material online, etc.

Exposure to such functions was viewed as a distal necessary cause of PIU symptoms. In itself, this encounter did not result in the occurrence of symptoms of PIU. However, as a contributory factor, the event could be a catalyst for the developmental process of PIU. A key factor here was the reinforcement received from an event (i.e., operant conditioning, whereby positive response reinforced continuity of activity). The model proposed that stimuli such as the sound of a modem connecting or the sensation of typing could result in a conditioned response. Thus, these types of secondary reinforcers could act as situational cues that contribute to the development of PIU and the maintenance of symptoms.

Central to the cognitive-behavioral model was the presence of maladaptive cognitions that were viewed to be proximal sufficient cause of PIU. Maladaptive cognitions were broken down into two subtypes; perceptions about one's self, and perceptions about the world. Thoughts about self are guided by ruminative cognitive style. Individuals who tend to ruminate would experience a higher degree in severity and duration of PIU, as studies have supported that rumination is likely to intensify or maintain problems, partly by interfering with instrumental behavior (i.e., taking action) and problem-solving. Other cognitive distortions include self-doubt, low self-efficacy and negative self-appraisal. These cognitions dictate the way in which individuals behave, and some cognitions would cause specific or generalized PIU. Specific PIU referred to the over-use and abuse of a specific Internet function. It was assumed to be the result of a pre-existing psychopathology that became associated with an online activity (for example, compulsive gamblers might realize that they could gamble online and ultimately showed symptoms of specific PIU as the association between need and immediate

reinforcement became stronger). However, it should be noted that not every compulsive gambler showed symptoms of PIU.

On the other hand, generalized PIU involved spending excessive amounts of time online with no direct purpose, or just wasting time. The social context of the individual, especially the lack of social support he or she received and/or social isolation, was one key factor that played a role in the causality of general PIU. Individuals with general PIU were viewed as being more problematic, as their behavior would not even exist in the absence of the Internet.

Based on Davis' model, Caplan (2003) further proposed that problematic psychosocial predispositions causes excessive and compulsive computer-mediated (CM) social interaction in individuals, which in turn increases their problems. The theory proposed by Caplan, examined empirically, had three main propositions:

1. Compared with others, individuals with psychosocial problems (e.g., depression and loneliness) hold more negative perceptions of their social competence
2. Such individuals prefer CM interactions to face-to-face ones, as the former is perceived to be less threatening and they perceive themselves to be more efficient in an online setting
3. This preference in turn leads to excessive and compulsive use of CM interactions, which then worsens their problems and creates new ones at school, work and home.

In Caplan's (2003) study, the participants consisted of 386 undergraduates (279 females and 116 males), with the age ranging from 18 to 57 years (mean age, 20 years). This study used Caplan's (2002) Generalized Problematic Internet Use Scale (GPIUS), a self-report assessing the prevalence of cognitive and behavioral symptoms of pathological Internet use along with the degree to which negative consequences affected the individual. The GPIUS had seven subscales – mood alteration, perceived social benefits, perceived social control, withdrawal, compulsivity, excessive Internet use, and negative outcomes. Also included in this study were validated depression and loneliness scales.

It was found that depression and loneliness were significant predictors of preference for online social interaction, accounting for 19 percent of the variance. In turn, participants' preference for online social interaction was found to be a significant predictor of their scores on pathological Internet use and negative outcomes. The data also suggested that excessive use was one of the weakest predictors of negative outcomes, whereas preference for online interaction, compulsive use, and withdrawal were among the strongest. Overall, loneliness and depression were not found to have large, independent effects on negative outcomes. The result of this study appeared to support the proposition that preference for online socialization was a key contributor to the development of problematic Internet use.

Caplan noted two unexpected results in the data. First, loneliness played a more significant role in the development of problematic Internet use compared

with depression. He attempted to explain this finding by stating that loneliness was theoretically the more salient predictor, as negative perception of social competence and communication skills is more pronounced in lonely individuals. On the other hand, a wide variety of circumstances that might not be related to a person's social life could result in depression (e.g., traumatic experiences). Secondly, using the Internet to alter mood was found to be lacking in influence on negative outcomes. For instance, it was proposed by Caplan that there are various different circumstances in which individuals use the Internet to alter their mood, and different usages would cause different mood alterations – for example, online game playing might be exciting and fun, while reading the news might be relaxing. Therefore, in itself, using the Internet to alter mood might not necessarily lead to the negative consequences associated with preference for online social interaction, excessive and compulsive use, and experiencing psychological withdrawal.

The limitations to this study include the need for future empirical evidence pertaining to the causality of specific CM communication characteristics that could lead to the preference for online social interaction. Also, the data were collected from a primarily sample that did not display very high degrees of problematic Internet use (median for preference was 1.28 on a scale ranging from 1 to 5; most participants did not prefer online over face-to-face social interactions). Finally, the study did not take into account the role that an individual's actual social skill and communication preference played in the development of problematic Internet use, despite the theory's emphasis on perceived social competence.

SUMMARY

This chapter has demonstrated that research into video-game and Internet addiction is a relatively little studied phenomenon, although there is more research regarding adolescent video-game addiction than there is on adolescent Internet addiction. Obviously, more research is needed before the debate on whether video-game and Internet addictions are distinct clinical entities is decided. From the sparse research, it is evident that playing video-games and Internet use appear to be at least potentially addictive. With respect to video-games, there is also a need for a general taxonomy of such 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 lots of different ways, including on handheld consoles, personal computers, home video-game consoles, arcade machines, the Internet, and other portable devices (e.g., mobile phones, i-Pods). 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 (for example, disinhibition on the Internet). Therefore, future research needs to distinguish between excessive play in different media.

There is also the question of developmental effects – that is, 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 – that is, does playing in groups or individually, with or against each other, affect the potential addictiveness of games in any way? These points 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 to 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 to 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), since there is little evidence to date of video-game addiction in adults – at least in offline games.

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.

With respect to excessive Internet use, the labels Internet Addiction, Internet Addiction Disorder, Pathological Internet Use, Problematic Internet Use, Excessive Internet Use and Compulsive Internet Use have all been used to describe more or less the same concept – i.e., that an individual is so involved in their online use as to neglect other areas of his or her life. However, it would seem premature at this stage to use one label for the concept, as most of the studies conducted in the field so far have presented varying degrees of differences and conflicting results.

There is clearly a need to distinguish between addictions *to* the Internet and addictions *on* the Internet. Gambling addicts who chooses to engage in online gambling, as well as a computer game addicts who play online, are not Internet addicts; the Internet is just the place where they conduct their chosen (addictive) behavior. These people display addictions *on* the Internet. However, there is also the observation that some behaviors engaged on the Internet (e.g., cybersex, cyberstalking, etc.) may be behaviors that the person would only carry out on the

Internet because the medium is anonymous, non-face-to-face, and disinhibiting (Griffiths, 2000c, 2001).

In contrast, it is also acknowledged that there are some case studies that seem to report an addiction to the Internet itself (see, for example, Young, 1996b; Griffiths, 2000b). Most of these individuals use functions of the Internet that are not available in any other medium, such as chat rooms or various role-playing games. These are people addicted *to* the Internet. However, despite these differences there seem to be some common findings, most notably reports of the negative consequences of excessive Internet use (neglect of work and social life, relationship breakdowns, loss of control, etc.) which are comparable to those experienced with other, more established addictions. In conclusion, it would appear that if Internet addiction does indeed exist, it affects only a relatively small percentage of the online population and there is very little evidence that it is problematic among adolescents. However, exactly what it is on the Internet that they are addicted to still remains unclear.

REFERENCES

Abramson, L., Metalsky, G.I. and Alloy, L.B. (1989). Hopelessness depression: a theory-based subtype of depression. *Psychological Review*, 96, 358–372.

American Psychiatric Association (1987). *Diagnostic and Statistical Manual for Mental Disorders*, 3rd edn. Washington, DC: American Psychiatric Association.

Anderson, K.J. (1999). "Internet use among college students: should we be concerned?" Paper presented at the Annual Meeting of the American Psychological Association, Boston.

Armstrong, L., Phillips, J.G. and Saling, L.L. (2000). Potential determinants of heavier Internet usage. *International Journal of Human Computer Studies*, 53, 537–50

Beard, K. and Wolfe, E. (2001). Modification in the proposed diagnostic criteria for Internet addiction. *Cyberpsychology and Behavior*, 4, 377–383.

Black, D., Belsare, G. and Schlosser, S. (1999). Clinical features, psychiatric comorbidity and health-related quality of life in persons reporting compulsive computer use behavior. *Journal of Clinical Psychiatry*, 60, 839–843.

Brasington, R. (1990). Nintendinitis. *New England Journal of Medicine*, 322, 1473–1474.

Braun, C.M.J., Goupil, G., Giroux, J. and Chagnon, Y. (1986). Adolescents and microcomputers: sex differences, proxemics, task and stimulus variables. *Journal of Psychology*, 120, 529–542.

Brenner, V. (1997). Psychology of Computer Use: XLVII. Parameters of Internet use, abuse and addiction: the first 90 days of the Internet Usage Survey. *Psychological Reports*, 80, 879–882.

Brown, R.I.F. (1993). Some contributions of the study of gambling to the study of other addictions. In: W.R. Eadington and J.A. Cornelius (eds), *Gambling Behavior and Problem Gamblin*. Reno, NV: University of Nevada Press, pp. 241–272.

Brown, R.I.F. and Robertson, S. (1993). Home computer and video-game addictions in relation to adolescent gambling: conceptual and developmental aspects. In: W.R. Eadington and J.A. Cornelius (eds), *Gambling Behavior and Problem Gambling*. Reno, NV: University of Nevada Press, pp. 451–471.

Caplan, S.E. (2002). Problematic Internet use and psychosocial well-being: development of a theory-based cognitive-behavioral measurement instrument. *Computers in Human Behavior*, 18, 553–575.

Caplan, S.E. (2003). Preference for online social interaction: a theory of problematic Internet use and psychosocial well-being. *Communication Research*, 30, 625–648.

Casanova, J. and Casanova, J. (1991). Nintendinitis. *Journal of Hand Surgery*, 16, 181.

Chak, K. and Leung, L. (2004). Shyness and locus of control as predictors of Internet addiction and Internet use. *CyberPsychology and Behavior*, 7, 559–570.

Charlton, J.P. (2002). A factor analytic investigation of computer "addiction" and engagement. *British Journal of Psychology*, 93, 329–344.

Chin-Chung, T. and Sunny, L. (2003). Internet addiction of adolescents in Taiwan: an interview study. *CyberPsychology and Behavior*, 6, 649–652.

Chou, C. (2001). Internet heavy use and addiction among Taiwanese college students: an online interactive study. *CyberPsychology and Behavior*, 4, 573–585.

Cleary, A.G., Mckendrick, H. and 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. and 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.

Davis, R. (2001). A cognitive-behavioral model of Pathological Internet Use. *Computers in Human Behavior*, 17, 187–195.

Deheger, M., Rolland-Cachera, M.F. and 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.

Egger, O. and Rauterberg, M. (1996). Internet behavior and addiction. Available at http://www.idemployee.id.tue.nl/g.w.m.rauterberg/ibq/res.htm (accessed 14 October 2005) from the Swiss Federal Institute of Technology, Zurich.

Egli, E.A. and 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. and St. John, J.N. (1984). Video-game palsy: distal ulnar neuropathy in a video-game enthusiast. *New England Journal of Medicine*, 311, 58–59.

Glasser (1976). *Positive Addictions*. New York, NY: Harper & Row.

Graf, W.D., Chatrian, G.E., Glass, S.T. and Knauss, T.A. (1994). Video-game related seizures: a report on 10 patients and a review of the literature. *Pediatrics*, 3, 551–556.

Greenfield, D.N. (1999). Psychological characteristics of compulsive Internet use: a preliminary analysis. *CyberPsychology and Behavior*, 2, 403–412.

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. (1991). 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 and K. David (eds), *Elusive Links: Television, Video-games, Cinema and Children's Behavior*. Gloucester, Gloucestershire: GCED/Park Publishers, pp. 66–93.

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*. New York, NY: Academic Press, pp. 61–75.

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. *Cyberpsychology and Behavior*, 3, 211–18.

Griffiths, M.D. (2000c). Excessive Internet use: implications for sexual behavior. *CyberPsychology and Behavior*, 3, 537–552.

Griffiths, M.D. (2001). Sex on the Internet: observations and implications for sex addiction. *Journal of Sex Research*, 38, 333–342.

Griffiths, M.D. (2002). *Gambling and Gaming Addictions in Adolescence*. Leicester, Leicestershire: British Psychological Society/Blackwells.

Griffiths, M.D. (2003a). The therapeutic use of video-games in childhood and adolescence. *Clinical Child Psychology and Psychiatry*, 8, 547–554.

Griffiths, M.D. (2003b). Video-games: advice for teachers and parents. *Education and Health*, 21, 48–49.

Griffiths, M.D. (2005a). A "components" model of addiction within a biopsychosocial framework. *Journal of Substance Use*, 10, 191–197.

Griffiths, M.D. (2005b). The relationship between gambling and video-game playing: a response to Johansson and Gotestam. *Psychological Reports*, 96, 644–646.

Griffiths, M.D. (2005c). Video-games and health. *British Medical Journal*, 331, 122–123.

Griffiths, M.D. (2006). Impact of gambling technologies in a multi-media world. *Casino and Gaming International*, 2, 15–18.

Griffiths, M.D. (2007). *Gambling Addiction and its Treatment within the NHS*. London: British Medical Association.

Griffiths, M.D. and Dancaster, I. (1995). The effect of Type A personality on physiological arousal while playing computer games. *Addictive Behaviors*, 20, 543–548.

Griffiths, M.D. and 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. and Hunt, N. (1998). Dependence on computer games by adolescents. *Psychological Reports*, 82, 475–480.

Griffiths, M.D., Davies, M.N.O. and Chappell, D. (2003). Breaking the stereotype: the case of online gaming. *CyberPsychology and Behavior*, 6, 81–91.

Griffiths, M.D., Davies, M.N.O. and Chappell, D. (2004a). Online computer gaming: a comparison of adolescent and adult gamers. *Journal of Adolescence*, 27, 87–96.

Griffiths, M.D., Davies, M.N.O. and Chappell, D. (2004b). Demographic factors and playing variables in online computer gaming. *CyberPsychology and Behavior*, 7, 479–487.

Grüsser, S.M., Thalemann, R. and Griffiths, M.D. (2007). Excessive computer game playing: evidence for addiction and aggression? *Cyberpsychology and Behavior*, 10, 290–292.

Gupta, R. and 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, whole issue.

Hall, A.S. and Parsons, J. (2001). Internet addiction: college student case study using best practices in cognitive behavior therapy. *Journal of Mental Health Counselling*, 23, 312–327.

Harding, G.F.A. and Jeavons, P.M. (1994). *Photosensitive Epilepsy*. London: Mac Keith Press.

Holden, C. (2001). "Behavioral" addictions: do they exist? *Science*, 294, 5544.

Jackson, L.A., von Eye, A., Biocca, F.A. *et al.* (2003). Personality, cognitive style, demographic characteristics and Internet use – findings from the HomeNetToo project. *Swiss Journal of Psychology*, 62, 79–90.

Johnson, B. and Hackett, A.F. (1997). Eating habits of 11- to 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, Oxfordshire: Freeman.

Kaltiala-Heino, R., Lintonen, T. and Rimpela, A. (2004). Internet addiction? Potentially problematic use of the Internet in a population of 12- to 18-year-old adolescents. *Addiction Research and Theory*, 12, 89–96.

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). Pathologicical preoccupation with video-games. *Journal of the American Academy of Child and Adolescent Psychiatry*, 29, 49–50.

Keisler, S., Sproull, L. and Eccles, J.S. (1983). Second class citizens. *Psychology Today*, 17(3), 41–48.

Kennedy-Souza, B. (1998). Internet addiction disorder. *Interpersonal Computing and Technology: An Electronic Journal for the 21st Century*, 6(1–2). Available at http://www.emoderators.com/ipct-j/1998/n1-2/kennedy-souza.html (accessed 10 December 2003).

Klein, M.H. (1984). The bite of Pac-man. *Journal of Psychohistory*, 11, 395–401.

Koepp, M.J., Gunn, R.N., Lawrence, A.D. *et al.* (1998). Evidence for striatal dopamine release during a video-game. *Nature*, 393, 266–268.

Kuczmierczyk, A.R., Walley, P.B. and Calhoun, K.S. (1987). Relaxation training, in vivo exposure and response-prevention in the treatment of compulsive video-game playing. *Scandinavian Journal of Behavior Therapy*, 16, 185–190.

Kraut, R., Patterson, M., Lundmark, V. *et al.* (1998). Internet paradox: a social technology that reduces social involvement and psychological well being? *American Psychologist*, 53, 1017–1031.

Kraut, R., Kiesler, S., Boneva, B. *et al.* (2002). Internet paradox revisited. *Journal of Social Issues*, 58, 49–74.

Kubey, R.W., Lavin, M.J. and Barrows, J.R. (2001). Internet use and collegiate academic performance decrements: early findings. *Journal of Communication*, 51, 366–382.

Lavin, M., Marvin, K., McLarney, A. *et al.* (1999). Sensation seeking and collegiate vulnerability to Internet dependence. *Cyberpsychology and Behavior*, 2, 425–430.

Leon, D. and Rotunda, R. (2000). Contrasting case studies of frequent Internet use: is it pathological or adaptive? *Journal of College Student Psychotherapy*, 14, 9–17.

Lo, S., Wang, C. and Fang, W. (2005). Physical interpersonal relationships and social anxiety among online game players. *CyberPsychology and Behavior*, 8(1), 15–20.

Loftus, G.A. and Loftus, E.F. (1983). *Mind at Play: The Psychology of Video-games*. New York, NY: Basic Books.

Maccoby, E.E. and Jacklin, C.N. (1974). *The Psychology of Sex Differences*. Stanford, CA: Stanford University Press.

Maeda, Y., Kurokawa, T., Sakamoto, K. *et al.* (1990). Electroclinical study of video-game epilepsy. *Developmental Medicine and Child Neurology*, 32, 493–500.

Marks, I. (1990). Non-chemical (behavioural) addictions. *British Journal of Addiction*, 85, 1389–1394.

Mathy, R. and Cooper, A. (2003). The duration and frequency of Internet use in a nonclinical sample: suicidality, behavioural problems and treatment histories. *Psychotherapy: Theory, Research, Practice, Training*, 40, 125–135.

McCowan, T.C. (1981). Space Invaders' wrist. *New England Journal of Medicine*, 304, 1368.

McIlwraith, R. (1990, August). "Theories of television addiction." Paper presented at the Annual Meeting of the American Psychological Association, Boston.

Miller, D.L.G. (1991). Nintendo neck. *Canadian Medical Association Journal*, 145, 1202.

Millett, C.J., Fish, D.R. and 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. and Bonian, V.G. (1992). "Mouse elbow": a new repetitive stress injury. *Journal of the American Osteopath Association*, 92, 701.

Mitchell, P. (2000). Internet addiction: genuine diagnosis or not? Lancet, 355, 632.

Moore, D. (1995). *The Emperor's Virtual Clothes: The Naked Truth about the Internet Culture*. Chapel Hill, NC: Alogonquin.

Morahan-Martin, J. and Schumacher, P. (2000). Incidents and correlates of pathological Internet use among college students. *Computers in Human Behavior*, 16, 13–29.

Morgan, C. and Cotton, S.R., (2003). The relationship between Internet activities and depressive symptoms in a sample of college freshman. *CyberPsychology and Behavior*, 6, 133–143.

Nalwa, K. and Anand, A.P. (2003). Internet addiction in students: a cause of concern. *CyberPsychology and Behavior*, 6, 653–656.

Niemz, K., Griffiths, M.D. and Banyard, P. (2005). Prevalence of pathological Internet use among university students and correlations with self-esteem, GHQ and disinhibition, *CyberPsychology and Behavior*, 8, 562–570.

Orzack, H. and Orzack, D. (1999). Treatment of computer addicts with complex comorbid psychiatric disorders. *Cyberpsychology and Behavior*, 2, 465–473.

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.

Petrie, H. and Gunn, D. (1998). "Internet 'addiction': the effects of sex, age, depression and introversion." Paper presented at the British Psychological Society London Conference, London.

Phillips, C.A., Rolls, S., Rouse, A. and 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.

Pratarelli, M., Browne, B. and Johnson, K. (1999). The bits and bytes of computer/Internet addiction: a factor analytic approach. *Behavior Research Methods, Instruments and Computers*, 31, 305–314.

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: Professional Association of Teachers.

Quirk, J.A., Fish, D.R., Smith, S.J.M. *et al.* (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.

Rotunda, R.J., Kass, S.J., Sutton, M.A. and Leon, D.T. (2003). Internet use and misuse: preliminary findings from a new assessment instrument. *Behavior Modification*, 27, 484–504.

Rutkowska, J.C. and Carlton, T. (1994). "Computer games in 12- to 13-year-olds' activities and social networks." Paper presented at the British Psychological Society Annual Conference, University of Sussex.

Scherer, K. (1997). College life on-line: healthy and unhealthy Internet use. *Journal of College Student Development*, 38, 655–665.

Schink, J.C. (1991). Nintendo enuresis. *American Journal of Diseases in Children*, 145, 1094.

Selnow, G.W. (1984). Playing video-games: the electronic friend. *Journal of Communication*, 34, 148–156.

Shaffer, H., Hall, M. and Vander Bilt, J. (2000). "Computer addiction": a critical consideration. *American Journal of Orthopsychiatry*, 70, 162–168.

Shapira, N., Goldsmith, T., Keck, P. Jr *et al.* (2000). Psychiatric features of individuals with problematic Internet use. *Journal of Affective Disorders*, 57, 267–272.

Shapira, N., Lessig, M., Goldsmith, T. *et al.* (2003). Problematic Internet use: proposed classification and diagnostic criteria. *Depression and Anxiety*, 17, 207–216.

Shimai, S., Yamada, F., Masuda, K. and 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 & Francis.

Siegal, I.M. (1991). Nintendonitis. *Orthopedics*, 14, 745.

Soper, W.B. and Miller, M.J. (1983). Junk time junkies: an emerging addiction among students. *School Counsellor*, 31, 40–43.

Spence, S.A. (1993). Nintendo hallucinations: a new phenomenological entity. *Irish Journal of Psychological Medicine*, 10, 98–99.

Surrey, D. (1982). "It's like good training for life". *Natural History*, 91, 71–83.

Tejeiro-Dalguero, R.A.T. and Moran, R.M.B. (2002). Measuring problem video-game playing in adolescents. *Addiction*, 97, 1601–1606.

Treuer, T., Fabian, Z. and Furedi, J. (2001). Internet addiction associated with features of impulse control disorder: is it a real psychiatric disorder? *Journal of Affective Disorders*, 66, 283.

Tsai, C-C. and Lin, S.S.J. (2003). Internet addiction of adolescents in Taiwan: an interview study. *CyberPsychology and Behavior*, 6, 649–652.

Vandewater, E.A., Shim, M. and Caplovitz, A.G. (2004). Linking obesity and activity level with children's television and video-game use. *Journal of Adolescence*, 27, 71–85.

Wan, C. and Chiou, B. Why are adolescents addicted to online gaming? An interview study in Taiwan. *CyberPsychology and Behavior* 9, 762–766.

Wanner, E. (1982). The electronic bogeyman. *Psychology Today*, 16(10), 8–11.

Wästlund, E., Norlander, T. and Archer, T. (2001). Internet blues revisited: replication and extension for an Internet paradox study. *Cyberpsychology and Behavior*, 4, 385–391.

Widyanto, L. and McMurran, M. (2004). The psychometric properties of the Internet addiction test. *CyberPsychology and Behavior*, 7, 443–450.

Wood, R.T.A. and Griffiths, M.D. (2007). Time loss whilst playing video-games: is there a relationship to addictive behaviors? *International Journal of Mental Health and Addiction*, 5, 141–149.

Wood, R.T.A., Griffiths, M.D., Chappell, D. and Davies, M.N.O. (2004). The structural characteristics of video-games: a psycho-structural analysis. *CyberPsychology and Behavior*, 7, 1–10.

Wood, R.T.A., Griffiths, M.D. and Parke, A. (2007). Experiences of time loss among video-game players: an empirical study. *CyberPsychology and Behavior*, 10, 45–56.

Xuanhui, L. and Gonggu, Y. (2001). Internet addiction disorder, online behavior and personality. *Chinese Mental Health Journal*, 15, 281–283.

Yoo, H.J., Cho, S.C., Ha, J. *et al.* (2004). Attention deficit hyperactivity symptoms and Internet addiction. *Psychiatry and Clinical Neurosciences*, 58, 487–494.

Young, K. (1996a). Internet addiction: the emergence of a new clinical disorder. *CyberPsychology and Behavior*, 3, 237–44.

Young, K. (1996b). Psychology of computer use: XL. Addictive use of the Internet: a case that breaks the stereotype. *Psychological Reports*, 79, 899–902.

Young, K. (1998). *Caught in the Net: How to Recognize the Signs of Internet Addiction and a Winning Strategy for Recovery*. New York, NY: Wiley.

Young K. (1999). Internet addiction: evaluation and treatment. *Student British Medical Journal*, 7, 351–352.

Young, K. and Rodgers, R. (1998). "Internet addiction: personality traits associated with its development." Paper presented at the 69th Annual meeting of the Eastern Psychological Association.

Young, K. Pistner, M., O'Mara, J. and Buchanan, J. (1999). Cyber disorders: the mental health concern for the new millennium. *Cyberpsychology and Behavior*, 2, 475–479.

Yu, Z. F. and Zhao, Z. (2004). A report on treating Internet addiction disorder with cognitive behavior therapy. *International Journal of Psychology*, 39, 407.

Zimbardo, P. (1982). Understanding psychological man: a state of the science report. *Psychology Today*, 16, 15.