

Implicit and explicit cognitions in problematic online game use.

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1. Introduction

Videogames have become one of the most popular and pervasive forms of entertainment. The popularity of video games is accompanied by social concerns regarding excessive video game use, sometimes hyperbolically called “video game addiction” (Lee, Doohwang and LaRose, Robert, 2007). Excessive computer game playing (ECGP) and excessive internet or computer use have been increasingly studied as possible addictions (Hsu et al., 2009; Hussain & Griffiths, 2009). Computer gaming and massively multiplayer online role playing games (MMORPG’s) in particular have developed a reputation for being pathologically overused by some players (Hsu, Wen, & Wu, 2009). Playing massively multiplayer online games (MMOGs) has been linked to many negative life outcomes (Brian & Wiemer-Hastings, 2005; Chuang, 2006; Cole & Griffiths, 2007; Griffiths, Davies, & Chappell, 2003).

Until today The American Psychological Association (APA) did not classify “game addiction” as a psychological disorder in their most recent edition of the Diagnostic Statistical Manual of Mental Disorders fourth edition (American Psychiatric Association, 2000) (DSM-IV). A growing number of researchers consider problematic game use (PGU) to be a behavioral addiction similar to pathological gambling. They apply the symptoms of pathological gambling derived from the Diagnostic and Statistical Manual of Mental Disorders fourth edition (American Psychiatric Association, 2000) (DSM-IV) (Gentile et al., 2011; Lemmens, Valkenburg, & Peter, 2011).

Problematic online game use

Haagsma, Pieterse, & Peters (2012) proposed the term Problematic online game use (POGU) to describe the problems related to online game use, which are significant among adolescents and young adults in particular (Haagsma, Pieterse, & Peters, 2012). POGU consists of psychosocial constructs and cognitive determinants.

Preference for online social interaction

Preference for online social interaction (POSI) is a psycho-social construct of POGU. Preference for online social interaction is a cognitive individual difference characterized by beliefs that one is safer, more confident and more comfortable with online interactions and relationships in contrast with traditional face-to-face interactions. (Haagsma, 2012) Literature on excessive gaming suggests that in particular online games that have a strong social component are related to negative outcomes. (Ng & Wiemer-Hastings, 2005)

Online games involving social interaction and the reported cases of problematic game behavior increased since the introduction of this social aspect in video games. (Griffiths & Davies, 2005)

Mood regulation

Mood regulation is a psycho-social construct of POGU and suggested as an important behavioral factor in problematic online game use. Lee and LaRose (2007) found that playing games to alleviate boredom or loneliness contributes to spending more time on gaming and contribute to the negative outcomes related to this behavior.

Deficient Self Regulation

LaRose et al. (2003) defines the cognitive determinant deficient self-regulation (DSR) as a state in which conscious self-control is relatively diminished. Caplan (2010) distinguish cognitive and behavioral aspects of deficient self-regulation. Cognitive aspects include a preoccupation, obsessive or uncontrollable thinking. The behavioral manifestation of deficient self-regulation includes compulsive use. Lee & LaRose (2007) found that deficient self-regulation was related to game use and negative consequences of gaming (Lui & Peng, 2009; Seay & Kraut, 2007)

Theory of Planned Behavior

The Theory of Planned Behavior (TPB) model (Ajzen, 1975) is based on the Theory of Reasoned Action (Fishbein & Ajzen, 1975). The perceived behavioral control (PBC) construct is included in TPB to enable more accurate predictions of intention and behavior. (Ajzen, 1991) Behavior of an individual is determined by an intention to engage in a particular behavior. (Ajzen, 1975) Intention is a function of three social cognitive constructs: *attitude* (a person's positive or negative evaluation of a particular behavior), *subjective norm* (perceived expectations of others to engage in certain behavior), and *perceived behavioral control* (the perception of the amount of control one has over certain behavior). (Ajzen, 1985) The TPB model is used in relation to many human behaviors including addictions.

Implicit measurements

Addiction research is currently exploring the value of implicit measures for assessing cognitions believed to be involved in the etiology and maintenance of addictive behaviors. Recently formulated dual-process models of addiction suggest that implicit or relatively automatic processes may play a central role in the etiology and maintenance of alcohol abuse. (e.g., Deutsch & Strack, 2006; Evans, 2003; Evans & Coventry, 2006; Strack & Deutsch, 2004;) According to the dual process theory two different parallel cognitive processes play a role in reasoning. (Sun, 2002; Evans, 2008) One process involves the implicit cognitions and the other involves explicit cognitions.

Explicit versus implicit cognitions

Explicit cognitions are cognitions about our behavior that are accessible for introspection and deliberate decision- making processes. Explicit cognitions are our conscious and deliberate acts that we can control actively. Implicit cognitions are cognitions who act beyond our conscious control, we are unaware of them, but they are influencing our behavior as well.

Cognitive processes such as attention bias and implicit reward-associations may mediate the impaired decision making and impulsive reward seeking behaviors that are instrumental in the formation and maintenance of addiction disorders, and potentially in a variety of reward seeking behaviors in general (Boyer & Dickerson, 2003).

Implicit Association Test

Implicit cognitions can be measured in several ways. One of the most reliable methodologies for assessing implicit associations is provided by the implicit association test (IAT; Greenwald, McGhee, & Schwartz, 1998).The Implicit Association Test (IAT) is based on the simple but ingenious principle that people perform tasks better (i.e., with greater speed and accuracy) when they can rely on well-practiced cognitive associations, compared with when task demands are in conflict with automatic mental links. (Rudman, 2011)

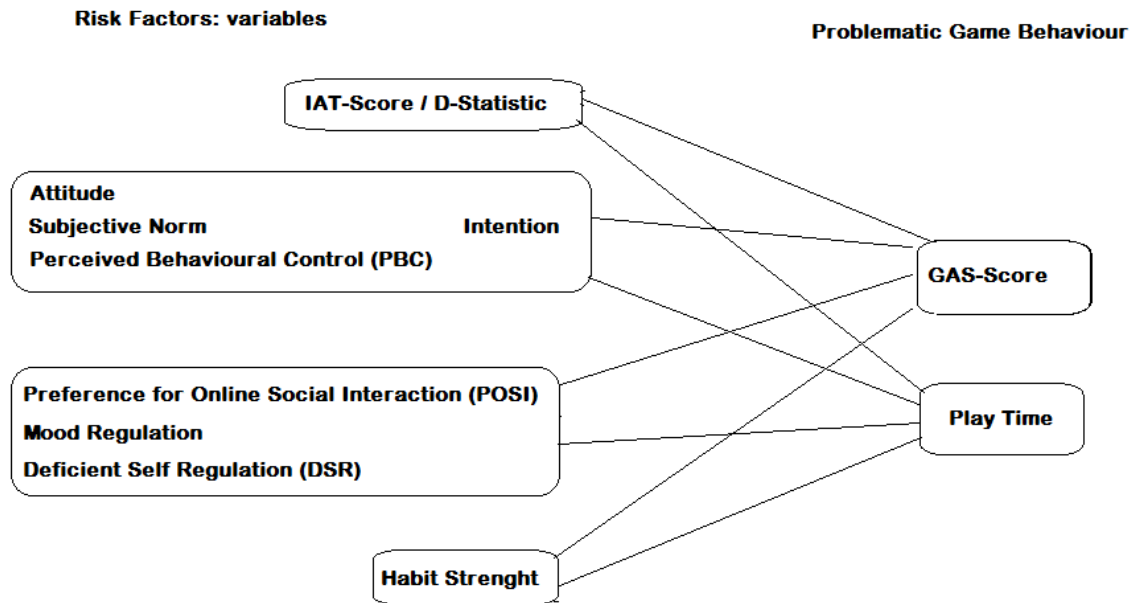
The study

Traditionally, addiction-related cognitions have been examined with self-report measures that ask respondents for introspection. (Hoeben, Wiers, & Roefs, 2006)Research on problematic online game use is focusing merely on explicit cognitions. As mentioned earlier, other addictive tendencies are already studied using implicit measurements.

The present study aims to explore implicit cognitions in problematic online game use and how implicit cognitions are related to explicit cognitions. Including implicit cognitions to the existing explicit cognitive models may reveal additional information regarding problematic online game use.

Research Questions

First goal of the present study is to explore if there are positive significant correlations between explicit cognitions, implicit cognitions and problematic online game use. Second goal is to test the usefulness of the implicit cognitions is explaining problematic online game use. Third goal is to compare gamers with non gamers.



Research Questions:

RQ1: Positive significant correlation between implicit cognitions (IAT-score / D-statistic) and gas.

RQ2: Positive significant correlation between implicit cognitions (IAT-score / D-statistic) and play time.

RQ3: Correlations between implicit cognitions (IAT-score / D-statistic) and theory of planned behavior.

RQ4: Correlations between implicit cognitions (IAT-score / D-statistic) and POGUS-subcales.

2. Method

Participants

All participants (n=16) were students of the Twente University and applied via a research pool called Sonasystems. A short message about the study was put online. Participants received a credit afterwards. Playing World of Warcraft in the previous 6 month period was chosen as the main inclusion criteria. Participants were divided into two groups. Group 1: (n=11) gamers labeled as Wow players. Group 2: (n=5) gamers labeled as non-Wow players. All participants completed the survey and the implicit association test.

Measurements & scales

The dependent variable problematic online game use (POGU) is defined by the score on game addiction scale (GAS) and the amount of time spend on gaming (Play Time). Independent variables were the explicit and implicit cognitions described in the following section.

Game Addiction Scale

Problematic online game use (POGU) is measured with the Game Addiction Scale (GAS) by Lemmens (Lemmens, Valkenburg, & Peter, 2009). This scale includes 7 items based on the criteria for pathological gambling derived from the Diagnostic and Statistical Manual of Mental Disorders, 4th edition. (DSM-IV) (American Psychological Association (APA), 1994). The scale includes one item for each of the 7 underlying criteria for pathological gambling:

1. Salience (thinking all day about gaming)
2. Tolerance (spending increasing amounts of time in gaming)
3. Mood modification (playing games to alter mood)
4. Relapse (others unsuccessfully tried to reduce your game use)
5. Withdrawal (feeling bad when unable to play games)
6. Conflict (having fights with others about the time spent on games)
7. Problems (neglecting other important activities)

Each statement is scored on a 5 point scale “never” (score 1), “rarely” (score 2), “sometimes” (score 3), “Often” (score 4), “very often” (score 5). The scale has good internal consistency ($\alpha = .84$) and demonstrated good convergent and criterion validity (Lemmens et al., 2009; 2011) A score of >3 on each of the 7 items indicates problematic game use.

Play Time

Playing frequency and playing time during week and weekend days indicates problematic game behavior. Time spend on gaming is possibly related to problematic game behavior, but as suggested in previous studies (Griffiths, 2010) playing time should not be considered as a main criterion for problematic game behavior. Recent research by Haagsma (2012) indicates that play time is not the most important indicator determining problematic game behavior.

Subscales of the Problematic Online Game Use Scale

To measure explicit cognitions about gaming we used several subscales from the problematic online game use scale (POGUS) created by Haagsma (Haagsma, 2012). POGUS is a modified version, from an internet to gaming perspective of the Generalized Problematic Internet Use Scale (GPIUS) by Caplan (Caplan, 2010).

Preference for Online Social Interaction

Preference for Online Social Interaction (POSI) is a list of three questions about preferences for online social interaction over to face to face or real life communication. Each statement is scored on a 5-point Likert scale (1='totally disagree' 2= 'disagree='disagree/agree' 4='agree' 5='totally agree'). The POSI has a good internal validity ($\alpha = .87$) (Haagsma, 2012)

Mood Regulation

Mood regulation, three questions to deter if a gamer uses gaming as a way of altering their mood for the better. Example: "*I played games to make me feel better when I was feeling lonely, sad or angry*". Each statement is scored on a 5-point Likert scale (1='totally disagree' 2= 'disagree' 3='disagree/agree' 4='agree' 5='totally agree'). Mood regulation has show a good internal validity ($\alpha = .89$) (Haagsma, 2012)

Deficient Self Regulation

Deficient Self Regulation is measured with 6 items derived from the POGUS subscales compulsive use and cognitive preoccupation. Each statement is scored on a 5-point Likert scale (1='totally disagree' 2= 'disagree' 3='disagree/agree' 4='agree' 5='totally agree'). Both cognitive preoccupation ($\alpha = .81$) and compulsive use ($\alpha = .87$) show a good internal validity. (Haagsma, 2012)

Habit Strength

Habit Strength ($\alpha = .83$) was measured with 4 items. The items were based on prior studies focused on media addiction (laRose & Eastin, 2004) and were rephrased in the context of game use by Haagsma (2012). Each statement is scored in a 5-point Likert scale (1='totally disagree' 2= 'disagree' 3='disagree/agree' 4='agree' 5='totally agree').

Theory of Planned Behavior

The TPB has a good predictive validity for a wide range of behavior including media-using behavior. Hsu and Lu (2004) found that subjective norm and attitude were related to the intention to play online games. Perceived behavioral control was found to be the most important factor in predicting problem video gaming behavior. (Haagsma, 2012) The TPB model contains 4 constructs; intention, attitude, subjective norm and perceived behavioral control.

Intention

Intention ($\alpha = .961$) was measured with 3 items in a 5-point Likert scale (1='totally disagree' 2= 'disagree' 3='disagree/agree' 4='agree' 5='totally agree') Participants had to answer questions like "*I intend to keep the amount of time spend to gaming within limits.*" Participants were asked to give an answer for several timeframes in the near future; week, month, and six months resulting in a total of 9 different statements about intention.

Attitude

Attitude was measured by two items. Participants had to respond to the following statements. "*Spending too much time on World of Warcraft is not a problem*" "*Spending too much time on World of Warcraft is not a bad*" Each statement is scored on a 5-point Likert scale (1='totally disagree' 2= 'disagree' 3='disagree/agree' 4='agree' 5='totally agree').

Subjective Norm

Subjective norm was measured by three items "*My classmates think that I should not spend too much time on World of warcraft*" "*My friends think that I should not spend too much time on World of warcraft*" "*My online-friends think that I should not spend too much time on World of warcraft*" Each statement is scored on a 5-point Likert scale (1='totally disagree' 2= 'disagree' 3='disagree/agree' 4='agree' 5='totally agree')

Perceived Behavioral Control

Perceived behavioral control (PBC) was measured by measures by answering 3 different statements. “For me, not spending too much time on World of Warcraft is...” “For me, keeping the amount of time I spend on World of Warcraft within limits is...” “For me, controlling my World of Warcraft use is...” Statements were scored on a 5-point Likert scale (1=’totally disagree’ 2= ’disagree’ 3=’disagree/agree’ 4=’agree’ 5=’totally agree’)

The Implicit Association Test

The implicit association test (Greenwald et al., 1998) is a computerized classification task in which participants have to quickly and accurately classify stimuli into two target categories (game related versus neutral) and two attribute categories (positive versus negative). In this study the target stimuli were pictures of World of Warcraft versus pictures of neutral objects. The attribute stimuli were common English words either positive or negative. (Appendix A)

The IAT was programmed in FreeIAT (Meade, 2009) and consisted of 5 blocks. Participants first received 10 trials of target discrimination practice using a left (E) and a right (I) response key. During the first combination task (STAGE 3), participants have to press one response key for World of warcraft pictures and positive words and the other response key for neutral pictures and negative words. This response assignment is then reversed in a second combination task (STAGE 5), so that participants then have to respond to World of warcraft pictures and negative words with one response key and to neutral pictures and positive words with the other response key.

Table
Overview of IAT phases

IAT				
Block	Trials	Function	Left key	Right key
1	10	Target practice	World of Warcraft	Neutral Objects
2	10	Attribute practice	Positive words	Negative words
3	10	Compatible combination test (stage 3)	World of Warcraft Positive words	Neutral Objects Negative words
4	10	Reversed attribute practice	Negative words	Positive words
5	10	Incompatible combination test (stage 5)	World of Wacraft Negative words	Neutral Objects Positive words

The IAT Effect

The underlying idea is that this simultaneous classification of targets and attributes should be easier when the response assignment of the target and attribute categories is compatible, or corresponds to respondents' implicit associations, than when this response assignment is incompatible, or does not match respondents' implicit associations. This performance difference is referred to as the IAT effect, represented by the D-statistic, and is assumed to reflect the strength of implicit associations between the targets and attribute categories (Greenwald et al., 1998).

We expect that excessive gaming creates implicit memory associations which may lead to problematic behaviors related to gaming. For example, faster performance when World of Warcraft pictures shares a response with positive attribute words and neutral pictures with negative attribute words, than when World of Warcraft pictures shares a response with negative attribute words and neutral stimuli with positive attribute words would indicate positive implicit associations with the target concept World of Warcraft.

The IAT shows good internal consistency in the region of ($\alpha = .80$). Stability over time is typically lower with an average test-retest value of ($\alpha = .60$) (e.g., Bosson et al., 2000; Cunningham et al., 2001; Greenwald & Nosek, 2001; around ($\alpha = .70$) for the alcohol IAT; Wiers et al., 2005).

Appendix A

IAT target stimuli

World of Warcraft: a set of 7 World of Warcraft screenshots. (Blizzard Entertainment)

Neutral Images: dice, padlock, binoculars, chicory, sandal, scissors, broccoli (Bank of standardized stimuli, BOSS)

IAT valence attribute stimuli

Positive: Good, Joy, Love, Peace, Wonderful, Pleasure, Glorious, Laughter, Happy

Negative: Bad, Agony, Terrible, Horrible, Nasty, Evil, Awful, Failure, Hurt (Meade, A. W. (2009). *FreeIAT*: An open-source program to administer the implicit association test.)

Procedure

A questionnaire was created and put online in Thesis Tools to collect the data of the explicit measurements. This survey containing several existing scales including: subscales of the pogus (Haagsma, 2012), the game addiction scale (Lemmens, 2009), theory of planned behavior (Ajzen, 1991), questions about play frequency and play time. Additionally an IAT test was developed with FreeIAT software. Including: World of Warcraft screenshots, pictures of neutral objects, and positive and negative attribution words.

Data Analysis

All data, from the Thesis Tools excel output and the FreeIAT software data output were imported, labeled and analyzed using IBM SPSS statistics 20 software. Correlations, ANOVA, linear regression analysis were performed.

3. Results

A total number of 16 participants completed the questionnaire and the implicit association test. All male (n=12) and female (n=4) participants were university students aged 19 to 32 years. A total of 11 participants (68, 75%) reported playing the video game World of Warcraft in the last 6 months were labeled as the “Wow gamers” group. The gamers who did not play World of Warcraft (n=5) (31, 25%) were labeled as the “non Wow gamers” group. Both groups completed the same questionnaire assessing explicit cognitions and all respondents participated in the same IAT test.

First goal of the present study was to explore if there were positive significant correlations between explicit cognitions, implicit cognitions and problematic online game use. Second goal was to test the usefulness of the implicit cognitions in explaining problematic online game use.

Correlations

RQ1: Correlations between implicit cognitions (IAT-score / D-statistic) and problematic online game use (GAS)

Non parametric correlation analysis (Spearman's rho) shows a non-significant correlation between implicit cognitions and game addiction scale score. ($r = .101$; $p > 0.05$)

RQ2: Correlations between implicit cognitions (IAT-score / D-statistic) and play time.

Non parametric correlation analysis (Spearman's rho) shows a non-significant correlation between implicit cognitions and game addiction scale score. ($r = .229$; $p > 0.05$)

RQ3: Correlation between implicit cognitions (IAT-score / D-statistic) and constructs of the theory of planned behavior.

Table 1

Correlations between Implicit Cognitions and Theory of Planned Behavior

	1	2	3	4	5
1. Attitude	-				
2. Subjective Norm	-.045	-			
3. Perceived Behavioral Control	-.758**	.227	-		
4. Intention	-.162	.420	.444	-	
5. D-Statistic	.258	-.269	-.493	-.083	-

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Conclusions

There's no significant correlation between implicit cognitions (D-Statistic) and the constructs of the theory of planned behavior. Correlations around .400 can be marked as a trend.

RQ4: Correlations between implicit cognitions (IAT-score / D-statistic) and POGUS-subcales.

Table 2

Correlations between Implicit Cognitions and Problematic Online Game Use Scale

	1	2	3	4	5
1. Preference for Online Social Interaction	-				
2. Mood Regulation	.170	-			
3. Deficient Self Regulation	.170	.664**	-		
4. Habit Strength	-.165	.805**	.885**	-	
5. D-Statistic	.287	.007	.101	.191	-

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Conclusions

There's no significant correlation between implicit cognitions (D-Statistic) and subscales of the problematic online game use scale.

Linear Regression

Second goal of our research was to test the additional value of the implicit cognitions when added to explicit cognitions. In addition to correlation analysis we tested the effect of each independent variable (x) on the dependent variable (y) using a linear regression model. In general a linear regression model requires normal distributed data. We made the assumption that our data was normally distributed. We compared two models: model 1: explicit cognitions (e.g. attitude) model 2: explicit cognitions and implicit cognitions (e.g. attitude + IAT score)

In the linear regression model the dependent variable was the GAS score. We tested every single explicit cognition, one at a time (step 1: reduced model) and added the implicit cognitions (step 2: full model) to test differences between the two models. The R-Square change is the increase in variance when a second predictor (step 2) is added. The R-square change is tested with an F-test. A significant F-test means that the variable added in step (step 2) significantly improved the prediction.

Conclusion

In our model the addition of implicit cognitions (step 2) to explicit cognitions (step 1) does not contribute to a significant increase of the amount of variance of the dependent variable explained by the independent variables. Significant determinants of problematic online game behaviour are attitude, PBC, mood regulation, deficient self control and habit strenght.

Table 3:

	Model	Un-standardized Coefficients	Standardized Coefficients		F	Sig.	R-Square Change
		B	Std. Error	Beta			
Subset Tests	Attitude	2,516	,712	,711	12,503	,004**	,481
	D-Statistic	-,293	2,809	-,021	,011	,918	,000
Subset Tests	Subjective Norm	,145	,778	,055	,035	,855	,003
	D-Statistic	2,186	4,115	,157	,282	,604	,021
Subset Tests	Perceived Behavioral Control	-1,869	,467	-,842	15,988	,002**	,541
	D-Statistic	-3,810	2,940	-,273	1,680	,217	,057

Subset Tests	Intention	,047	,244	,053	,037	,851	,003
	D-Statistic	1,997	3,860	,143	,268	,614	,020
Subset Tests	Preference for Online Social Interaction	,521	,935	,158	,310	,587	,023
	D-Statistic	1,293	3,948	,093	,107	,749	,008
Subset Tests	Mood Regulation	1,354	,379	,700	12,743	,003*	,486
	D-Statistic	,932	2,740	,067	,116	,739	,004
Subset Tests	Deficient Self Regulation	1,093	,134	,911	66,274	,000**	,820
	D-Statistic	,536	1,563	,038	,118	,737	,001
Subset Tests	Habit Strength	1,145	,238	,816	23,161	,000**	,629
	D-Statistic	-,794	2,368	-,057	,112	,743	,003

** Significant at the 0.01 level.

4. Discussion

The present study explored the role of implicit and explicit cognitions on problematic online game use. Positive implicit associations with online games were measured using a unipolar Implicit Association Test (IAT). The main focus of this study was to examine how these implicit online game related associations would relate to gaming behavior (problematic online game use) and whether they would predict gaming behavior above explicit online game-related cognitions.

No significant correlations were found between online game related associations and explicit online game related cognitions. The IAT did not yield a significant effect in predicting online game behavior beyond the variance explained by explicit game-related cognitions.

There are several possible reasons for the absence of correlations. First: The IAT was programmed in FreeIAT using pictures as targets and words as attributes. The images used as targets were assumed to be in contrast with each other. The target stimuli were either World of Warcraft or neutral objects. World of Warcraft is a computer game with a large amount of visual complex stimuli such as different characters, objects, and landscapes in different color settings.

Prior to the selection of the target images, none of the pictures were tested and validated as being stereotype examples of Wow or neutral.

Limitations

This study has several limitations. The sample size (n=16) is relatively small. This might explain the absence of even marginally significant correlations. In general using a small number of participants leads to wider confidence intervals, lower statistical power and data that is not normally distributed. Correlations between constructs only show an estimate of the relatedness between two or more constructs. Assumptions about cause and effect between constructs are only theoretical and based on the available literature.

The absence of any statistical significant increase in the explained variance (by adding implicit cognitions to the model) could be explained by the fact that the data was not normally distributed. With the assumption about the normality, the data didn't fit the model. In general linear regression analysis requires a sufficient amount of data in order to perform step by step comparisons of predictors.

The Implicit Association Test is a relatively new method of measuring implicit cognitions. It has been used in studies regarding substance abuse, such as alcohol, but is rarely used in relation with problematic game behavior. An validated IAT related to problematic game use wasn't available. Therefore we constructed our own World of warcraft related Implicit Association Test using the FreeIAT software.

World of warcraft and neutral pictures were chosen as target stimuli, mostly based on common sense. The pictures used as stimuli for were not verified nor validated prior to the research as being typical World of warcraft or typical neutral stimuli.

The words both positive attribute words and negative attribute words, used as stimuli, were validated in other studies, but not specifically in relation to implicit association tests. The absence of reliability and validity of the used stimuli could have influenced the scores on the IAT test and possibly explanation the absence of significant results.

The software used for the IAT test is freeware; this means that possible bugs could be present in the software that possibly influenced the reported and measured data. We didn't we test

the software extensively prior to our research. We choose to let the program compute the IAT effect (the D-statistic). We didn't use the raw data output of the FreeIAT software, to compute the D-statistic manually, or validated the stimuli used in the IAT.

Another factor that might explain the absence of a IAT effect could be the insufficient amount of excessive World of Warcraft players in our sample. All participants were university students and none of them reported excessive abuse. We didn't include questions about long gaming sessions, for examples game sessions of more than 24-hours non-stop. In general university students have the intelligence that enables them to reflect on their own behavior, this could explain the relatively moderate responses.

Directions for future research

The use of implicit measures in exploring behavior and research methods such as the IAT-test are relatively new. In general more research on implicit measures is needed. More specific, the creation of a valid set of target and attribute stimuli to would have been helpful in this study. Using sufficient amounts of respondents with a diversity of background (e.g. school, age, gender, race, etc.) could reveal more significant relations between explicit, implicit cognitions in relation to problematic online game use.

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