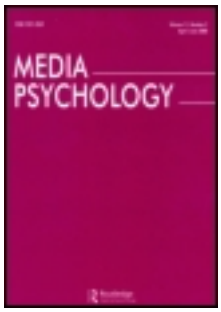

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Development and Validation of a Game Addiction Scale for Adolescents

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Development and Validation of a Game Addiction Scale for Adolescents

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*The aim of this study was to develop and validate a scale to measure computer and videogame addiction. Inspired by earlier theories and research on game addiction, we created 21 items to measure seven underlying criteria (i.e., salience, tolerance, mood modification, relapse, withdrawal, conflict, and problems). The dimensional structure of the scale was investigated in two independent samples of adolescent gamers (*N = *352 and* N = *369). In both samples, a second-order factor model described our data best. The 21-item scale, as well as a shortened 7-item version, showed high reliabilities. Furthermore, both versions showed good concurrent validity across samples, as indicated by the consistent correlations with usage, loneliness, life satisfaction, social competence, and aggression.*

Game addiction is currently one of the most discussed psychosocial aspects associated with playing computer and videogames. Recently, the American Medical Association (2007) strongly encouraged the American Psychiatric Association (APA) to consider the inclusion of "video game addiction" as a formal diagnostic disorder in the upcoming revision of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-V*, expected in 2012). Although the APA (2007) does not consider "video game addiction" a mental disorder at this time, such a diagnosis could be confirmed by 2012, if research warrants it. The main aim of the current study is to respond to the need

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for more research on this issue by developing a game addiction scale for adolescents based on criteria for pathological gambling found in the *DSM* (APA, 1980, 1994, 2000). We specifically focused on adolescents because (a) they generally play computer and videogames more frequently than adults (e.g., Griffiths, Davies, & Chappel, 2004) and (b) they are considered more vulnerable to game addiction than adults are (Griffiths & Wood, 2000).

There is considerable disagreement among researchers about the concept of "game addiction." Although the term addiction is not used by clinical psychologists, game addiction is the most prevalent term among researchers to describe excessive, obsessive, compulsive, and generally problematic use of videogames (e.g., Charlton & Danforth, 2007; Chiu, Lee, & Huang, 2004; Chou & Ting, 2003; Fisher, 1994; Griffiths & Davies, 2005; Grüsser, Thalemann, & Griffiths, 2007; Hauge & Gentile, 2003; Ko, Yen, Chen, Chen, & Yen, 2005; Ng & Wiemer-Hastings, 2005; Soper & Miller, 1983; Wan & Chiou, 2006). Other terms used to describe excessive or problematic gaming include "videogame dependence" (Griffiths & Hunt, 1995, 1998), "problematic game playing" (Salguero & Moran, 2002; Seay & Kraut, 2007), and "pathological gaming" (Johansson & Gotestam, 2004; Keepers, 1990). Irrespective of the terminology used, researchers generally agree that computer and videogame overuse can lead to a behavioral addiction (Griffiths, 2005). Addictive behavior refers to behavior that is excessive, compulsive, uncontrollable, and psychologically or physically destructive (Mendelson & Mello, 1986). In accordance with this behavioral definition, we define game addiction as excessive and compulsive use of computer or videogames that results in social and/or emotional problems; despite these problems, the gamer is unable to control this excessive use.

Many studies on game addiction have used the diagnostic criteria for pathological gambling found in various versions of the *DSM* (APA, 1980, 1994, 2000) to define and measure "pathological" game use.[1] By adapting six or seven of these pathological gambling criteria, researchers have developed different scales to measure game addiction (Charlton & Danforth, 2007; Chou & Ting, 2003; Fisher, 1994; Griffiths, 1997; Griffiths & Dancaster, 1995; Griffiths & Hunt 1995, 1998; Grüsser, Thalemann, Albrecht, & Thalemann, 2005; Hauge & Gentile, 2003; Phillips, Rolls, Rouse, & Griffiths, 1995; Salguero & Moran, 2002). Other studies, that were aimed specifically at addiction to *online* games, have often adapted Young's (1996) 8-item questionnaire for diagnosing Internet addiction (e.g., Chak & Leung, 2004; Ko et al., 2005; Rau, Peng, & Yang, 2006; Yee, 2006). Young's model for Internet addiction is also based on the clinical definitions of pathological gambling found in *DSM-IV* (APA, 1994). Several studies have adapted the ICD-10 (World Health Organization, 1993) diagnostic criteria for pathological gambling (e.g., Grüsser et al., 2007; Thalemann, Wolfing, & Grüsser, 2007), whereas others have devised their own set of criteria for game addiction (e.g., Chiu et al., 2004; Ng & Wiemer-Hastings, 2005; Wan & Chiou, 2006).

Despite the widespread adaptation of *DSM*'s pathological gambling criteria to measure addiction to (online) games, little research has been done on the validity of this method. It is generally assumed that the criteria are correlated and together measure the underlying construct of game addiction. A model in which a number of correlated dimensions are explained by one higher-order construct is called a second-order model (e.g., Byrne, 2001; Noar, 2003). However, none of the earlier studies have actually tested whether it is justified to assume that the adapted criteria can be accounted for by one single higher-order construct: game addiction. It is important to test whether game addiction is a second-order construct because such a construct can often provide a more parsimonious model than a multidimensional first-order construct (Chen, Sousa, & West, 2005). Moreover, if a second-order construct is a valid description of the data, it can possibly be measured with a smaller number of items (Noar, 2003). Using fewer items reduces response burden on respondents and allows researchers additional space to assess other important constructs in a survey.

To test whether the seven pathological gambling criteria indeed form the second-order construct game addiction, we created 21 items representing seven *DSM*-based criteria for game addiction that have been identified in earlier research (e.g., Griffiths, 2005; Griffiths & Davies, 2005). We developed three items for each of the following seven criteria:

1) *Salience:* Playing a game becomes the most important activity in a person's life and dominates his or her thinking (preoccupation), feelings (cravings), and behavior (excessive use).
2) *Tolerance:* The process whereby someone starts playing games more often, thereby gradually building up the amount of time spent on games.
3) *Mood modification:* The subjective experiences that people report as a result of engagement in games. This dimension was previously labeled euphoria (Griffiths, 1995, 1997), referring to a "buzz" or "high" that is derived from an activity. However, mood modification may also include tranquillizing and/or relaxing feelings related to escapism.
4) *Withdrawal:* Unpleasant emotions and/or physical effects that occur when game play is suddenly reduced or discontinued. Withdrawal consists mostly of moodiness and irritability, but may also include physiological symptoms, such as shaking.
5) *Relapse:* The tendency to repeatedly revert to earlier patterns of game play. Excessive playing patterns are quickly restored after periods of abstinence or control.
6) *Conflict:* This refers to all interpersonal conflicts resulting from excessive gaming. Conflicts exist between the player and those around him/her. Conflicts may include arguments and neglect, but also lies and deception.
7) *Problems*: This refers to problems caused by excessive game play. It mainly concerns displacement problems as the object of addiction takes

preference over activities, such as school, work, and socializing. Problems may also arise within the individual, such as intrapsychic conflict and subjective feelings of loss of control.

DETERMINING THE VALIDITY OF THE GAME ADDICTION SCALE

The second aim of this study concerns the validity of our game addiction scale. We focused on two types of validity: population cross-validity and concurrent validity. Population cross-validity is often assessed by investigating whether the results found in one sample of a population can also be found in another sample drawn from the same population (e.g., Raju, Bilgic, Edwards, & Fleer, 1997). Population cross-validation was investigated by administering our questionnaire to two independent samples of adolescent gamers and assessing whether the hypothesized dimensional structure of the game addiction scale holds for both samples. Concurrent validity is measured by investigating the relation of the construct to measures of similar constructs or by correlating scores on the game addiction scale with variables that have empirically established relationships with game addiction. We assessed concurrent validity by comparing scores on the game addiction scale to time spent on games (i.e., usage), life satisfaction, loneliness, social competence, and aggression. If the game addiction scale is related to these concepts in the expected direction, this would validate its practical use as a construct.

MEASURES OF CONCURRENT VALIDITY

Time Spent on Games

Time spent on games has been used in previous research as an indicator of problematic gaming (e.g., Roe & Muijs, 1998). Although the time spent on games should not be used as a basis for classifying individuals as addicted, addicted players are expected to spend more time on games than those who are not addicted. Therefore, a strong correlation between time spent on games and the game addiction scale was considered as evidence of concurrent validity.

Life Satisfaction

Heavy gamers generally show decreased psychological well being (Healy, 1990) and lower satisfaction with daily life (Shapira et al., 2003). Similarly, more severe addiction to online games among males is associated with lower

satisfaction with daily life (Ko et al., 2005). People who are less satisfied with their daily life are more likely to escape this reality through excessive use of games. Therefore, we expect to find a negative relation between life satisfaction and game addiction.

Loneliness

People classified as pathological Internet users have been found to be more lonely than people exhibiting no symptoms or limited symptoms (Kubey, Lavin, & Barrows, 2001; Morahan-Martin & Schumacher, 2000; Nichols & Nicky, 2004). Likewise, loneliness has been found to be one of the strongest predictors of game addiction among online gamers (Parsons, 2005; Seay & Kraut, 2007). As a result, we expect that game addiction and loneliness are positively related.

Social Competence

This measure concerns the relative tendency or disposition to be sociable or associate with one's peers. Several studies have indicated that the higher the tendency of being addicted to the Internet, the less sociable a person is (Caplan, 2002; Loytsker & Aiello, 1997; Whang, Lee, & Chang, 2003). Similarly, studies on the relationship between social competence and excessive game play indicate that heavy use of computer games is negatively associated with sociability (Lo, Wang, & Fang, 2005; Roe & Muijs, 1998). Thus, we expect social competence to be negatively related to game addiction.

Aggression

The relationship between playing violent games and aggressive feelings and emotions has been well established (for reviews, see Anderson & Bushman, 2001; Sherry, 2001). Previous studies have also shown that a large majority of popular videogames contain various degrees of graphic violence (Dietz, 1998; Smith, Lachlan, & Tamborini, 2003). By combining these findings, heavy users in general are expected to show more signs of aggression. A direct relation between game addiction and aggression has been found by Hauge and Gentile (2003). Addicted adolescents had higher hostile attribution scores, were significantly more likely to report having been in a physical fight in the last year, and had more arguments with friends and teachers. Recent studies (Grüsser et al., 2007; Kim, Namkoong, Ku, & Kim, 2008) also reported a significant difference in reported aggressive behavior between pathological and non-pathological players. Therefore, we expect a positive relationship between game addiction and aggression.

METHOD

Sample

We conducted two surveys among two independent samples of Dutch adolescents. In May 2007, we conducted a survey among 644 adolescents from six schools of secondary education in the Netherlands (52% girls). The age of respondents varied between 12 and 18 years with a mean age of 14.8 ($SD = 1.64$). In May 2008, we conducted the same survey among 573 different adolescents from five different schools of secondary education in the Netherlands (51% girls). The age of respondents varied between 12 and 18 years with a mean age of 15.2 ($SD = 1.35$).

Procedure

A paper-and-pencil survey was distributed during school hours after receiving passive consent from the parents. Passive consent requires parents to sign and return a form if they refuse to allow their child to participate. To improve the privacy of the responses, respondents were assured that their answers would remain anonymous, analyzed only by us, and not shown to their teachers or parents. Most respondents completed the survey within 20 minutes. If respondents had not played videogames in the last month, they were exempt from filling in the game addiction scale. In the first sample, almost 55% ($N = 352$) of the respondents (33% girls and 67% boys) played games. In the second sample, almost 65% ($N = 369$) played games (32% girls and 68% boys). Responses to the game addiction items were screened for missing data and distribution. Four cases were excluded due to extreme abnormalities in their responses, which clearly suggested that the questionnaire had not been filled in sincerely. Respondents with more than two missing values were also eliminated from further analysis. For respondents with one missing value ($N = 14$), we replaced the missing value by that respondent's mean score on the 21-item game addiction scale. In total, 721 respondents (352 from the first sample and 369 from the second sample) were included in the scale analyses.

Measures

Game addiction. The game addiction scale consisted of 21 items (Appendix). Three items were created for each of the previously identified criteria: salience, tolerance, mood modification, relapse, withdrawal, conflict, and problems. The items were randomly distributed over the scale. According to Young (1998), addiction is present when a person meets the specified criteria during a period of six months. In accordance with this semiannual

criterion, every item in our scale was preceded by the statement: "How often during the last six months . . .?" Players rated all game addiction items on a 5-point continuum scale: 1 *(never)*, 2 *(rarely)*, 3 *(sometimes)*, 4 *(often)*, 5 *(very often)*. According to Comrey (1988), such a 5-point rating scale offers sufficient distribution of responses.

Time spent on games. The weekly time spent on general use of computer and videogames, and the time spent on specific platforms (i.e., PCs, consoles, handheld gaming devices) was measured by multiplying the days per week by the number of hours per day spent on these activities.

Loneliness. Loneliness was measured by selecting five items with the highest item-total correlations from the 20-item UCLA loneliness scale (Russell, 1996). Sample items are: "I feel alone" and "I feel like there is no one I can turn to." Response categories ranged from 1 *(totally disagree)* to 5 *(totally agree)*. The items were averaged to create the scale scores. This five-item scale had a Cronbach's alpha of .90 ($M = 1.60$, $SD = .74$) in the first sample and .88 ($M = 1.85$, $SD = .78$) in the second sample.

Life satisfaction. Respondents' degree of life satisfaction was measured using the 5-item Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985). Examples of items are "I am satisfied with my life" and "In most ways my life is close to my ideal." Response categories ranged from 1 *(totally disagree)* to 5 *(totally agree)*. The items were averaged to create the scale scores. Cronbach's alpha for this scale was .88 ($M = 3.61$, $SD = .83$) in the first sample and .87 ($M = 3.57$, $SD = .80$) in the second.

Social competence. The items of this scale were based on earlier instruments measuring social skills, interpersonal competence, or communicative efficacy among adolescents (e.g., Buhrmester, Furman, Wittenberg, & Reis, 1988; Inderbitzen & Foster, 1992). The eight items in our scale measured four social competence dimensions: initiation of relationships/interactions, supportiveness, assertiveness, and ability to self-disclose. Sample items include: "I can start a conversation with a stranger" and "I can stand up for myself when being treated unfair." Response options ranged from 1 *(I find this very hard)* to 5 *(I find this very easy)*. The items were averaged to create the scale scores. Cronbach's alpha for this scale was .84 in the first sample ($M = 3.62$, $SD = .66$) and .82 ($M = 3.64$, $SD = .62$) in the second sample.

Aggression. Respondents' degree of aggressiveness was measured using the nine-item Physical Aggression Subscale from Buss and Perry's (1992) Aggression Questionnaire. Examples of items are: "I have threatened people I know" and "Once in a while I can't control the urge to strike another person." Response categories ranged from 1 *(totally disagree)* to 5 *(totally agree)*. The items were averaged to create the scale scores. Cronbach's alpha for this scale was .90 ($M = 1.81$, $SD = .85$) in the first sample and .89 ($M = 1.98$, $SD = .83$) in the second sample.

RESULTS

Descriptive Results

Out of the 644 respondents in the first sample, almost 55% ($N = 352$) indicated that they had played computer or videogames during the last month. Out of 573 respondents in the second sample, 65% ($N = 369$) reported that they had played games in the last month. In both samples, boys were more likely to play games than girls. Out of 308 boys in the first sample, 78% ($N = 241$) played games, compared to 33% ($N = 111$) of the 336 girls χ^2 (1, $N = 644$) = 132.54, $p < .001$. In the second sample, out of 289 boys, 88% ($N = 253$) played games, compared to 41% ($N = 116$) of the 284 girls χ^2 (1, $N = 573$) = 136.24, $p < .001$. In general, male players also spent more time on games than female players. Male gamers spent an average of 10.5 hours ($SD = 9.9$) per week on games, whereas female gamers spent an average of 4.3 hours ($SD = 4.8$) per week on games, $t(719) = 6.05$, $p < .001$. Time spent on games ranged from 10 minutes to 63 hours per week.

The Dimensional Structure of the Game Addiction Scale

Our first aim was to investigate whether the seven criteria of game addiction (i.e., salience, tolerance, mood modification, relapse, withdrawal, conflict, and problems) can be accounted for by one higher-order factor; game addiction. We used structural equation modeling (AMOS 7.0) to test such a second-order factor model. Our model assumes that the correlations among the seven criteria of game addiction can be entirely explained by one higher-order factor game addiction. More specifically, our model predicts that (a) adolescents' responses to the 21-item game addiction scale can be explained by seven first-order factors (i.e., salience, tolerance, mood modification, etc.); (b) each observed item has a non-zero loading on the first-order factor it was designed to measure, and zero loadings on the six other first-order factors; (c) error terms associated with each observed item are uncorrelated; and (d) correlations among the seven first-order factors can be explained fully by their loading on the second-order factor (for a more detailed discussion, see Byrne, 2001).

Figure 1 depicts the dimensional structure of our hypothesized second-order factor model. The ovals in Figure 1 represent latent constructs, the rectangles represent the manifest or observed items. We used two fit indices to evaluate the fit of our model: the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA). Particularly when dealing with large samples, these indices are considered informative fit criteria in SEM. An acceptable fit is expressed by a CFI greater than .90 and a RMSEA value less than .08. A good fit is expressed in a CFI value higher than .95 and a RMSEA value close to .06 (Byrne, 2001; Hu & Bentler, 1999).

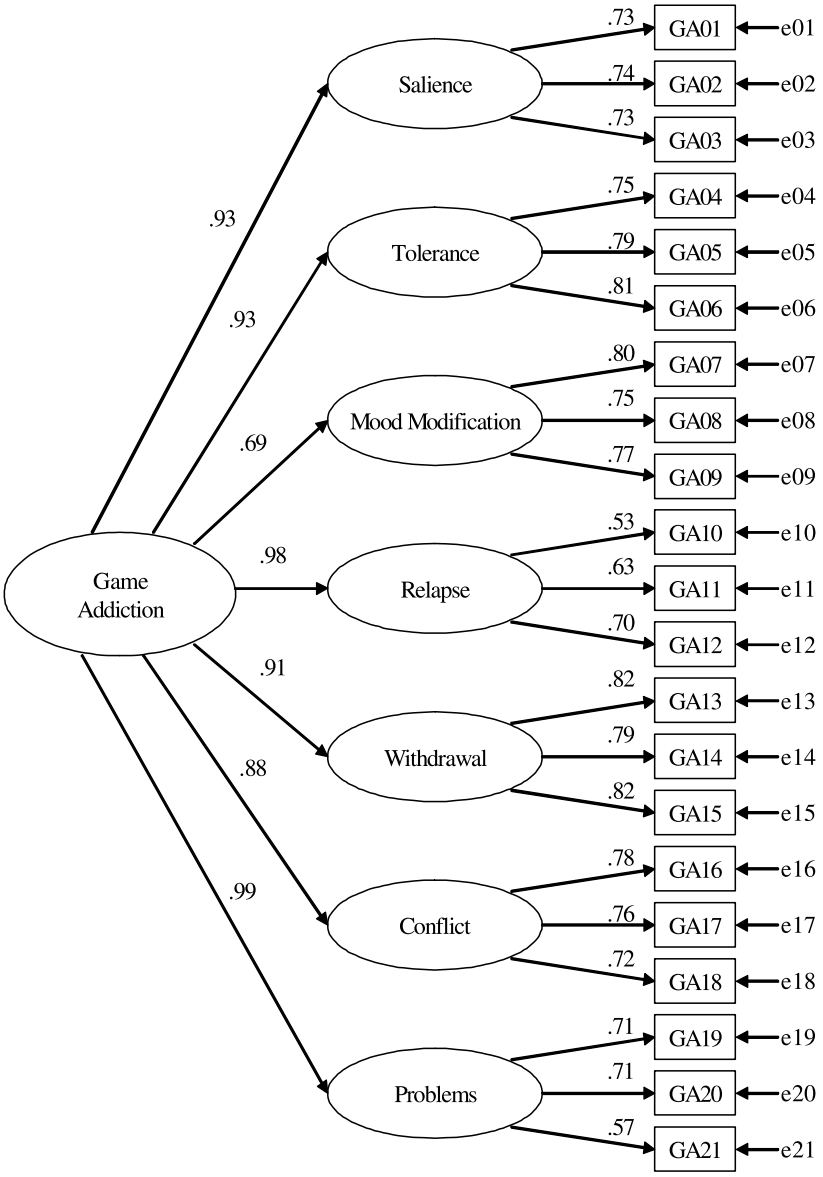

FIGURE 1 Second-order factor structure of the 21-item Game Addiction Scale (N = 351). *Note.* Factor loadings are standardized scores.

Out of convention, we also report the chi-square value and the χ^2/df ratio (Wheaton, Muthén, Alwin, & Summers, 1977).

The 21-item second-order factor model resulted in an acceptable model fit in the first sample, $\chi^2(182, N = 352) = 594.2$, $p < .001$, CFI = .903, RMSEA = .080 (90% confidence interval (CI): .073, .087, χ^2/df ratio = 3.26. Figure 1 shows that all loadings of the observed items on the seven first-order

factors (the measurement loadings) and those of the first-order factors on the second-order factor game addiction (the structural loadings) were above .50. To investigate whether our model also held for the second sample, we performed a multiple-sample analysis. The unconstrained model for both samples yielded an acceptable model fit, χ^2 (364, $N = 721$) = 1083.29, $p <$ .001, CFI = .904, RMSEA = .053 (90% CI: .049; .056), χ^2/df ratio = 2.98. Although some measurement and structural loadings differed between the two samples, these differences were consistently small. Overall, the structure of the second-order factor model showed an adequate fit and was very similar in both samples. The 21-item game addiction scale had a Cronbach's alpha of .94 in the first sample ($M = 1.59$, $SD = .62$) and .92 in the second sample ($M = 1.64$, $SD = .57$).

A 7-Item Game Addiction Scale

When a second-order construct is a valid description of the data, it can possibly be measured with fewer items (Noar, 2003). Therefore, an additional aim of this study was to investigate whether a 7-item second-order model would provide an equal or even better description of the data. Since measurement loadings slightly differed between samples, we merged the two samples in order to select the items with the highest overall measurement loadings from each of the seven first-order factors. These combined measurement loadings and the specific items selected for the 7-item scale can be found in the Appendix.

Finally, we tested a second-order structural model similar to the one depicted in Figure 1, but with only one item to measure each of the seven criteria. The unconstrained model for both samples yielded a good model fit, χ^2 (28, $N = 721$) = 69.9, $p \leq .001$, CFI = .974, RMSEA = .046 (90% CI: .032; .059), χ^2/df ratio = 2.5. Constraining both the measurement and structural loadings to be equal across the two samples did not lead to a significant chi-square change, $\Delta\chi^2$ (14, $N = 721$) = 13.53, *ns*, indicating that the loadings were not significantly different across the two samples. The 7-item game addiction scale had a Cronbach's alpha of .86 in the first sample ($M = 1.52$, $SD = .64$) and .81 in the second sample ($M = 1.54$, $SD = .61$).

Construct Validity of the Game Addiction Scale

Our second aim was to investigate the concurrent validity of the two versions of the game addiction scale. To examine the concurrent validity, we correlated respondents' mean scores on both versions of the game addiction scale with time spent on games, loneliness, life satisfaction, aggression, and social competence. As Table 1 shows, both the 21- and the 7-item versions of the scale showed strong correlations with time spent on games, and significant moderate correlations with the psychosocial variables in the

TABLE 1 Correlations Between the Game Addiction Scales and Concepts Meant to Establish Their Concurrent Validity

	Sample 1 ($N = 352$)		Sample 2 ($N = 369$)	
	21-item scale	7-item scale	21-item scale	7-item scale
Time spent on games	.583**	.576**	.550**	.549**
Loneliness	.337**	.314**	.192**	.174**
Life satisfaction	−.308**	−.290**	−.161**	−.136**
Social competence	−.194**	−.176**	−.184**	−.158*
Aggression	.257**	.265**	.205**	.188**

*$p = < .01$; **$p = < .001$.

expected directions; the correlations were highly comparable across both samples. In addition, the correlations of the 7-item version did not significantly differ from those of the 21-item version, indicating that the 7-item version of the game addiction scale was just as valid as the longer version.

Finally, to differentiate between excessive usage and game addiction, we examined the correlations between time spent on games and the psychosocial variables. Both samples showed a correlation between time spent on games and aggression ($r = .179$, $p < .001$ in the first sample; $r = .113$, $p < .05$ in the second sample). In addition, a positive correlation between time spent on games and loneliness emerged in the first sample ($r = .133$, $p < .05$), but not in the second sample. Since time spent on games did not show a significant correlation with the other variables used to assess concurrent validity (i.e., life satisfaction and social competence), usage was not considered a valid indicator of pathological behavior, as it only minimally correlates with the psychosocial variables.

Determining Addiction

Both versions of our game addiction scale showed good reliability and validity across samples. A final aim of this study, therefore, was to use our 7-item scale to assess the prevalence of addiction among adolescent Dutch gamers. Based on arguments put forth by Charlton and Danforth (2007), we adapted both monothetic and polythetic formats to determine whether someone is addicted to games. In a monothetic format, all criteria for game addiction must be endorsed in order to be identified as a game addict. The monothetic format differs from the polythetic format applied by the *DSM* for diagnosing pathological gambling. In the polythetic format, endorsement of at least half of the criteria is required for a positive diagnosis.

In the current study, an item was considered met when a person answered 3 *(sometimes)* on a 5-point continuum scale, ranging from 1 *(never)* to 5 *(very often)*, over the last six months. Using this cut-off point, the polythetic

format resulted in 9.4% of the gamers who met at least four of the seven items in the first sample. In the second sample, this method indicated that 9.3% of the gamers met at least four of the seven items. When using *often* or *very often* as a cut-off point, 1.4% in the first sample and 1.6% in the second sample could be considered addicted. Applying the monothetic format to the 7-item scale resulted in 2.3% addicted players in the first sample, and 1.9% addicted players in the second sample (i.e., players who had at least sometimes experienced all of the seven criteria).

DISCUSSION

The main aim of this study was to provide a reliable and valid scale to measure game addiction. Based on a review of about 30 studies on this subject, we opted for the most widely used term and method to measure game addiction: the diagnostic criteria for pathological gambling reported in the *DSM-IV*. Earlier studies that applied *DSM*-based game addiction scales have generally assumed that game addiction consists of a number of criteria, which can all be explained by the higher-order construct game addiction. Although such a second-order structure has often been implicitly assumed in earlier research, it has never been explicitly tested. Therefore, our first aim was to investigate the validity of this presupposed second-order factor structure. We developed a 21-item game addiction scale based on seven *DSM* criteria for pathological gambling (i.e., salience, tolerance, mood modification, withdrawal, relapse, conflict, and problems). Each criterion was measured with three items. Confirmatory factor analysis provided evidence of the validity of the presumed second-order structure. In contrast, a one-factor model, where all 21 items load directly on the latent construct game addiction, did not provide an adequate model fit.

To investigate whether our scale provided a valid measurement of game addiction, we first assessed population cross-validity. For this purpose, we administered our survey to a second independent sample of adolescent Dutch gamers. Our results showed that the scale was highly reliable across the two samples, and the second sample also confirmed the validity of the presumed second-order structure. We additionally investigated the reliability and validity of a shortened 7-item version of our game addiction scale. Confirmatory factor analysis of this 7-item second-order model showed good structural fit and consistent results across samples.

The second aim of our study was to investigate the construct validity of our scales. In both samples, the 21- and 7-item versions of the game addiction scale showed a strong correlation with time spent on games. However, time spent on games should not be used as a basis for measuring pathological behavior, as it is not consistently correlated to the psychosocial concurrent validity measures. Concurrent validity of the game addiction scales was

satisfactory as indicated by correlations between the game addiction scales and measures that have previously shown to be related to game addiction. In both samples, life satisfaction, loneliness, social competence, and aggression all showed significant correlations in the expected directions with both 21-item and 7-item versions of the game addiction scale.

Prevalence of Game Addiction

Our data indicated that the percentage of addicted adolescent Dutch gamers is approximately 2%, but it could be as high as 9%, depending on the method of determining when someone is addicted. The polythetic format requires addicts to endorse half (or more) of the proposed criteria, whereas the monothetic format requires endorsement of all of the criteria. Although the *DSM* applies a polythetic format on their criteria for diagnosing pathological gamblers, there are two arguments why the monothetic approach would lead to a better estimate of addicted gamers. First, the polythetic format is likely to lead to over-estimation of the frequency of addicted gamers. Using the polythetic format, researchers have reported a remarkably high number of addicted players; 16% (Griffiths 1997), 20% (Griffiths & Hunt, 1998), and 39% (Charlton & Danforth, 2007). When Charlton and Danforth (2007) applied a monothetic format to their sample, they found that 1.8% of their respondents could be categorized as addicted, which is proportionate to the estimated percentage of pathological gamblers (Walker & Dickerson, 1996). Second, several researchers have stated that the occurrence of negative life consequences is a crucial element in distinguishing addiction from habits (e.g., LaRose, Lin, & Eastin, 2003; Orford, 1985). By their definition, the criteria conflict, withdrawal, and problems indicate negative life consequences and pathological tendencies (Seay & Kraut, 2007). Because the monothetic format requires that all criteria of game addiction are met, this format automatically incorporates the endorsement of the criteria for negative life consequences, thereby allowing a more accurate distinction between habitual behavior and addiction.

Whichever method is applied to determine the number of addicts, these self-reported outcomes should currently only be used to provide an indication of the prevalence of game addiction. Before the scale can be used as a diagnostic tool, clinical psychologists should decide whether game addiction can be considered a legitimate pathology. This is not only relevant with regards to the possible inclusion of this disorder in the *DSM-V*, but also for physicians, care workers, parents, and gamers confronted with adverse consequences of excessive gaming. For the vast majority of adolescent players, their game addiction scores merely reflect enthusiasm for videogames or a relatively harmless displacement from other activities (see mean scores in the Appendix). However, for a small minority of adolescent gamers, their scores are indicative of more serious problems arising from compulsive use. Not only does this small group meet all of the criteria adapted from the *DSM*,

they also experience increased social and emotional problems as indicated by the relationship between game addiction scores and psychosocial variables (i.e., increased loneliness, decreased life satisfaction, decreased social competence, and increased aggression).

Limitations and Suggestions for Future Research

The focus of our study was on addiction to games. Although some studies on Internet addiction have included excessive use of online games (e.g., Pratarelli, Browne, & Johnson, 1999; Young, 1996), we believe that Internet addiction and game addiction are distinct, albeit related, concepts. A game addict who excessively engages in online games is not addicted to the Internet. The Internet is merely the place where the game addiction manifests itself (Griffiths & Davies, 2005). Furthermore, unlike usage of the Internet, videogames are used solely for recreational purposes. Excessive use of the Internet might still positively contribute to work or study, whereas the same pattern of excessive (online) videogame use is likely to affect work or study negatively. It is important that future research distinguishes between different types of Internet-related addictions, as the Internet is only one of several locations where an addiction can manifest itself.

Our scale is designed to measure game addiction among adolescents. An adequate scale should take the developmental level of the respondents into account. Therefore, our items specifically tap the developmental level of adolescents. For example, some items refer to adolescents' homework or parents. However, adolescents are certainly not the only players who can get addicted to games. Therefore, future research could examine whether some of our items can be adjusted to fit the experiences of other age groups, such as young children or adults, by paying special attention to the developmental level of the target group.

The correlations between the game addiction scales and psychosocial variables, such as loneliness, life satisfaction, social competence, and aggression do not allow us to specify any causal relation. In general, the causal direction between game addiction and psychosocial variables has not been decisively established in previous research. For instance, the findings of Mitchell and Wells (2007) suggest that game addiction cannot be considered merely a consequence of an existing condition or problem. Rather, game addiction presents a genuine (primary) problem in itself, which may elicit other negative consequences. In contrast, a study by Seay and Kraut (2007) suggests that low psychological well-being can result in game addiction, and not vice versa. There is, thus, a vital need for future research to disentangle the causal relation between game addiction and psychosocial variables.

In conclusion, as games and other interactive media have become an indispensable part of adolescents' daily life, it is crucial to understand and distinguish the ways in which excessive use is related to their development. This study has shown that both the 21- and the 7-item versions of our

game addiction scale provide a solid theory-based instrument to empirically measure game addiction among adolescents. Although our findings pertain only to Dutch adolescents, we hope that our scale will contribute to the general measurement of game addiction and provide a better understanding of associated psychosocial characteristics.

NOTE

1. A scale based on *DSM* criteria for "pathological gambling" might have been better labelled a "pathological gaming scale." However, as the *DSM* has not yet accepted pathological gaming as a disorder, labeling self-reported behavior as an unrecognized pathology seems presumptuous. Therefore, we decided to use the most prevalent term among researchers: game addiction.

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APPENDIX

Measurement Loadings of the 21 Game Addiction Items in the Combined Sample (N = 721)

	How often during the last six months . . .	Loading	Mean	*SD*
	Salience			
GA01	Did you think about playing a game all day long?*	.71	1.55	.88
GA02	Did you spend much free time on games?	.70	2.46	1.16
GA03	Have you felt addicted to a game?	.70	1.59	.95
	Tolerance			
GA04	Did you play longer than intended?	.70	2.40	1.18
GA05	Did you spend increasing amounts of time on games?*	.79	1.64	.95
GA06	Were you unable to stop once you started playing?	.72	2.16	1.16
	Mood Modification			
GA07	Did you play games to forget about real life?*	.76	1.52	.86
GA08	Have you played games to release stress?	.70	1.51	.89
GA09	Have you played games to feel better?	.76	1.44	.85
	Relapse			
GA10	Were you unable to reduce your game time?	.56	1.51	.94
GA11	Have others unsuccessfully tried to reduce your game use?*	.61	1.66	1.07
GA12	Have you failed when trying to reduce game time?	.56	1.70	1.00
	Withdrawal			
GA13	Have you felt bad when you were unable to play?*	.85	1.32	.72
GA14	Have you become angry when unable to play?	.82	1.38	.77
GA15	Have you become stressed when unable to play?	.80	1.43	.78
	Conflict			
GA16	Did you have fights with others (e.g., family, friends) over your time spent on games?*	.74	1.29	.65
GA17	Have you neglected others (e.g., family, friends) because you were playing games?	.70	1.23	.61
GA18	Have you lied about time spent on games?	.68	1.43	.81
	Problems			
GA19	Has your time on games caused sleep deprivation?	.67	1.50	.91
GA20	Have you neglected other important activities (e.g., school, work, sports) to play games?*	.68	1.69	.97
GA21	Did you feel bad after playing for a long time?	.48	1.32	.69

Note. Response options were: (1) *never*, (2) *rarely*, (3) *sometimes*, (4) *often*, (5) *very often*.
*Included in the 7-item Game Addiction Scale.