Gaming addiction, definition and measurement: A large-scale empirical study

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A B S T R A C T

Although the general public appears to have embraced the term ‘videogame addiction’, the scientific debate as to whether ‘gaming addiction’ can actually be considered an addiction similar to substance addictions of DSM-IV is still unsettled. To date, research on gaming addiction has focused on problematic behavior from the gaming activity itself and there has been little empirical research related to pathological personality patterns that usually are associated with substance addictions. Therefore, the current study examined how game exposure and ‘problematic gaming behavior’ are related to pathological personality patterns associated with addiction by means of the Minnesota Multiphasic Personality Inventory-2 (MMPI-2). A large-scale survey study was performed among 1004 adolescent boys (age-range 11-18, M = 14.18, SD = 1.36) measuring problematic gaming behavior, physical game-related symptoms, gaming behavior and three MMPI-2 subscales measuring personality patterns usually associated with substance addiction (MAC-R, APS, AAS). Results showed that problematic gaming and physical symptoms were positively related to all MMPI-2 subscales, while game exposure was not related to the indirect measures of addictive personality patterns (i.e., MAC-R, APS). Thus, problematic gaming should be clearly distinguished from high game exposure. High game exposure merely indicates enthusiasm for some although it may be psychopathological for others.

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1. Introduction

In his recent book ‘Unplugged: My Journey into the Dark World of Video Game Addiction’, former videogame addict and university professor Ryan van Cleave describes how he almost lost everything as his life became consumed by online gaming. On the verge of committing suicide he attempted to break his deleterious habits, only to find himself with heavy withdrawal symptoms as a drug addict trying to wean off from drugs. The story of Van Cleave, who was born as Ryan G. Anderson but changed his name in tribute to his World of Warcraft arena team, is one of many that is frequently cited by the media.

While the mass media and the general public seem to have accepted terms like ‘videogame addict’ and ‘gaming addict’ referring to individuals who play videogames for a long time, the scientific world is still debating definitions and parameters of ‘gaming addiction’. One question is the extent to which gaming for hours a day can be considered a healthy enthusiasm, or whether it is indicative of an addictive mental disorder. The media may be right, but empirical evidence is still lacking. The present study aims to provide such empirical evidence. It examines whether so much gaming can be indicative of a psychiatric disorder similar to those described in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR, American Psychiatric Association [APA], 2000) or similar to the mental and behavioral disorders in the International Classification of Diseases (ICD-10, World Health Organization [WHO], 1994). The study examines how current practices in defining and measuring ‘gaming addiction’ relate to clinical personality assessment methods associated with substance dependence. Mental disorders and gaming addiction are discussed and tested in the framework of the Minnesota Multiphasic Personality Inventory-2 (MMPI-2).

Research shows that adolescent boys spend increasing amounts of time playing videogames (over 1 h a day on average and up to 13 h per week, Gentile, Lynch, Ruh Linder, & Walsh, 2004; Swing, Gentile, Anderson, & Walsh, 2010). Videogames appear to be especially attractive to boys (Durkin & Barber, 2002; Sublette & Mullan, 2007-5632/5 - see front matter © 2013 Elsevier Ltd. All rights reserved. http://dx.doi.org/10.1016/j.chb.2013.05.015

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further complicates the debate. Consequently, scholars in the field started using different terms, such as pathological gaming, videogame addiction, videogame dependence, and problematic game playing (Griffiths & Meredith, 2009; Lemmens, Valkenburg, & Peter, 2009), and often failed to explicitly define the term of choice (Seok & DaCosta, 2012), which further complicates the debate.

The debate highlights the importance of clearly distinguishing between the motivations of overly enthusiastic gaming and overly addictive gaming (Gentile, 2009; Griffiths & Meredith, 2009; Kuss & Griffiths, 2012; Lemmens, Valkenburg, & Peter, 2011b; Mullan, 2012). The topic that arguably generates the most debate involves whether addiction is a primary or secondary problem. For instance, Wood (2008b) recognizes that some gamers play a lot and consequently experience problems, but argues that the gaming behavior itself may not be the cause of the problems, rather a symptom of other pre-existing problems such as bullying or trouble with emotion regulation. This seems to be supported by the finding that lower self-esteem, lower social competence, and higher loneliness are risk factors for pathological gaming (Lemmens, Valkenburg, & Peter, 2011b). Griffiths (2008c) contests this view. He argues that for many alcoholics and drug addicts their behavior also is symptomatic of other underlying problems that existed prior to the addiction, which is known as secondary addiction in the addiction literature. Furthermore, Gentile et al. (2011) have provided some evidence that pathological gaming may also be a primary problem, leading to depression, anxiety, and social phobia instead of being a consequence thereof (similar findings for pathological internet use have been found; Lam & Peng, 2010). Despite this difference between primary and secondary addictions, the resulting behavior is nonetheless addiction (Griffiths, 2008c).

The discussion about gaming addiction is part of a wider debate on the comparison between traditional chemical addictions (such as those involving alcohol, nicotine, and other drugs) and behavioral addictions that do not involve the ingestion of a psychoactive substance (such as gambling, gaming, sex, and exercise). Currently, both the DSM-IV-TR (APA, 2000) and the ICD-10 (WHO, 1994) have enlisted substance dependence and substance abuse (or harmful use) under the category of substance use disorders. However, these terms are limited to addictions involving substances. Many academics argue that other (non-chemical) behaviors may also be addictive (Griffiths, 2005; Griffiths & Meredith, 2009; Shaffer et al., 2004), and these kinds of behavioral addictions have therefore often been referred to as non-chemical (behavioral) addictions.

The ongoing debate on defining addiction highlights the need for empirical evidence demonstrating whether playing video games a lot can be addictive in a similar way as substance addiction. Recent (fMRI) studies have shown that similar neural processes take place in both substance addicts and online gaming addicts, and the experiences of both groups appear very similar (Ko et al., 2009; Thalemann, Wölfling, & Grüsser, 2007). Moreover, increased activity was recorded in the brain of gaming addicts in areas that are usually associated with substance addictions. However, to provide a definitive answer to the question, scholars suggest that the behavioral ‘addicts’ need to be compared to known and established clinical criteria for substance addictions (Griffiths, 2005; Griffiths, 2010; Griffiths & Meredith, 2009). The current study adds to this by examining whether ‘gaming addicts’ display similar pathological personality structures to substance addicts.

The Minnesota Multiphasic Personality Inventory-2 (MMPI-2) is the most widely used clinical screening instrument for assessing psychopathology and maladaptive personalities (Rouse, Butcher, & Miller, 1999; Van der Heijden, Egger, & Derksen, 2008). The full MMPI-2 consists of 567 items, based on a so-called criterion keying method. This personality inventory is widely acknowledged and has the advantage over earlier personality inventories because it is less sensitive to socially desirable answering patterns and less dependent on face validity (Friedman, Lewak, Nichols, & Webb, 2001). From the MMPI-2 item pool, a number of subscales have been derived with limited numbers of items among which subscales that discriminate between substance abusers and non-abusers as well as between substance abusers and those suffering from other mental disorders. Three subscales specifically tap into personality patterns associated with substance abuse (Rouse et al., 1999).

The oldest subscale is the MacAndrew Alcoholism Scale-Revised (MAC-R, MacAndrew, 1965). Even though MacAndrew originally created the scale to detect alcoholism, there is substantial evidence that drug abusers and pathological gamblers are in the same range as alcoholics on the MAC-R. MAC-R is also referred to as a measure of addiction proneness or increased risk of substance abuse rather...
than a substance abuse detection scale (e.g., Friedman et al., 2001; Rouse et al., 1999). One of the strengths of the MAC-R is that items that clearly related to substance abuse were excluded. Due to this low face validity, the scale is virtually insensitive to the denial of substance abuse problems (Miller, Shields, Campfield, Wallace, & Weiss, 2007). Therefore, the MAC-R is appropriate for the present study as the scale offers a subtle and indirect measure of a personality pattern often associated with addiction, while being virtually resistant to denial.

A second MMPI-2 subscale used in the present study is the Addiction Potential Scale (APS, Weed, Butcher, McKenna, & Ben-Porath, 1992), which was designed to identify "personality characteristics and lifestyle patterns that are associated with alcohol and drug abuse" (Weed et al., 1992, pp. 390–391). In line with the development of the MAC-R, items that obviously referred to substance abuse were excluded from the APS (Friedman et al., 2001; Miller et al., 2007; Weed et al., 1992). The APS differs from the MAC-R in that the first assesses risk of substance abuse on the basis of general psychological distress, while the latter assesses that risk on the basis of antisocial and impulsive personality patterns (Rouse et al., 1999).

To complement the MAC-R and APS, the Addiction Acknowledgment Scale (AAS, Weed et al., 1992) was included. In contrast to the two scales described above, the AAS was specifically intended to tap into the willingness to admit substance abuse. Comparisons of the different substance abuse scales have quite consistently shown that the AAS outperforms both the MAC-R and the APS in discerning between substance abusers and non-abusers (Clements & Heintz, 2002; Rouse et al., 1999; Weed et al., 1992).

Thus, well-established measures to assess maladaptive personality patterns associated with substance abuse were related to measures of video game exposure and problematic gaming behavior to address the extent to which playing a lot of video games can be conceptualized as an addiction. We expected that problematic gaming was at least moderately related to these personality patterns. Furthermore, we expected that game exposure as such did not relate to these personality patterns. Finally, on the basis of the work by Charlton and Danforth (2007), we expected that game exposure and problematic gaming behavior would be related. Given the prevalence and popularity of playing videogames among adolescent boys, the current study was limited to adolescent boys as the most appropriate target sample for further investigation.

2. Method

2.1. Participants and design

A survey study among 1004 adolescent boys (age-range 11–18 years; M = 14.18, SD = 1.36; response rate 96.17%) was conducted, sampling 14 different secondary schools located in both rural and urban areas throughout the Netherlands. Educational ability levels (cf. IQ; Nije Bijvank, Konijn, & Bushman, 2012) varied and the large majority of participants had a Caucasian background. Most boys reported playing games (97.41%), while a minority (2.59%) indicated they never played videogames.

2.2. Procedure

The study has been approved by the Institutional Review Board and was conducted at secondary schools. Consent for study participation was retrieved from school authorities, teachers, and parents. Only one parent refused their child's participation. Upon entering a classroom, participants were asked to answer the questions privately. Anonymity and confidentiality of answers were ensured. Participants could withdraw from the study at any time. Completing the questionnaire took 20–30 min. Finally, participants were debriefed and thanked.

2.3. Measures

All measures, except game exposure, comprised multiple statements with dichotomous answering options to indicate to which extent each item fitted the participant ('yes’/’no'). In line with common practices in applying the MMPI-2, and for purposes of analysis, all ‘no’ answers were scored ‘0’ and all ‘yes’ answers were scored ‘1’. The MMPI-2 is a highly standardized personality inventory that is generally used by therapists for assessing psychopathology in clinical practice using such a scoring and scaling profile method (Rouse et al., 1999; Weed et al., 1992).

Problematic gaming behavior was measured by six of the items from Griffiths’ (2008b) checklist, that largely overlaps the six psychological components of addictions presented by Griffiths (2005). Items were simplified for the adolescent boys (e.g., “I often play 3–4 h on end when I play a game”). Summing item scores created a scale-score (range 0–6), with higher scores indicating higher levels of game-related behavioral problems.

Physical symptoms were measured by simplifying the seven physical symptoms presented by Griffiths (Griffiths, 2008b; Griffiths & Meredith, 2009). The word ‘game’ itself was not mentioned in any of these items (e.g., “I often have back aches”; “I regularly skip meals”). Summing scores formed a scale-variable (range 0–7). Almost half of the participants indicated not experiencing any of the physical complaints, resulting in a relatively low mean (M = 1.12, SD = 1.28).

The MacAndrew Alcoholism Scale-Revised (MAC-R, MacAndrew, 1965) was included as an indirect measure of addiction proneness, consisting of 49 items. Given our target group, two items were simplified (e.g., “I have had problems with the police or a judge”; “I sometimes get the feeling that I leave my body and can see myself”). After reverse-coding 11 items, scores were summed. Participants’ actual scores ranged from 8 to 34 (M = 19.88; SD = 4.11).

The Addiction Potential Scale (APS, Weed et al., 1992) was included in the study as a complementary scale to the MAC-R, as it assesses general risk for addiction via a different personality pathway (Rouse et al., 1999). The APS comprises 39 items (e.g., “Sometimes, my mind seems to work slower than usual”; “Most people are honest, mainly because they are scared to get caught”). After reverse-coding 16 items, scores were summed (range 10–30; M = 20.45; SD = 3.54).

The Addiction Acknowledgment Scale (AAS, Weed et al., 1992) was included as an obvious and face valid measure of the respondent’s willingness to admit addiction. Of the 13 items of the original scale, nine pertain specifically to drugs or alcohol, and thus the words alcohol and drugs were replaced by ‘gaming’ (e.g., “Only when I play a game, I can really be myself”; “After a bad day, I usually need to play a game to relax”). After reverse-coding three items, scores were summed (range 0–11; M = 4.39; SD = 2.18).

Game exposure was measured by asking participants how many hours per week they played videogames. Game exposure ranged from 0.5 h to 76 h a week (M = 10.56, SD = 10.31), which is in the same range as findings reported in other studies (Griffiths, 2008a; Willoughby, 2008).

Preferred gaming mode was measured by asking respondents whether they preferred to play games offline or online. Finally, several demographics questions were included (e.g., age, education).

3. Results

Problematic gaming status was established on the basis of Griffiths’ (2008b) guidelines that answering ‘yes’ to more than four items of the problematic gaming behavior scale indicated problematic gaming behavior (such cut-off scores are only available for
Griffiths’ scale and the MAC-R). In the current study, this resulted in 86 boys (8.57%) being classified as problematic gamers, with the remaining 918 boys (91.43%) being classified as non-problematic gamers. Regarding the MAC-R, MacAndrew suggested a cut-off score of 24 items answered with ‘yes’. That is, participants with a MAC-R score higher than 24 are more likely to have an addictive personality than others (Friedman et al., 2001). Based on this cut-off score, in the current study, 14.14% of the adolescent boys showed a MAC-R score indicating an addictive personality, while the remaining 85.86% of the total sample was not. Thus, the MAC-R score revealed a larger group of ‘gaming addicts’ than Griffiths’ problematic behavior scale.

Next, the relationships between the different scales were analyzed, following the guidelines provided by Cohen (1992): r’s between .10 and .30 were considered small effects, r’s between .30 and .50 were considered medium effects, and r’s larger than .50 were considered large effects. The correlation matrix (Table 1) showed that most correlations were positive and significant at the .01-level, the exceptions being related to game exposure and preferred gaming mode. Problematic gaming behavior was found to correlate strongly with the Addiction Acknowledgment Scale (AAS) and game exposure. Small correlations were found between problematic gaming behavior and preferred gaming mode, and the more indirect measures of addictive personality (MAC-R and APS). Small correlations were also found for physical symptoms and all three MMPI-2 subscales, while these symptoms were unrelated to game exposure and preferred gaming mode. Between the MMPI-2 subscales (MAC-R, APS and AAS), small to strong correlations were found. Finally, a moderate correlation was found between game exposure and the AAS, and small correlations were found between preferred gaming mode, the AAS, and game exposure.

Next, a multivariate analysis of variance (MANOVA) was performed to check whether problematic gamers (based on the cut-off score in Griffiths, 2000b) differed from non-problematic gamers in their scores on the MAC-R, APS, and AAS. Multivariate tests revealed a significant main effect, Wilk’s $\lambda = .87, F(3,1000) = 50.67, p < .001, \eta^2_g = .13$. Univariate F-tests (Table 2) showed that the boys who were classified as problematic gamers scored significantly higher on all three scales than non-problematic gamers.

Finally, a check was made as to whether these differences would remain when other variables were controlled for, including game exposure, preferred gaming mode, and age. Therefore, a multivariate analysis of covariance (MANCOVA) was performed to see whether problematic and non-problematic gamers differed while controlling for the above mentioned variables, which were entered as covariates$^1$. Multivariate tests showed significant effects for all three covariates on the dependents, while the multivariate effect for problematic gaming behavior remained intact as well (see Table 3).

Univariate F-tests further supported that the main effects of problematic gaming behavior on the MAC-R, APS, and AAS remained intact when game exposure, preferred gaming mode, and age were controlled for (see Table 4). Boys classified as problematic gamers were found to have significantly higher scores than the other boys on the MAC-R, APS, and AAS, even when controlling for their game exposure, preferred gaming mode, and age. With regard to the covariates, the univariate F-tests (Table 5) showed that game exposure and preferred gaming mode significantly affected MAC-R and AAS scores, but not APS scores. In contrast to this, age did not significantly affect AAS scores, but did significantly and positively affect APS and MAC-R scores.

4. Discussion

The primary aim of the current study was to examine whether playing video games a lot can be considered an addiction in terms of pathological behavior, or whether these are unrelated and playing a lot should just be considered high enthusiasm for playing games. Therefore, a large scale survey among adolescent boys was performed in which problematic gaming behavior and game exposure were related to three well-established MMPI-2 substance abuse subscales, namely the MacAndrew Alcoholism Scale-Revised, the Addiction Potential Scale, and the Addiction Acknowledgment Scale.

The study’s findings indicate that problematic (psychological) gaming behavior and physical symptoms were each positively related to the three substance abuse personality scales of the MMPI-2. This appears to indicate that problematic gaming and physical symptoms are associated with personality patterns also found in substance addicts. Furthermore, the relatively weak relationship between game exposure and physical symptoms, and the somewhat stronger relationship between these symptoms and problematic behavior from gaming, appear to suggest that physical complaints are not necessarily related to playing for many hours on end. Rather, the physical game-related symptoms appear to

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$^1$ Because the questions about preferred gaming mode and game exposure were not mandatory for participants who indicated that they were not gamers, the $N$ in the MANCOVA is lower than the $N$ reported in earlier analyses, resulting in slightly different degrees of freedom and means.
The current study’s findings suggest that gaming may indeed be addictive in a similar sense as alcohol and other drugs, thereby supporting Griffiths’ viewpoint that activities other than taking a substance may also be addictive (Griffiths, 2005). Furthermore, the current study adds to the existing commonalities and similarities between substance use disorders and activities such as pathological gambling (Grüsser, Thalemann, & Griffiths, 2007; Potenza, 2006) and pathological gaming (Ko et al., 2009; Kuss & Griffiths, 2012; Thalemann et al., 2007). As the number of similarities between chemical and non-chemical addictions expands, it becomes more likely that there is indeed one psychological process underlying various, if not all, addictions; chemical as well as non-chemical (Kuss & Griffiths, 2012; Wood, 2008a,b). Thus, videogaming is not inherently addictive but may be expressed as pathological gaming in personalities sensitive to addiction.

Our findings show that the percentage of gamers suffering from personality patterns related to addiction is 14.14% based on problematic MAC-R-levels and 8.57% based on problematic behavior from gaming. These percentages are in the same range as prevalence estimates for pathological gaming in related studies (Gentile, 2009; Gentile et al., 2011; Grüsser et al., 2007; Hussain & Griffiths, 2009; Lemmens et al., 2009) and other chemical and non-chemical addictions (Sussman, Lisha, & Griffiths, 2011).

However, the study’s survey design cannot establish causality. Most studies in this line of research have not established the direction of the relationships between game exposure and other variables. Recently, longitudinal studies provided initial evidence that pathological gaming leads to outcomes such as depression, anxiety, and social phobia (Gentile et al., 2011; like pathological internet use; Lam & Peng, 2010). However, more longitudinal studies are needed. Inclusion of the MMPI-2 addiction measures in future research may further provide valuable insights into addiction-related personality patterns and highly engaged gaming behavior.

Currently, the DSM-IV-TR (APA, 2000) and the ICD-10 (WHO, 1994) do not include criteria for pathological gaming or gaming addiction, nor does the proposed revised DSM-V (APA, n.d.). In the DSM-IV-TR, pathological gambling was clearly separated from chemical addictions, as it was initially categorized under ‘impulse control disorders’ while chemical addictions were categorized under ‘substance use disorders’. For the envisioned DSM-V, the APA has proposed to rename the category ‘substance use disorders’ to ‘substance use and addictive disorders’, thereby opening up the possibility to include both chemical as well as non-chemical addictions and move pathological gambling to this new category (APA, n.d.). In considering internet addiction (including online gaming) for inclusion in this new category, APA concluded in 2010 that present empirical evidence was not sufficient to warrant inclusion (APA, 2010). The findings presented in this paper as well as recent empirical studies (Gentile et al., 2011) warrant a reconsideration of including pathological gaming in the DSM-V.

Even though questions still remain about the nature of non-chemical (behavioral) addictions, the current study suggests that behavioral addictions may originate from psychological processes similar to substance addictions (Shaffer et al., 2004). It is valuable putting more effort into understanding this process instead of debating its existence. In sum, the present study showed that gaming addiction goes beyond mere high game exposure and some gamers may display personality patterns that are usually associated with substance addiction. Thus, while some game players can...
indeed be diagnosed as addicted in terms of pathological behavior, researchers need to be careful in whom are classified as addicted.

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