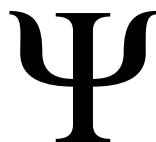




DET PSYKOLOGISKE FAKULTET



***Video Game Addiction among Young Adults in Norway:
Prevalence and Health***

HOVEDOPPGAVE

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Abstract

The present study sought to investigate video game addiction among Norwegian adults aged 16-40 years. Video game addiction has not yet been classified as a disorder in the DSM or ICD systems, and its existence is debated in the field. A central issue in this study was whether or not excessive video game playing should be considered an addiction. It is concluded that video game addiction does appear to be a valid term, which can be applied to a small subgroup of gamers. Prevalence is estimated to range from 0.6% to 4.0% of young adults, depending on whether a polythetic, monothetic or core criteria approach to defining addiction is adopted. Compared to respondents who did not engage in video game play, addicted gamers were found to score lower on a measure of life satisfaction, and higher on measures of anxiety, depression and symptoms of insomnia. However, the levels were all within the non-pathological range. Also, addicted gamers were found to spend significantly more time playing video games than non-addicted gamers, but contrary to what was expected, addicted gamers did not seem to prefer MMORPGs over other games.

Abstract

Denne studien undersøkte videospillavhengighet blant nordmenn i alderen 16-40 år. Videospillavhengighet har foreløpig ikke blitt klassifisert som en forstyrrelse i DSM- eller ICD-systemet, og på feltet diskuteres det hvorvidt en slik forstyrrelse kan sies å eksistere. Et sentralt tema i denne studien var hvorvidt overdreven spilling bør anses som en avhengighet. Det konkluderes med at videospillavhengighet ser ut til å være en gyldig beskrivelse av et fåtall spillere. Prevalens estimeres å ligge mellom 0.6% og 4.0% blant unge voksne, avhengig av om metoden benyttet for å identifisere avhengighet er polytetisk, monotetisk eller basert på kjernekrterier. Sammenliknet med deltakere som ikke spiller videospill, ble det funnet at avhengige spillere skårer lavere på mål av tilfredshet med livet, og høyere på mål av angst, depresjon og symptomer på insomni. Skårene ligger imidlertid på et ikke-patologisk nivå. Det ble også funnet at avhengige spillere bruker signifikant mer tid på videospill enn det ikke-avhengige spillere gjør. I motsetning til forventet, ble det funnet at avhengige spillere ikke ser ut til å foretrekke MMORPG-spill fremfor andre typer spill.

Over the past decades the world has witnessed an exploding rate of technological advances, especially in the computer sciences. Since the invention of the World Wide Web twenty years ago, the computer has become a common household item, connecting people across the globe, simplifying work, and providing plenty of opportunities for recreational activities. One particularly popular recreational activity is playing video games. In 2008, video games sales reached 32 billion dollars worldwide. Comparatively, DVD and Blu-ray sales grossed 29 billion dollars combined (Beaumont, 2009).

Video Game Addiction

With increasing popularity comes increasing worry that video games can be addictive. Both the media and the research literature frequently depict new cases of people playing video games to the point that they supposedly have severe detrimental effects on their daily functioning, and in the worst case scenarios may lead to school dropout, loss of job, families and friends, and even death (Allison, von Wahlde, Shockley, & Gabbard, 2006; Bjørkeng, 2008; Chappell, Eatough, Davies, & Griffiths, 2006; Larsen, 2005; "My life as an online gamer," 2005; Salmon, 2010). Furthermore, health services receive an increasing amount of enquiries from people who play video games excessively and need help to gain control over their gaming (Synovate, 2008). Some people report playing as much as 70 hours per week (Griffiths, Davies, & Chappell, 2004).

Orford (2001) warns that societies are most vulnerable for new types of addiction when introduced to new objects or activities. However, there is a great disagreement among researchers as to whether or not it is possible to develop an addiction to video games. Central to the discussion are games that are played online,

particularly, but not limited to Massively Multiplayer Online Role-Playing Games (MMORPGs). This genre of games have gained a worldwide popularity and the most popular game of them all, World of Warcraft, claims to have surpassed 11.5 million subscriptions as of December 2008 (Blizzard Entertainment, 2008). As a relatively new phenomenon, the excessive playing of video games is a hot topic. This paper will address this topic and present results from a survey conducted in Norway.

The primary issues addressed in this paper will be how to construe excessive video game playing; is it an addiction? Also, to what extent is video game addiction prevalent in Norway, who is the typical “addict”, and what and how often do they play? The aims of the present study are therefore to estimate the prevalence of video game addiction in Norway, and also to investigate whether or not addiction is associated with measures of physical and mental health. The latter includes measures of life satisfaction, as well as symptoms of insomnia, anxiety and depression. Different approaches to identify video game addiction are discussed. In addition, the present study aims at investigating differences in playing habits between addicted gamers and non-addicted gamers, as well as gender differences.

Before introducing the present study, a brief overview of previous research will be provided. First, a few characteristics of the gamers and some central game genres will be introduced, followed by three general views of addiction by Orford (2001), Shaffer et al. (2004) and West (2006), respectively. Thereafter follows an overview of some of the work that has been done to establish criteria for video game addiction, as well as a discussion of some of the problems related to defining such criteria. Finally, some of the arguments for and against the existence of video game addiction are summarized.

Terminology

To describe this paper's topic, the term "video game addiction" will be used. "Video game" is here considered a blanket term that includes all kinds of electronic games that are played on a computer or a stationary or portable game device, excluding all forms of gambling. The term "addiction" is controversial as it may hold certain derogatory implications, and other terms such as "pathological gaming" or "problem gaming" could perhaps better have conveyed the same meaning without the negative connotations. However, as the term "addiction" is commonly used in the current research field, it will also be used in this paper.

Who Are the Gamers and What Games do They Play?

It is difficult to describe gamers in general as most studies on video game addiction have either been limited to adolescents, and/or have focused solely on certain gamer populations, such as online gamers. Samples have often been limited to gamers who play certain games, and/or have been self-recruited through gamer web sites. Because the samples have been constricted, so has the possibility for generalisation of the results. Many studies have indicated that most gamers are male (Griffiths, et al., 2004; Ko, Yen, Chen, Chen, & Yen, 2005; Salguero & Morán, 2002; Synovate, 2008), and some have reported that the male-female distribution is as large as 85% vs. 15% in favour of the males (Griffiths, et al., 2004; Salguero & Morán, 2002). Furthermore, studies have indicated that the use of video games is most frequent among adolescents or people in their twenties (Griffiths, et al., 2004; Synovate, 2008). Also, studies have estimated that gamers spend 18-36 hours per week playing video games (Charlton & Danforth, 2007; Griffiths, et al., 2004; Kim, Namkoong, Ku, & Kim, 2008). However,

these figures might not be descriptive of gamers in general, as all the samples have been drawn from limited populations of gamers.

A Norwegian survey indicated that among gamers who play every day, online games seemed to be more commonly preferred than offline games. Among this group, role-playing games, action games and strategy games were most popular, and far more so than they were with gamers who played less often. Furthermore, gamers who were considered to show signs of problem gaming, appeared to be overrepresented among the gamers who played these game genres (Synovate, 2008).

In a strategy game, the gamer usually leads a faction in warfare. The target is to reduce enemy forces with the ultimate goal being victory. To achieve this, the gamer must exercise superior strategy and tactics to the opponent. When playing offline, the gamer fights the computer or game console, whereas online, different gamers may fight each other.

An action game is typically based on shooting or fighting. In shooter games, the gamer usually controls one character and engages in up-close battle with weapons. This genre of games challenge the gamer's coordination and reaction-time, as opposed to strategy games which are more based on logic, overview and planning (although reaction-time is also essential to some strategy games). The action game always provides some goal of the battle, such as capturing the other team's flag or being the last man standing, and so on. Like in strategy games, the gamer fights the computer or game console when offline. When online, the gamers may fight each other, either individually or in teams. Both in strategy games and action games, the offline modes usually follow a story line, whereas the online modes tend to be open-ended.

In role-playing games the gamer usually controls one character or a small group of characters, with whom they explore a virtual world. The most popular of these games take place online with thousands of gamers and are referred to as MMORPGs. An MMORPG is never-ending, and the virtual world evolves even as the gamer is offline. The purpose of the game is to continually develop the character into getting better and stronger by fighting and completing quests. As the character develops and the quests become more difficult, it is common that the gamer joins a guild with other gamers in order to cooperate. The developers of World of Warcraft state that a guild of about 40 high-level gamers are needed to overcome some of the more difficult challenges, and even then it can take a week or more to succeed ("Insider Interview. Raiding in World of Warcraft," n.d.). Joining a guild can thus entail several hours of continuous game play (Griffiths, et al., 2004). Some gamers have termed MMORPGs "heroinware", referring to the perceived addictive nature of these games. In the field of research, MMORPGs are commonly the games in question when discussing video game addiction. It has been found that these games are played for longer periods of time than offline games (Ng & Wiemer-Hastings, 2005). The social aspects of the MMORPGs, combined with the fact that they are never-ending and run in real-time, are considered factors contributing to addiction by pressuring gamers to devote themselves to the game (Allison, et al., 2006). The increasing demands put on the gamers as they make progress in the game appear to pull some gamers in. Evidently, in some cases this can lead to severe detrimental effects on the gamer's real life, due to neglect of important real life aspects such as school/work, family, friends, sleep, physical health, and so on. For some, the game seems to become more important to the gamers than their real lives (Chappell, et al., 2006).

What Is Addiction?

Whether or not one will accept the concept of video game addiction largely depends on one's definition of addiction in general. At the most basic level, one can separate between two categories of addiction: chemical and behavioural. Chemical addictions are addictions to substances such as alcohol and narcotics, whereas the behavioural addictions include all non-chemical addictions, such as pathological gambling. However, when considering new potential behavioural addictions, the clinical criteria for chemical addictions are commonly used as a basis of comparison (Griffiths, 1999). This practice has been criticized for implying that all addictions should be defined by the core symptoms of chemical dependencies (Orford, 2001). Alternative views have been suggested. For instance, Orford (2001) has put forth the idea of excessive appetites. He considers most addictions to be based on activities or objects that generally are unproblematic, such as alcohol, food, sex, and gambling. However, the activities can become problematic for some people because they form great attachments to them. Chemical dependencies are here viewed simply as a few of many kinds of dependencies or addictions, as opposed to some that are central to the others. Orford's view basically states that people can become addicted to any kind of activity or object. Consequentially, a need arises to separate between activities or objects that people often become addicted to from the ones that seldom lead to addiction (Orford, 2001). To do so, one may need to investigate the object's or action's consequences for the individual. It has been suggested that negative consequences and compulsion may be central in separating addiction from high engagement. Whereas individuals who are simply highly engaged with an activity perform this activity for their own enjoyment; addicted individuals perform the activity out of a need or

compulsion to do so. Further, people who are highly engaged suffer no negative consequences from the action in question, while the opposite is the case for addicts (Charlton & Danforth, 2004).

Other researchers have suggested that addiction in general could be viewed as a syndrome (Shaffer, et al., 2004). This approach suggests that different addictions might not be separate from each other, but different expressions of the same underlying addiction syndrome. Reviews of the findings suggest common neurobiological responses in different types of addiction, particularly in the dopamine system (Betz, Mihalic, Pinto, & Raffa, 2000; Holden, 2001). A malfunction in the dopamine system is theorized to be a cause of the “reward deficiency syndrome”, which is presumed to play a central part in the development and maintenance of both drug and behavioural addictions. Other commonalities between addictions include genetic and psychosocial vulnerability as well as social risk factors (Brewer & Potenza, 2008; Shaffer, et al., 2004). Shaffer et al. (2004, p. 368) state that “The extant evidence suggests that (1) many commonalities occur across different expressions of addiction and (2) these commonalities reflect shared etiology: a syndrome.”

In an attempt to integrate pieces of knowledge about addiction into one synthesized theory, West (2006) has suggested that addiction may be viewed as a deficit in the “motivational system”, resulting in a loss of control over reward-seeking behaviour. West regards addiction as a social construct, and thus rejects the idea of it as something that can be specifically defined. He goes on to explain that addiction in some cases can be part of a syndrome, as is the case with the alcohol dependence syndrome, which involves cravings and withdrawal symptoms. However, this may not always be the case. He suggests that addiction could be a symptom, rather than a unitary disorder,

because of its many different underlying abnormalities, as well as variations in severity and behaviour patterns.

The three views presented above are not necessarily mutually exclusive. Instead they seem to complement each other, each of them capturing different aspects of the complex field of addiction. Orford (2001) points out a need to expand the concept of addiction, Shaffer et al. (2004) recognizes common underlying causes of different types of addiction, whereas West (2006) reflects on the motives behind, and the differences between them. Most likely, no theory captures the whole "truth" about addiction, but combined, different views may shed some light on the most important aspects. None of these three views would exclude the possibility of a video game addiction, if research on the field were to warrant such a diagnosis.

Criteria for Video Game Addiction

Neither the American Psychiatric Association nor the World Health Organization has classified video game addiction as a psychiatric disorder in their respective diagnostic manuals (American Psychiatric Association, 2000; World Health Organization, 1999). However, the American Psychiatric Association does not exclude the possibility of such a diagnosis in future editions of the DSM (American Psychiatric Association, 2007).

Because excessive video game playing is a relatively new phenomenon, the research on a potential addiction to such games is still in an early phase, and commonly acknowledged criteria for the classification of video game addiction have yet to be developed. However, several attempts have been made to define or establish such criteria (e.g. Charlton, 2002; Giles & Price, 2008; Griffiths, 1999; Hussain & Griffiths, 2009; Lemmens, Valkenburg, & Peter, 2009; Porter, Starcevic, Berle, & Fenech, 2010;

Salguero & Morán, 2002; Wan & Chiou, 2007) and Brown's criteria for behavioural addictions have often been used as a basis for this work. Brown's list of criteria includes salience, withdrawal, conflict, euphoria, tolerance, as well as relapse and reinstatement (Brown, 1991, 1993, cited in Charlton, 2002). Based on these criteria, for a behavioural addiction to be considered present, the activity must take priority in the person's life, cause unpleasant emotional or physical effects when discontinued or halted, cause interpersonal or intrapersonal conflicts, cause elated feelings or a “high” in the individual, cause a need to engage in the activity for an increasingly longer period of time in order to achieve the same “high”, and finally, the activity must be reverted to earlier patterns when resumed after attempts to abstain from it.

A similar view has later been put forth by Griffiths (1999) who suggested a subcategory to behavioural addictions called “technological addictions”. Among other things, this category includes video game addiction and internet addiction. The technological addictions feature six core components of addiction: salience, tolerance, mood modification, withdrawal symptoms, conflict and relapse. These criteria are quite similar to the ones postulated by Brown, and according to Griffiths, a behaviour that features these six components can be considered an addiction.

It has also been suggested to categorize excessive gaming as a subcategory of internet addiction, along with sexual preoccupations, and e-mail or text messaging (Block, 2008). According to Block, these behaviours feature four components of addiction: excessive use, tolerance, withdrawal and negative repercussions. Block suggests internet addiction to be considered a compulsive-impulsive spectrum disorder in the upcoming DSM-V.

Many of the current measurements of video game addiction is based on the DSM criteria for gambling or drug dependence (e.g. Lemmens, et al., 2009; Porter, et al., 2010; Salguero & Morán, 2002). By adapting the DSM criteria of pathological gambling to apply to gaming, the Game Addiction Scale has been developed by Lemmens et al. (2009). This scale consist of seven items, intended to measure salience, tolerance, mood modification, relapse, withdrawal, conflict and problems. The scale has been extensively validated by its authors, and correlate with time spent on games, life satisfaction, loneliness, social competence and aggression. The scale also seems to be reliable across samples.

Measuring Video Game Addiction

Because there are so many different views and measurements currently applied in the field, different operationalizations of video game addiction are adopted across studies. When separating addiction from non-addiction, different studies use different cut-off levels (Charlton & Danforth, 2007; Griffiths & Dancaster, 1995; Synovate, 2008; Wan & Chiou, 2007), and some do not offer an explanation or reasoning as to why a particular cut-off has been selected (e.g. Wan & Chiou, 2007). Other studies operate entirely without cut-offs, ranging addiction along poorly defined scales, reporting that subjects are “less” or “more” addicted (e.g. Ko, et al., 2005), or along somewhat better defined scales with numeric scores, though providing vague impressions of what any given score entails in terms of addiction (e.g. Kim, et al., 2008; Smahel, Blinka, & Ledabyl, 2008; Wang & Chu, 2007). Different usage of criteria and cut-offs thus result in wide variation in reported prevalence estimates, as demonstrated by Charlton and Danforth (2007), who found that tweaking the cut-offs and criteria resulted in prevalence estimates ranging from 1.8% to 38.7% in the same sample group.

Comparatively, the prevalence rate of pathological gambling is usually estimated at about 1% (Wiebe & Volberg, 2007).

Central to this problem, is the question of whether a monothetic or a polythetic approach better captures addiction. With a monothetic approach, all criteria of a given measurement have to be met in order for addiction to be considered present. With a polythetic approach, only a certain number of the criteria need to be met. There are advantages and disadvantages with both. Whereas polythetic approaches may be too liberal, monothetic approaches may be too strict (First, Frances, & Pincus, 2004). A third option is using a “core criteria” approach, where only criteria that are central to addiction have to be met. Investigating the core criteria of behavioural addiction, as defined by Brown (1991, 1993, cited in Charlton, 2002) Charlton noticed a division between strong and mild criteria. He found that the mild criteria; tolerance, euphoria and cognitive salience, indicated high engagement rather than addiction. Meanwhile, relapse and reinstatement, withdrawal symptoms, behavioural salience and conflict (inter-personal and between activities) appeared to indicate addiction. Charlton suggests that the milder, peripheral facets might precede the stronger in a possible developmental model, in which an individual progresses through a phase of high engagement before reaching the stage of addiction. While the strong indicators involve negative consequences for the individual, that is not the case for the mild ones. High engagement is thus non-pathological, indicating that the individual merely enjoys the activity.

Another major criticism against the research on video games addiction is that the various measurements developed from criteria on gambling or drug dependence may compromise the validity of the scales, as well as contribute to the aforementioned over-estimation of prevalence rates.

Video Game Addiction: The Debate

There is a disagreement in the field as to whether or not excessive video game playing should be considered an addiction. Almost 80% of online computer gamers report sacrificing at least one important real life aspect (job/education, family/friends/partner, hobbies or sleep) in order to play computer games (Griffiths, et al., 2004). However, it is not until the gamer keeps playing despite severe negative consequences, that there is reason to worry about addiction (Charlton & Danforth, 2004). Even then, the problem might not be addiction. Wood (2008a) have stated that people who seem to be addicted are in fact not; instead they merely use the game to escape some other troubles in their lives. Although Wood's claim may be true, the same might also be true for other types of addiction. It is well documented that addictive disorders such as alcohol- and drug dependence, as well as gambling have high co-morbidity rates with other psychiatric disorders such as depression, anxiety and personality disorders, among other things (Hall, 1996; Merikangas, et al., 1998; Petry, Stinson, & Grant, 2005; Weissman, Myers, & Harding, 1980), yet few researchers or theorists doubt the existence of these addictive disorders. Thus, there is no reason to dismiss the possibility that an individual might be addicted to video games simply because he or she has additional problems. However, a causal relationship between video game addiction and other mental disorders has yet to be established. It has been warned that it is of crucial importance to establish a potential addiction's construct validity before assuming that a new disorder has been discovered, meaning that it is important to figure out whether the "addiction" is a primary or a secondary disorder (Shaffer, Hall, & Vander Bilt, 2000).

It has been argued that until there is evidence that the video games themselves have addictive properties, excessive video game playing cannot be accepted as an addictive disorder (Wood, 2008a). It has been claimed that the primary factors that lead to addiction are intrinsic, cannot be attributed to the game, and that excessive video game playing does not meet the “core requirements” of addiction (here defined as impaired control, a lack of ability to stop or limit behaviour, salience, tolerance, withdrawal, and reinstatement) (Blaszczynski, 2008).

Some studies have shown, however, that video games do indeed appear to hold some of the qualities common to other addictions. According to one study, excessive gamers appeared to find video game cues more arousing than did casual gamers. As with chemical addictions, excessive video game playing appeared to be maintained through sensitization in the mesolimbic dopamine system, along with incentive salience as a motivational component for rewarding specific video game related cues (Thalemann, Wölfling, & Grüsser, 2007). This is in line with the theory by Shaffer et al. (2004) that a common neurobiology may underlie all forms of addiction. One study demonstrated that the level of dopamine released by video game play was similar to the level of dopamine caused by an intravenous injection of amphetamine (Koepp, et al., 1998). However, as this study used money as a reward for progress in the video game, one cannot be certain that it was the video game alone that caused the high level of dopamine.

Furthermore, the games themselves appear to be able to affect the gamer's motivation, through the game's reward system. When the rewards in a game are set to be unexpected, intangible (the rewards are not substantial entities), contingent (the rewards are given based on gamer performance) and with low relevance (the rewards are not

important to the gamer), the gamer's intrinsic motivation for playing seems to be higher than the extrinsic motivation. Intrinsic motivation seems to be associated with addiction, while extrinsic is not. Rather, extrinsic motivation tends to undermine intrinsic motivation. Video games seem to foster intrinsic motivation by down-tweaking the factors that could encourage extrinsic motivation (rewards that are expected, tangible, non-contingent and highly relevant) (Wan & Chiou, 2007).

Other researchers have made similar observations, particularly concerning MMORPGs, suggesting that such games may be addictive because of powerful variable ratio reinforcement schedules in the games that induce operant conditioning responses in the gamers, keeping them hooked on the game (Charlton & Danforth, 2007).

However, this claim is questionable because the gamer usually knows what is required to achieve a reward in these games. Meanwhile, attention and admiration from peers supplies the gamers with social reinforcement (Charlton & Danforth, 2007). As the gamer levels up in such games, increasingly longer playing time is required in order to make progress and the fact that these games are generally never-ending contributes to keeping the gamer hooked. Some video games (not restricted to MMORPGs) also reward "loyal" behaviour, such as playing for eight hours straight, playing 1000 games, or cooperating with 16 other gamers at once (King & Delfabbro, 2009). Interestingly though, some games also offer a "rest bonus" which the gamers gain when not playing. In World of Warcraft, gamers earn one "bar" or "bubble" of rest bonus for every eight hours they stay logged off the game. The rest bonus causes the character to gain experience more quickly the next time the gamer logs in to the game. A maximum of 30 "bars/bubbles" can be earned, which correspond to about one and a half level increase in experience. However, as this entails ten days of staying away from the game, the

same experience is gained more quickly by playing. Seemingly, the rest bonus have been developed to benefit casual gamers (who do not play very often, but nonetheless have to pay the same monthly fee as more avid gamers), rather than to discourage excessive play ("How to play. Resting," n.d.). However, in some parts of the world, restrictions are put on MMORPGs in order to avoid addiction (Meenan, 2007). In China, World of Warcraft characters lose strength after three hours of continuous game play, and are completely depleted after five.

It has been suggested that pre-existing problems, such as social difficulties combined with stressful life events may be a partial cause of video game addiction. People who go through stressful events and lack social connections or empowerment in their real lives might be drawn into the world of video games because of the recognition they receive from other gamers as their in-game status increases. Resources which gamers have in-game; social or otherwise, may thus become more valuable to them than those they have (or do not have) in real life, thereby increasing their vulnerability for excessive gaming (King & Delfabbro, 2009).

Summary of Previous Research

To summarize, a central aspect of addiction is that the behaviour is maintained despite severe consequences to the addicted person's life (Charlton & Danforth, 2004). Addiction might be caused by excessive appetites (Orford, 2001), a deficit in the motivational system (West, 2006), and might have a neurobiological foundation (Shaffer, et al., 2004). In accordance with the latter, video game addiction appears to be maintained through the same pathways in the brain as other addictive disorders (Thalemann, et al., 2007). Social difficulties and stressful life events may also attribute to video game addiction (King & Delfabbro, 2009).

There is reason to believe that some games might inherently be addictive (Wan & Chiou, 2007), perhaps especially MMORPGs (Allison, et al., 2006; Chappell, et al., 2006; Griffiths, et al., 2004; Ng & Wiemer-Hastings, 2005). This game genre, as well as action and strategy games, has been found to be especially popular among gamers who might be addicted to video games (Synovate, 2008).

Many attempts have been made to develop criteria for video game addiction. The Game Addiction Scale developed by Lemmens et al. (2009) has been shown to be valid and reliable. However, a wide array of scales exists in the field. A recurring issue in research is whether to adopt a polythetic, monothetic or core criteria approach to identifying addiction. A consensus has yet to be reached.

The Present Study

As most research on video game addiction has been based on samples of self-recruited gamers or drawn from limited populations such as online gamers, there is a need in the field for studies based on samples from less restricted populations in order to learn something about gamers in general. Wood (2008b) has pointed out a need for learning the extent of a problem before defining an activity as problematic. Consequently, in the field of video game addiction there is a need for research such as prevalence studies, as this has not often been done before.

The present study is an independent part of an ongoing research project at the University of Bergen, aimed at investigating the understanding of video game addiction, and is based on a selection of the same data.

The hypotheses of the study were that video game addiction would be associated with negative life influences: lower life satisfaction, higher anxiety and depression, symptoms of insomnia, poorer physical health and less physical exercise. Further, it was

expected that addicted gamers would spend more time on video games than non-addicted gamers, and that they would show a preference for MMORPGs, action games and strategy games. Also, addicted gamers were on average expected to be younger than the other groups, and consist mostly of males. The investigation of gender differences was mainly exploratory, but it was expected that females generally would play less video games than males.

Method

Participants

A questionnaire was distributed by mail to 2500 randomly chosen Norwegian citizens selected by the Norwegian national registration office. The age range was 16 to 40 years. Due to the sampling procedure used by the registration office, 15 year olds who turned 16 in the year of the study could also be selected. Sixteen 15 year olds therefore participated in the present study. Out of the 2500 individuals asked to participate, 816 responded. Also, 101 questionnaires were returned because of wrong recipient address, resulting in a response rate of 34%. Of the respondents, 56.1% were female. The average age of the respondents was 27.9 years ($SD = 7.36$). Forty gift certificates were drawn among the respondents as an incentive for participation.

Materials

Video game playing habits. The respondents were asked how many hours per week they spent playing video games, and whether or not they or their loved ones were worried that the respondent may have a problem with excessive video game playing. They were also asked to report how often they used each of four kinds of game devices: handheld devices, stationary consoles, installed games on a PC, and the web browser on a PC. Further, they were asked how often they played each of 11 genres of games:

adventure, driving, sports, MMORPG, family/party, action, strategy, puzzle, platform, simulation and fighter games. These items were all rated on a 7-point continuum scale: 1 (*never*), 2 (*less than one day per month*), 3 (*one-three days per month*), 4 (*one day per week*), 5 (*two-three days per week*), 6 (*four-six days per week*), 7 (*every day*).

Game addiction. The Game Addiction Scale (Lemmens, et al., 2009) contains seven items that measure symptoms of video game addiction over the past six months. These are: *How often during the last six months: 1. Did you think about playing a game all day long?* (Salience), *2. Did you spend increasing amounts of time on games?* (Tolerance), *3. Did you play games to forget about real life?* (Mood modification), *4. Have others unsuccessfully tried to reduce your game use?* (Relapse), *5. Have you felt bad when you were unable to play?* (Withdrawal), *6. Did you have fights with others (e.g., family, friends) over your times spent on games?* (Conflict), *7. Have you neglected other important activities (e.g., school, work, sports) to play games?* (Problems). All scales used in the present study were presented in Norwegian.

The items on the Game Addiction Scale are rated on a 5-point likert scale from 1 (*never*) to 5 (*very often*). As suggested by the authors of the scale, an item was considered endorsed when a respondent scored 3 or higher. The cut-off for addiction was in the present study set to a minimum score of three on at least four of the seven items. Thus, a polythetic approach was chosen, in accordance with the current standard of diagnostic guidelines for similar mental health issues (such as pathological gambling) set by the American Psychiatric Association (2000).

Satisfaction with life. The Satisfaction with Life Scale (SWLS) (Diener, Emmons, Larsen, & Griffin, 1985) consists of five items (e.g. *In most ways, my life is close to my ideal*). The items are ranged on a 7-point Likert scale from 1 (*Fits poorly*) to

7 (*Fits perfectly*). The scale ranges from 5 to 35. Scores from 20 to 24 are considered normal. Internal consistency (Cronbach's alpha) for the scale in this study was .91.

Anxiety and depression. The Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983) consists of two subscales that measure symptoms of anxiety (e.g. *I get sudden feelings of panic*) and depression (e.g. *I still enjoy the things I used to enjoy*) during the past week. Each of the two subscales consists of seven items that are rated from on a scale ranging from 0 to 3. Each subscale has a range of 0-21. Scores of 8 or lower on each subscale are considered non-pathological. Internal consistency (Cronbach's alpha) in the study was .75 for the anxiety subscale, and .77 for the depression subscale.

Insomnia. Bergen Insomnia Scale (BIS) (Pallesen, et al., 2008) consists of six items that measure symptoms of insomnia during the past month (e.g. *In the past month, how many days per week have you felt dissatisfied with your sleep?*). The items are rated from 0 (*zero days per week*) to 7 (*seven days per week*). The scale ranges from 0-42. Compared to normative data for men and women aged 18 to 44 years, scores of 12 or lower are considered within the normal range. Internal consistency (Cronbach's alpha) for the scale in this study was .82.

Health and exercise. The respondents were asked to answer one question about physical health (*How do you consider your health?*), rated from 1 (*very good*) to 4 (*poor*). The respondents were also asked to answer one question about exercise (*How often do you practice sports, or exercise so much that you sweat and/or get out of breath?*), which was rated on a 7-point continuum scale: 1 (*never*), 2 (*less than one day per month*), 3 (*one-three days per month*), 4 (*one day per week*), 5 (*two-three days per week*), 6 (*four-six days per week*), 7 (*every day*).

Statistics

The gender distribution among the respondents was 56.1 % females and 43.9% males. Younger males (15-27 years) were underrepresented among the respondents ($n = 155$), and older females (28-40 years) were overrepresented ($n = 238$). In order to compensate for this skewed distribution, the data were weighted. An overview of the Norwegian population by Statistics Norway was used to calculate the weights.

Based on their scores on the addiction scale, each respondent was categorized into an “addiction” group or a “non-addiction” group. Based on reported time spent playing video games, the non-addiction group was further divided into two groups: one group consisting of the respondents who do not engage in video game play at all (reported playing time of 0 hours per week), and one consisting of the respondents who do play video games, but are not considered addicted. Thus, the following three groups emerged: “addicted gamers” ($n = 33$), “non-addicted gamers” ($n = 429$), and “non-gamers” ($n = 355$).

Chi-square was used to determine whether or not differences in nominal variables between the three groups were significant.

One-way analysis of variance (ANOVA) was used to measure differences in continuous variables between the three groups. Group (addicted gamers vs. non-addicted gamers vs. non-gamers) was always the independent variable when ANOVA was used. A homogeneity of variance test was used to determine which post-hoc test to use in further analyses. When the variances between groups were found to be equal, the Scheffé test was used since it does not assume that each condition holds the same number of cases (Howitt & Cramer, 2008). However, when unequal variances were

found between the groups, the Games-Howell range test was used, as recommended by Howitt and Cramer (2008).

For analyses of gaming habits and personal concerns about own gaming behaviour, the non-gamer group was left out because they per definition have no gaming habits. For these analyses, independent samples *t*-tests were used to find differences between the two remaining groups. For each comparison, the Levene's Test for Equality of Variances was used to determine whether to use the *t*-value for equal variances or the *t*-value for unequal variances. Also, one sample *t*-tests were used to find differences within each of the two groups.

Results

Prevalence

The estimated prevalence of video game addiction was 4.0% ($n = 33$).

Demographics

Some differences in demographic variables were found between the three groups. As opposed to the sample in general, 84.8% of the addiction group were males. In comparison, the non-addicted gamer group consisted of 60.7% males, and the non-gamer group consisted of 36.3% males. These differences were significant, $\chi^2 = 61.94$, $df = 2$, $p < .001$.

A one-way ANOVA where age was the dependent variable was conducted. The ANOVA showed a significant main effect of age, $F(2, 813) = 27.42$, $p < .001$. A Games Howell post-hoc test showed that addicted gamers ($M = 23.0$, $SD = 7.01$) were younger than non-addicted gamers ($M = 27.0$, $SD = 7.49$), and non-gamers were older than both addicted gamers and non-addicted gamers ($M = 30.0$, $SD = 6.53$), $p < .05$.

There were also differences between the three groups on demographic variables such as living situation, marital status, education level and employment situation, as presented in Table 1. Addicted gamers reported more often than the respondents in the two other groups that they were still living with their parents ($\chi^2 = 51.24$, $df = 2$, $p < .001$), that they were single ($\chi^2 = 10.02$, $df = 2$, $p = .007$), that they did not have higher education ($\chi^2 = 28.81$, $df = 2$, $p < .001$), and that they were not employed in a full time or part time job ($\chi^2 = 25.34$, $df = 2$, $p < .001$).

Table 1

Respondents' living situation, relationships status, education and work situation. Group percentages.

Group	Have moved out from parents' home	Are in a relationship	Have higher education	Have full time or part time job
Addicted Gamers	51.1%	54.5%	25.0%	33.3%
Non-addicted Gamers	71.7%	60.1%	39.1%	59.2%
Non-Gamers	89.5%	70.3%	56.3%	71.3%

Gaming Habits

The analyses in this section compare only addicted gamers and non-addicted gamers.

Gaming time. A one sample *t*-test showed that addicted gamers ($M = 14.67$, $SD = 13.64$) played more hours per week compared to non-addicted gamers ($M = 5.57$, $SD = 8.13$), $t = 3.764$, $df = 33,571$, $p = .001$.

The respondents' reported playing time ranged from 0 to 63 hours per week. The respondent who reported playing for 63 hours per week was categorized as a non-addicted gamer. The highest reported playing time in the addicted group was 50 hours per week. One respondent classified as addicted reported playing 0 hours per week.

Game devices. Compared to the overall average within the addicted gamer group ($M = 3.6$, $SD = 1.16$), a one-sample t -test indicated that none of the game devices stood out as significantly more popular than the others among the addicted gamers. However, handheld devices ($M = 2.64$, $SD = 1.75$) were significantly *less* popular, $t = -3.219$, $df = 32$, $p = .003$.

Compared to the overall average within the non-addicted gamer group ($M = 2.7$, $SD = 1.03$), a one-sample t -test indicated that the internet browser on a PC ($M = 2.91$, $SD = 1.73$) stood out as significantly more popular than the others, $t = 2.523$, $df = 423$, $p = .012$. Handheld devices ($M = 2.52$, $SD = 1.75$) were significantly less popular, $t = -2.164$, $df = 425$, $p = .031$.

An independent samples t -test showed that addicted gamers used all devices significantly more often compared to the non-addicted gamers, with the exception of handheld devices. Independent samples t -values are presented in Table 2.

Table 2

Game devices. Differences between addicted gamers (AG) and non-addicted gamers (NAG).

Game device	Group means (SD)		t	df	p
	AG	NAG			
Handheld	2.64 (1.75)	2.52 (1.75)	0.391*	457	ns
Stationary	3.73 (1.88)	2.67 (1.46)	3.165	34,779	.003
PC-installed games	4.35 (2.17)	2.71 (1.75)	4.128	33,578	.000
PC-web browser	3.81 (1.79)	2.91 (1.73)	2.854*	455	.005

Note. Differences unequal, except where marked with *. Significant t -values are in boldface.

Game genres. Compared to the overall average within the addicted gamer group ($M = 2.78$, $SD = 1.02$), a one-sample t -test indicated that action games stood out as

particularly popular among addicted gamers. One sample *t*-values for both addicted gamers and non-addicted gamers are presented in Table 3.

In the non-addicted gamer group ($M = 1.86$, $SD = 0.69$), puzzles, family/party, action and sports games were the most popular, while fighter, MMORPGs, simulation and strategy games were the least popular.

Table 3

Game genres. One-sample t-test addicted gamers (test value 2.7806), one-sample t-test non-addicted gamers (test-value 1.8568).

Game genre	Addicted Gamers ($M=2.7806$)				Non-addicted gamers ($M=1.8568$)			
	<i>M</i> (<i>SD</i>)	<i>t</i>	<i>df</i>	<i>p</i>	<i>M</i> (<i>SD</i>)	<i>t</i>	<i>df</i>	<i>p</i>
Adventure	2.85 (1.90)	0.216	32	ns	1.75 (1.39)	-1.520	423	ns
Driving	2.96 (1.55)	0.642	32	ns	1.95 (1.13)	1.688	424	ns
Sports	2.95 (1.69)	0.563	32	ns	2.01 (1.34)	2.326	423	.021
MMORPG	2.92 (2.25)	0.358	32	ns	1.52 (1.38)	-4.974	424	.000
Family/party	2.82 (1.42)	0.174	32	ns	2.01 (1.01)	3.187	424	.002
Action	3.80 (1.79)	3.238	32	.003	2.06 (1.46)	2.864	423	.004
Strategy	2.39 (1.56)	-1.430	32	ns	1.65 (1.16)	3.632	422	.000
Puzzle	2.52 (1.49)	-1.001	31	ns	2.52 (1.54)	8.845	424	.000
Platform	2.53 (1.51)	-0.948	32	ns	1.83 (1.20)	0.486	424	ns
Simulation	2.22 (1.60)	-2.000	32	ns	1.62 (1.21)	-4.120	423	.000
Fighter	2.57 (1.56)	-0.777	32	ns	1.50 (1.03)	-7.200	424	.000

Note. Significant *t*-values are in boldface.

With the exception of puzzles, the addicted gamers reported playing every game genre significantly more often than non-addicted gamers. With puzzles there were no significant differences between the groups. An overview of independent samples *t*-values are presented in Table 4.

Table 4

Game genres. Differences between addicted gamers (AG) and non-addicted gamers (NAG).

Game genre	Group means (<i>SD</i>)		<i>t</i>	<i>df</i>	<i>p</i>
	AG	NAG			
Adventure	2.85 (1.90)	1.75 (1.39)	3.235	34,428	.003
Driving	2.96 (1.55)	1.95 (1.13)	3.629	34,401	.001
Sports	2.95 (1.69)	2.01 (1.34)	3.781*	455	.000
MMORPG	2.92 (2.25)	1.52 (1.38)	3.502	33,613	.001
Family/party	2.82 (1.42)	2.01 (1.02)	3.198	34,308	.003
Action	3.80 (1.79)	2.06 (1.46)	5.402	35,062	.000
Strategy	2.39 (1.56)	1.65 (1.16)	2.642	34,500	.012
Puzzle	2.52 (1.49)	2.52 (1.54)	-0.007*	455	ns
Platform	2.53 (1.51)	1.83 (1.20)	2.588	34,917	.014
Simulation	2.22 (1.60)	1.62 (1.21)	2.126	34,601	.041
Fighter	2.57 (1.56)	1.50 (1.03)	3.878	33,913	.000

Note. Differences unequal, except where marked with *. Significant *t*-values are in boldface.

Gender differences. Because the addicted gamer group was small and contained few females, both gamer groups (addicted and non-addicted) were combined in order to examine gender differences.

Males ($M = 7.62$, $SD = 10.20$) were found to generally spend more time per week playing video games compared to females ($M = 3.87$, $SD = 5.56$), $t(440,62) = 5.01$, $p < .001$.

Compared to their own average ($M = 2.92$, $SD = 1.07$), PC –installed games ($M = 3.17$, $SD = 1.91$) stood out as a particularly popular game device among male gamers, $t = 2.257$, $df = 285$, $p = .025$. Meanwhile, handheld game devices ($M = 2.49$, $SD = 1.74$) were particularly unpopular, $t = -4.153$, $df = 286$, $p < .001$.

Compared to the female gamer average ($M = 2.51$, $SD = 1.00$), internet browser games ($M = 3.05$, $SD = 1.92$) were particularly popular, $t = 3.685$, $df = 169$, $p < .001$. Stationary consoles ($M = 2.18$, $SD = 1.16$) were particularly unpopular ($t = -3.698$, $df =$

169, $p < .001$), along with PC-installed games ($M = 2.24$, $SD = 1.51$), which were also unpopular, $t = -2.321$, $df = 169$, $p = .021$.

Further, the most popular games among males ($M = 2.07$, $SD = 0.79$) were action games, sports, and driving games. Significantly unpopular among male gamers were fighter, simulation and platform games. One sample t -values for both male gamers and female gamers are presented in Table 5.

Table 5

Game genres. One-sample t-test male gamers (test value 2.0708), one-sample t-test female gamers (test-value 1.6749).

Game genre	Male Gamers ($M=2.0708$)				Female gamers ($M=1.6749$)			
	$M(SD)$	t	df	p	$M(SD)$	t	df	p
Adventure	1.95 (1.53)	-1.310	284	ns	1.64 (1.31)	-0.390	171	ns
Driving	2.26 (1.28)	2.433	286	.016	1.63 (0.90)	-0.657	170	ns
Sports	2.38 (1.50)	3.534	285	.000	1.56 (0.99)	-1.530	170	ns
MMORPG	1.87 (1.76)	-1.897	286	ns	1.20 (0.76)	-8.100	170	.000
Family/party	2.07 (1.15)	0.009	286	ns	2.07 (0.92)	5.670	170	.000
Action	2.64 (1.67)	5.807	285	.000	1.42 (0.91)	-3.692	170	.000
Strategy	1.95 (1.35)	-1.506	285	ns	1.29 (0.75)	-6.666	169	.000
Puzzle	2.20 (1.40)	1.518	285	ns	3.05 (1.61)	11.207	170	.000
Platform	1.87 (1.30)	-2.642	286	.009	1.90 (1.14)	2.526	170	.012
Simulation	1.80 (1.33)	-3.386	286	.001	1.41 (1.04)	-3.259	169	.001
Fighter	1.78 (1.26)	-3.944	286	.000	1.23 (0.68)	-8.595	170	.000

Note. Significant t -values are in boldface.

Among female gamers ($M = 1.67$, $SD = 0.61$), puzzles, family/party games, and platform games were the most popular. Significantly unpopular among female gamers were fighter games, MMORPGs, strategy games, action games, and simulation games.

The three favourites among females; puzzles, family/party games and platform games, were also the only game genres that males did not play significantly more often than females. Puzzles were the only game genre that females played significantly more often than males. Table 6 presents an overview over independent samples t -values.

Table 6

Game genres. Differences between male and female gamers.

Game genre	Group means (<i>SD</i>)		<i>t</i>	<i>df</i>	<i>p</i>
	Males	Females			
Adventure	1.95 (1.53)	1.64 (1.31)	2.335	403,258	.020
Driving	2.26 (1.28)	1.63 (0.90)	6.098	442,916	.000
Sports	2.38 (1.50)	1.56 (0.99)	7.082	450,500	.000
MMORPG	1.87 (1.76)	1.20 (0.76)	5.635	423,323	.000
Family/party	2.07 (1.15)	2.07 (0.92)	-0.017	419,510	ns
Action	2.64 (1.67)	1.42 (0.91)	10.153	451,580	.000
Strategy	1.95 (1.35)	1.29 (0.75)	6.673	451,467	.000
Puzzle	2.20 (1.40)	3.05 (1.61)	-5.988*	455	.000
Platform	1.87 (1.30)	1.90 (1.14)	-0.227*	456	ns
Simulation	1.80 (1.33)	1.41 (1.04)	3.472	422,248	.001
Fighter	1.78 (1.26)	1.23 (0.68)	6.031	451,450	.000

Note. Differences unequal, except where marked with *. Significant *t*-values are in boldface.

Physical and Mental Health

Concern about gaming behaviour. For the analyses of concern about gaming behaviour, the non-gamer group was left out.

Not surprisingly, addicted gamers tended to be more concerned about their own gaming than non-addicted gamers. Addicted gamers reported more often than non-addicted gamers that they think they play too much video games ($\chi^2 = 13.08$, $df = 1$, $p < .001$), that they think they have a problem with gaming ($\chi^2 = 48.30$, $df = 1$, $p < .001$), and that loved ones are concerned about their gaming ($\chi^2 = 75.11$, $df = 1$, $p < .001$).

Table 7 presents the figures for the two groups on these variables.

Table 7

Respondents' concern about gaming behaviour. Group percentages.

Group	Think they play too much VG	Report having a problem with gaming	Loved ones concerned
Addicted Gamers	24.2%	18.2%	39.4%
Non-addicted Gamers	6.6%	0.7%	3.1%

Note. VG = video games.

Satisfaction with life. A one-way ANOVA where score on the SWSL was the dependent variable, showed a significant main effect of this scale, $F(2, 808) = 16.42, p < .001$. A Scheffé post-hoc test showed that addicted gamers ($M = 20.42, SD = 4.52$) scored significantly lower than both non-addicted gamers ($M = 25.44, SD = 6.03$) and non-gamers ($M = 26.58, SD = 6.26$), $p < .05$. No significant differences were found between non-addicted gamers and non-gamers.

Anxiety and depression. A one-way ANOVA where score on the HADS anxiety subscale was the dependent variable, showed a significant main effect of this subscale, $F(2, 811) = 7.08, p = .001$. A Scheffé post-hoc test showed that addicted gamers ($M = 6.75, SD = 2.42$) scored significantly higher than both non-gamers ($M = 4.73, SD = 3.08$) and non-addicted gamers ($M = 5.08, SD = 3.01$), $p < .05$. No significant differences were found between non-addicted gamers and non-gamers.

A one-way ANOVA also showed a significant main effect of the HADS depression subscale, $F(2, 811) = 10.95, p < .001$. A Scheffé post-hoc test showed that addicted gamers ($M = 4.95, SD = 2.95$) scored significantly higher than both non-gamers ($M = 2.62, SD = 2.94$) and non-addicted gamers ($M = 3.14, SD = 2.86$), $p < .05$. No significant differences were found between non-addicted gamers and non-gamers.

Insomnia (BIS). A one-way ANOVA where score on the BIS was the dependent variable, showed a significant main effect of this scale, $F(2, 808) = 3.31, p = .037$. A Scheffé post hoc test showed that the addicted gamers ($M = 14.10, SD = 8.87$) scored significantly higher than non-gamers ($M = 10.36, SD = 8.16$), $p < .05$. No other significant differences were found.

Physical Health. A one-way ANOVA where physical health was the dependent variable, showed a significant main effect of physical health, $F(2, 805) = 5.10, p < .006$. A Scheffé post hoc test showed that non-gamers ($M = 1.95, SD = 0.77$) reported being in better physical health than non-addicted gamers ($M = 2.12, SD = 0.81$), $p < .05$. No other differences were found.

Physical Exercise. A one-way ANOVA showed no significant main effect of physical exercise.

Alternative Approaches to Identify Addiction

A monothetic approach to identifying addiction resulted in a prevalence estimate of 0.6% ($n = 5$). Gaming time in this group averaged 30.62 hours per week ($SD = 19.26$). Reported gaming time ranged from 3 to 50 hours per week, but all respondents except for one reported playing for more than 30 hours per week.

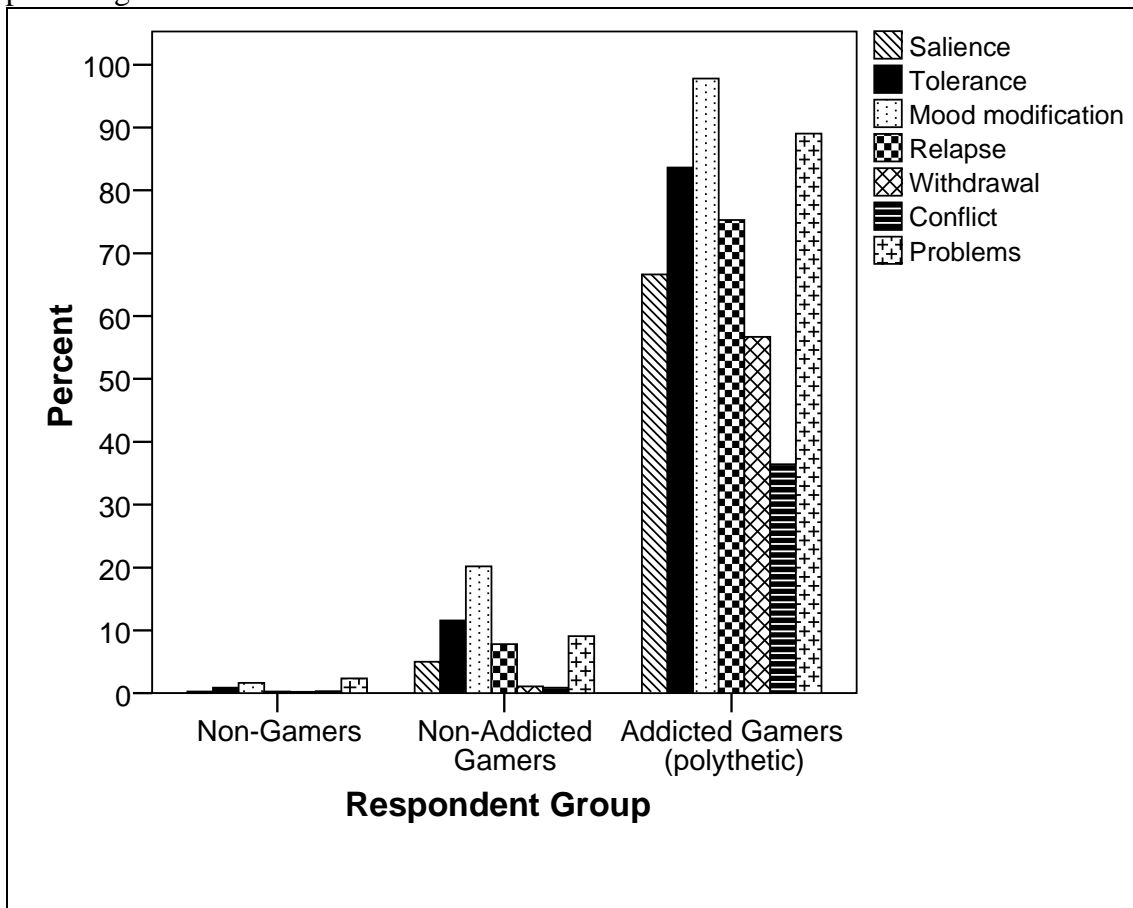
According to the authors of the Game Addiction Scale, three of the items may be regarded as core criteria, because they inherently imply negative consequences (Lemmens, et al., 2009). These are conflict, withdrawal and problems (conflict with other activities). 1.2% of the sample endorsed all three items ($n = 9$), and 2.8% endorsed at least two out of three ($n = 23$).

Other researchers have suggested the three mentioned above plus relapse and behavioural salience (Charlton, 2002; Charlton & Danforth, 2007). However, the Game

Addiction Scale does not measure the latter. Excluding this criterion then, 0.9% of the sample endorsed all four items ($n = 7$), and 2.3% endorsed at least three out of four ($n = 19$).

Figure 1 shows the percentage of participants who endorsed each of the items in the Game Addiction Scale. While relatively many of the addicted gamers experience problems (conflict with other activities) as well as relapse, approximately half of the gamers classified as addicted experience withdrawal, and even fewer report (interpersonal) conflicts related to their gaming.

Figure 1. Respondents endorsing each of the seven Game Addiction Scale items. Group percentages.



Discussion

Summary of Results

The primary aim of the present study was to investigate the prevalence of video game addiction in Norway, and to investigate whether addiction was associated with measures of physical and mental health. The second aim was to investigate characteristics of addicted gamers, compared to non-addicted gamers and non-gamers. Third, the present study aimed to compare male and female gamers in order to investigate differences in gaming habits.

The hypothesis that addiction would be associated with negative life influences was partially supported. Compared to non-gamers, addicted gamers were found to score significantly lower on the measure of life satisfaction, and well as higher on measures of anxiety, depression and insomnia. However, the scores were within the non-pathological range for all groups, even though addicted gamers on average reported a slightly elevated level of symptoms of insomnia.

Based on previous research, it was expected that addicted gamers would spend more time playing video games compared to non-addicted gamers, that they would show a preference for MMORPGs, as well as action and strategy games, that they would be younger than the respondents in the two other groups, and that the addicted gamer group would consist mainly of males. These hypotheses were supported, except for the finding that addicted gamers did not show a preference for MMORPGs or strategy games, but for action games. The differences found in living situation, relationships status, education and work situation may presumably be attributed to the general age differences between the groups.

The hypothesis that female gamers would play less than male gamers was supported. Another interesting gender difference was also discovered: female gamers tended to prefer different game consoles and game genres than males.

Prevalence

The results from the present study indicate that 4% of the respondents might be addicted to video games. Compared to prevalence rates of gambling, which are usually estimated at 1% (Wiebe & Volberg, 2007), this estimate is somewhat elevated. However, considering that this study focused on adults aged 16 to 40, the prevalence in the Norwegian population as a whole is probably lower, because older adults are less likely to play video games. Also, if a monothetic approach had been adopted, the estimate would have been lower (0.6%). There is, however, reason to believe that this would have been an underestimation. One would not expect pathological gamblers or patients who are drug dependent to display every possible symptom of their respective disorders. Nor does it seem reasonable to expect this of people who are addicted to video games. Therefore, it is possible that the monothetic approach might capture only the most severe cases of addiction, and thereby exclude less severe cases.

A compromise may have been found in the research on core and peripheral criteria (Charlton, 2002; Charlton & Danforth, 2007). As Figure 1 showed, it was found that almost 100% of the addicted gamers and about 20% of the non-addicted gamers in the present study endorsed the “mood modification” item, “How often during the last six months did you play games to forget about real life?” The finding that so many gamers endorsed this item may suggest that it is a peripheral criteria indicating engagement. If that is the case, then it is not surprising that many non-addicted gamers endorsed this item. Neither is it surprising that almost all of the addicted gamers

endorsed it, as it seems reasonable to expect that someone who is addicted to an activity is highly engaged in that activity. The wording of the item may perhaps on the surface give an impression of measuring pathology. However, it can be argued that an aspect of all hobbies is that they help people to unwind and forget about the stress and complications in life. One would not claim that people who enjoy reading a book after a stressful day are addicted to reading. The fact that an activity can be used as an “escape” or a means of coping does not necessarily indicate that it is anything more than a hobby. However, when the activity takes priority in an individual’s life and thereby cause severe detrimental effects on the individual’s life, addiction may be the problem. This is where the core criteria come in. Based on the fact that they entail negative consequences for the gamer, the authors of the Game Addiction Scale (Lemmens, et al., 2009) have suggested that the following three items may be considered core criteria: How often during the last six months: “...did you have fights with others (e.g., family, friends) over your time spent on games?” (measures conflict), “...have you felt bad when you were unable to play?” (measures withdrawal) and “...have you neglected other important activities (e.g., school, work, sports) to play games?” (measures “problems”, or conflict with other activities). 1.2% of the sample in the present study endorsed all three items. However, research indicates that relapse should be included as a core criterion as well (Charlton, 2002; Charlton & Danforth, 2007). According to Lemmens et al (2009), the following item in the Game Addiction Scale is intended to measure relapse: “How often during the last six months have others unsuccessfully tried to reduce your game use?” When this item is considered a core criterion along with the other three, it is found that 0.9% of the sample endorse all four. However, it is questionable whether this item truly reflects the concept of relapse, as the item does not imply that the respondent must

actually have stayed away from games for some time, and then fallen back into old patterns. The way it is phrased, respondents may check this item if their loved ones are simply asking for them to reduce their playing, and they do not listen. In fact, this is the way the item was translated into Norwegian, and is also how it is phrased in Dutch, the scale's original language. Further, Charlton and Danforth (2007) also found a fifth core criteria: behavioural salience. The Game Addiction Scale does not include this criterion. The item labelled "Salience" measures only cognitive salience, not behavioural.

It is possible that some revising would be beneficial to the Game Addiction Scale. It might prove beneficial also to validate the scale for a core criteria approach to addiction. However, this does not necessarily mean that the current scale measures high engagement rather than addiction. Extensive validation by the authors indicate that the scale does in fact measure pathological video gaming (Lemmens, et al., 2009).

Physical and Mental Health

Compared to non-gamers, video game addiction was in the present study found to be associated with a somewhat lowered life satisfaction, elevated levels of symptoms of insomnia, as well as elevated levels of anxiety and depression. However, these levels were within the non-pathological range for all groups, although addicted gamers' average level of insomnia symptoms was slightly elevated compared to the normative data. There are thus no indications that addicted gamers as a group suffer clinical levels of anxiety, depression or insomnia. Nor are they in worse physical health than non-gamers. As the data are cross-sectional, no inferences about causation can be made. However, some possibilities for the slightly elevated levels of insomnia symptoms are that the addicted gamers perhaps prioritize gaming over sleep (Griffiths, et al., 2004), or that perhaps an unknown variable cause both addiction and symptoms of insomnia.

Even though the levels on the scales regarding mental health were not in the clinical range, addicted gamers as a group were less satisfied with their lives compared to non-gamers. Also, non-gamers experienced fewer symptoms of anxiety and depression in their daily lives than addicted gamers. Again, no assumptions about causation can be made, but some possibilities are that video game addiction perhaps causes these negative life influences, or alternatively that negative life influences cause video game addiction. A third possibility is that some unknown third variable causes the differences.

Differences in Gaming Habits: Addicted Gamers vs. Non-addicted Gamers

Addiction was associated with gaming time, as addicted gamers spent significantly more time playing video games compared to non-addicted gamers. However, the average gaming time among addicted gamers was quite low in the present study, compared to many other studies that report gaming times of 18 to 36 hours per week (Charlton & Danforth, 2007; Griffiths, et al., 2004; Kim, et al., 2008). Fourteen hours per week spent on video games may not seem like a large amount of time. An average of two hours per day spent on video games may not cause severe consequences to a person's life. After all, with approximately six hours left over in the day (reserving eight hours for work and another eight for sleep), there is still time to spend with family, friends, homework, and other hobbies. Thus, gaming time alone might not be a good indicator of addiction. For example, it is conceivable that people can be addicted to video games even if they are currently avoiding games.

Various explanations could account for the rather low average gaming time found in the present study. First, gaming time could be of little importance for addiction. However, this violates the assumption that behavioural salience is central to

addiction (Charlton, 2002). A more likely explanation is the broad sample of respondents in the present study. Many studies have for instance focused solely on MMORPG-gamers, which probably result in greater average playing times, since MMORPGs are generally played for longer periods of time than other games (Ng & Wiemer-Hastings, 2005). A second possibility related to sampling, is that the low number of addicted gamers in the present study could have caused a bias in the results. Also, it is possible that the polythetic approach adopted in the present study could have led to an overestimation of addiction and thereby lowered the average gaming time, assuming that addicted gamers actually spend more time gaming than highly engaged gamers, which may not necessarily be the case. However, the conjecture is illustrated by the finding that the monothetic approach resulted in an average gaming time of more than 30 hours per week among addicted gamers.

Regarding game genres and game devices, it is noteworthy that non-addicted gamers seem to prefer to play games via a PC web browser, and that the greatest difference in game device usage between the two groups is constituted by PC-installed games. Whereas browser games are not typically associated with addiction, many of the game genres that are considered addictive are often installed and played on a PC. Another noteworthy finding is that addicted gamers play almost every game genre more often than non-addicted gamers. Considering the difference between the two groups in weekly playing time this result may initially seem unsurprising, but it is interesting that the addicted gamers' "surplus" of playing time is distributed relatively evenly across the game genres. The finding that only one game genre stood out as particularly popular among addicted gamers, might imply that addicted gamers in general do not focus on certain categories, but play them all equally. The exception is action games, one of the

game genres that seems to be preferred by gamers who show signs of problem gaming (Synovate, 2008). Considering the attention MMORPGs have received in the research field, and their status as particularly addictive, it is surprising that this game genre did not stand out. A few different explanations can possibly account for these findings. One explanation might be that MMORPGs by researchers perhaps have received too much attention and “blame” for video game addiction. Studies have often focused solely on these types of games, while other genres have been left out. The present findings imply that more research on other game genres could be beneficial.

The low number of addicted gamers in the present study could be another explanation for why MMORPGs did not stand out. A side effect of doing prevalence studies is that the number of respondents in the “clinical” group will be low, which affects the generalisation of the findings. In this instance it is therefore possible that MMORPGs in fact are among the most popular game genres with the population of addicted gamers, but that this is not reflected by the small sample.

A third possibility is that MMORPGs are less popular among Norwegian gamers than among gamers from other parts of the world. However, this is unlikely, considering the finding that MMORPGs, along with action and strategy games are the most popular among online gamers in Norway (Synovate, 2008).

Gender Differences

In line with previous research, the addicted gamer group in the present study consisted mainly of males. However, more than half of the respondents (56.6%) reported that they play video games at least every once in a while, and more than one-third of these gamers were female (37.6%). This percentage is somewhat larger than generally reported in other studies (e.g. Griffiths, et al., 2004; Salguero & Morán,

2002). The explanation for this might lie in the differences observed in gaming habits between the genders. Female gamers were found to spend significantly less time playing video games than did males. Of the eleven game categories provided in the survey, males played eight of them significantly more often than females. Two of the three remaining categories; family/party- and platform games resulted in no significant differences between genders, but puzzles were played significantly more often by females than by males. As the PC web browser generally was found to be a favourite game device among females, this result is not surprising. Puzzles are typically played through an internet browser, or on handheld devices like cell phones. However, it is interesting that females spent more time than males on this type of game. First, this probably explains why puzzles were the only category that addicted gamers did not play more often than non-addicted gamers. Secondly, because they are a somewhat different form of game in that they are generally short lasting, they are not typically the kind of game one would associate with video game addiction. This is also true for family/party games, and to a certain extent also for platform games. Although females also play other games, the finding that these games generally are preferred, while games such as MMORPGs, strategy-, and action games are among the least popular, might explain why so many studies report a predominance of male gamers. Methodological concerns in many of these studies, like samples being self-recruited through gamer web sites and a general focus on online games, likely cause researchers to miss out on the composition and diversity of the general gamer population.

The present study cannot explain why males and females in general have such different gaming habits, or why addicted gamers are predominantly male, as the data are

cross-sectional. However, the results indicate that further research on female gaming patterns could be beneficial in order to learn more about these issues.

Does the Present Study Support the Notion of a Video Game Addiction?

The adoption of the polythetic approach implies that there is a possibility that the prevalence reported in the present study may have been overestimated. As previously mentioned, a core criteria approach might provide a compromise between the monothetic and polythetic approaches. However, because the Game Addiction Scale has not yet been validated for such use, this approach was not adopted for the main analyses in this study. Nonetheless, whether a polythetic, monothetic or core criteria approach was used, some respondents always met the criteria for addiction. Furthermore, about one in five of the gamers classified as addicted believe that they have a problem with gaming, and approximately one in four think that they spend too much time on games.

Although the average gaming time among addicted gamers in the present study was found to be somewhat low, the strictest, monothetic approach resulted in an average gaming time of more than 30 hours per week. When these respondents in addition endorse every item on the addiction scale, it seems likely that they do experience some problems related to video game playing. Thus, provided that the Game Addiction Scale actually measures pathology rather than high engagement, it does seem possible that some individuals might be addicted to video games.

As previously mentioned, one's definition of addiction in general is central to whether or not one will accept excessive video gaming as addictive behaviour. An important aspect of addiction is that the behaviour is maintained despite severe negative consequences to the addicted person's life (Charlton & Danforth, 2004). This is in line with Orford's (2001) idea of excessive appetites, and findings from the present study

appear to fit well with this view. At least a few of the respondents seem to have formed an unhealthy attachment to video games, in that they spend very much time on gaming. Furthermore, because these individuals also endorse all of the Game Addiction Scale items, negative consequences are implied (Lemmens, et al., 2009).

With caution, it can thus be stated that the present study does seem to indicate that video game addiction might be a valid term, at the very least applicable to a few individuals. Whether a primary or a secondary disorder, excessive video game playing is quite a real problem for some individuals, and many seek clinical treatment (Synovate, 2008). Clinical experience with excessive gaming is thus increasing, and could perhaps offer valuable insights to the field of research.

Strengths and Limitations

Some strengths with the present study are that the sample was relatively large, randomly selected, and not limited to adolescents or certain gamer groups. Further, this is the first study in Norway to utilise an established measurement of video game addiction.

There are also some limitations with the study. First, the subsample of addicted gamers was small. This has implications for generalising the findings regarding addicted gamers to the population.

Second, the response rate was somewhat low, which may also have implications for generalising the results. However, studies have indicated that the implications of low response rates are minor (Curtin, Presser, & Singer, 2000; Keeter, Kennedy, Dimock, Best, & Craighill, 2006).

A third limitation concerns the polythetic approach adopted to identify addicted respondents, which might have resulted in a slight overestimation of addiction. On the

other hand, the alternative monothetic approach would presumably have resulted in an underestimation. Adopting a core criteria approach might have been an acceptable compromise, but the Game Addiction Scale has not yet been validated for such use.

Suggestions for Future Research

There is a need to establish how widespread the problem of video game addiction is, as well as to find out more about what characterizes addicted gamers. As more than one-third of all gamers are female, further investigation of female vs. male gaming patterns might help to find out why the gender distribution among addicted gamers is so large. Also, broadening the investigation of the games' addictive natures to include more game genres, could prove rewarding.

In order to learn more about addicted gamers, more population-wide studies need to be conducted. First, however, the measurements of video game addiction could benefit from being refined. Further effort should be made to develop some universally agreed-upon criteria. If the Game Addiction Scale is to be the basis for this work, some reconsideration of the scale might be beneficial. Missing from the scale, for instance, is an item measuring behavioural salience, and other items may benefit from being rephrased.

Furthermore, as research indicates that some criteria should hold greater weighting in classifying addiction, the concept of core and peripheral criteria should be further tested. Also, studies should aim to learn whether video game addiction should be considered a primary or secondary disorder. One way to do so may be to conduct more studies on brain activity and biochemistry in relation to video games, and thus help establish whether or not excessive video game playing has the biological foundation to be considered an addiction.

Although addiction to video games is not yet a clinical diagnosis, leaning on the increasing amounts of clinical experience might prove valuable for future research.

Summary and Conclusion

One of the aims of this paper was to describe the gaming habits of the typical Norwegian video game “addict”. In summary, it appears that addicted gamers are relatively young, and predominantly male. Surprisingly, action games alone seem to be a favourite among addicted gamers, while MMORPGs and strategy games are not. However, this finding can perhaps be attributed to the small subsample of addicted gamers in the present study. Furthermore, female gamers were found to have different gaming habits than males, and it is possible that this might be a reason why relatively few females are recruited to studies on gamers and game addiction.

A central issue in this paper was whether or not excessive video game playing should be considered an addiction. The main aim of this study was therefore to estimate the prevalence of video game addiction in a population of young Norwegian adults, and to investigate how video game addiction relates to measures of physical and mental health.

In the field, an increasing body of evidence suggests that video games may in fact be addictive. Research indicating that excessive video game playing appears to be maintained through the same pathways in the brain as chemical addictions (Koepp, et al., 1998; Thalemann, et al., 2007), as well as research on the inherent addictiveness of the games themselves (Charlton & Danforth, 2007; King & Delfabbro, 2009; Wan & Chiou, 2007), are among the many interesting findings. It has become apparent that certain games might be more compelling than others, with MMORPGs receiving most

of the attention (Allison, et al., 2006; Chappell, et al., 2006; Ng & Wiemer-Hastings, 2005).

The present study shows that addicted gamers are of equally good physical health as non-gamers, and spend the same amount of time on physical exercise. However, addicted gamers score lower than non-addicted gamers and non-gamers on measures of life satisfaction, and higher on measures of anxiety and depression. With regards to symptoms of insomnia, addicted gamers score higher than non-gamers. This indicates that addicted gamers in general experience a somewhat higher level of negative life influences compared to non-gamers and non-addicted gamers. However, there are no indications that addicted gamers require clinical treatment with regards to these issues, as the levels are all within a non-pathological range.

Furthermore, the present study shows that excessive game playing for some individuals appears to be maintained despite negative consequences to their lives, as measured by the Game Addiction Scale. For these individuals, excessive gaming is probably best considered pathological. However, these gamers make out a small minority of the gamer population. The present study indicates that 0.6% - 4% of Norwegian adults between the ages of 16 to 40 years might be classified as addicted to video games. Strengths and limitations with the polythetic, monothetic and core criteria approaches, makes it difficult to provide a precise prevalence estimate. A core criteria approach may prove an acceptable compromise in the future, if the Game Addiction Scale is validated for such use.

Regardless of the exact prevalence of gaming addiction, to most people gaming may simply be a hobby. However, the present study shows that video game addiction is indeed a fitting description of at least a few gamers.

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