Validation and psychometric properties of a short version of Young’s Internet Addiction Test

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Abstract
The phenomenon of excessive or pathological Internet use has been investigated in the last decades in order to reveal psychological correlates as well as potential treatments. A key element of the respective research and clinical practice is a valid and reliable diagnosis of pathological Internet use. One of the most frequently used questionnaires is Young’s Internet Addiction Test (IAT). However, the factorial structure of the IAT is still discussed controversially. In four studies with different samples we a) addressed the factorial structure of a German version of the IAT with exploratory factor analysis and reduced the items to those with sufficient factor loadings and item characteristics, b) checked the factorial structure using confirmatory factor analysis, and c) analyzed convergent, divergent and incremental validities. We revealed a short version of the IAT, which consists of 12 items and a two factorial solution and good reliability (study 1). The two factors were named “loss of control/time management” and “craving/social problems”. This two factorial solution was confirmed by the confirmatory factor analysis (study 2) and we have found good indices for convergent, divergent and incremental validity (studies 3 and 4). In conclusion, the short version of the IAT has good psychometric properties and represents the Internet addiction’s key elements based on the proposed diagnostic criteria. We suggest that with the 12 item version of the IAT, future studies can more reliably assess the problems individuals experience in their daily life due to an excessive usage of the Internet or specific applications, respectively.

Keywords:
Pathological Internet use, Internet Addiction Test, Behavioral addiction
Introduction

The Internet is used in daily life as a very helpful tool for searching information, being in contact with friends all over the world, academic and professional activities and other domains of work or social life. In most cases, people can deal with the possibilities which are provided by the Internet and can regulate appropriately their online activities. However, in recent years, it has become a problem for some individuals to control their excessiveness of using the Internet which may cause severe problems in everyday life with respect to social relationships, work or academic processes, financial issues and psychological well-being (Morahan-Martin, 2008; Young, 1998b).

The phenomenon of excessive or pathological Internet use has been termed differentially in recent articles, for instance Internet addiction (Block, 2008; Chou, Condron, & Belland, 2005; Pratarelli & Browne, 2002; Widyanto & Griffiths, 2006; Young, 2004), compulsive Internet use (Meerkerk, van den Eijnden, & Garretsen, 2006), problematic Internet use (Caplan, 2002), pathological Internet use (Davis, 2001), and unregulated Internet usage (LaRose, Lin, & Eastin, 2003). Irrespective of the exact term for describing the phenomenon, this kind of dysfunctional, excessive or addictive usage of the Internet is not included in the standard diagnostic criteria for psychological disorders (i.e., DSM-IV-TR, ICD-10), so far, although some authors claim that Internet addiction should be included in future manuals (Block, 2008; Grant, Potenza, Weinstein, & Gorelick, 2010) (see also the review on criteria and diagnostic instruments of several behavioral addictions in Albrecht, Kirschner, & Grüsser, 2007). Most recently, it has been decided that indeed Internet Addiction will be listed in the appendix of the next DSM-V, in a category summarizing all disorders which currently do not meet criteria for a fully accepted diagnosis (Holden, 2010).

It is still a topic of debate whether or not Internet addiction shares some important aspects with other forms of behavioral addiction (e.g., pathological gambling), or even with substance dependency (cf., Meerkerk, van den Eijnden, Vemulst, & Garretsen, 2009). From a
neuropsychological or cognitive science perspective, we also see some parallels between excessive Internet use and behavioral addictions, such as pathological gambling. For example, there is some recent evidence for reductions in decision-making abilities in individuals with Internet addiction (Ko et al., 2010; Pawlikowski & Brand, 2011; Sun et al., 2009), which are seen as a main cognitive correlate of substance dependence (Bechara, 2005) and which are also seen in pathological gambling (Brand et al., 2005; Cavedini, Riboldi, Keller, D’Annucci, & Bellodi, 2002; Goudriaan, Oosterlaan, Beurs, & van den Brink, 2005, 2006) and other types of impulse control disorders or behavioral addictions (e.g., Svaldi, Brand, & Tuschen-Caffier, 2010). Therefore, we also use the term Internet addiction when referring to the phenomenon of the inability to control Internet usage followed by problems in daily life and psychological domains.

Since the classification of Internet addiction is still under debate, the diagnostic procedures and instruments used in previous studies and clinical settings are inconsistent. One of the most frequently used questionnaires, however, is the Internet Addiction Test by Young (Widyanto & McMurran, 2004; Young, 1998a). The IAT operationalizes the degree of subjective complaints in daily life in the course of excessive usage of the Internet and is based upon diagnostic criteria for pathological gambling. The IAT consists of 20 items which assess several problems one may have due to excessive Internet use, such as problems related to neglecting work, family and friends caused by a loss of control over the time spent on the Internet. There are also items assessing a kind of craving, e.g., thinking about when having the chance to be online again, and other symptoms Internet addicted individuals may have when they are offline, such as bad temper and nervousness, depressive feelings and so on. The IAT has been used in a sum of internationally published studies coming from different countries, such as USA (Widyanto, Griffiths, & Brunsden, 2011), France (Khazaal et al., 2008), Germany (Brand et al., 2011), Norway (Johansson & Götestam, 2004), Finland (Kaltiala-Heino, Lintonen, & Rimpelä, 2004; Korkeila, Kaarlas, Jääskeläinen, Vahlberg, &
Taiminen, 2010), Italy (Ferraro, Caci, D'Amico, & Di Blasi, 2007), Greece (Siomos, Dafouli, Braimiotis, Mouzas, & Angelopoulos, 2008), Iran (Ghassemzadeh, Shahraray, & Moradi, 2008), China (Lam, Peng, Mai, & Jing, 2009), and Korea (Ha et al., 2007). Furthermore, the IAT has been modified in some recent studies to assess addictive behavior in the context of specific Internet applications, such as Internet role playing games (e.g., World of Warcraft) (Chan & Rabinowitz, 2006; Kim, Namkoong, Ku, & Kim, 2008; Pawlikowski & Brand, 2011) or Internet sex (Brand et al., 2011).

Although the IAT has become a famous instrument for diagnosing Internet addiction, the factorial structure of the IAT is still discussed controversially. For instance, the range of factors extracted from the 20 items comprises one main factor (Khazaal et al., 2008), two factors (Korkeila et al., 2010), three factors (Chang & Law, 2008; Widyanto et al., 2011), and six factors (Ferraro et al., 2007; Widyanto & McMurran, 2004). Potential reasons for the divergent findings can lie on cultural effects, since the samples in the studies mentioned came – at least partially – from different countries. However, there seem to be additional methodological issues that can cause the variety of findings. One issue, which can be considered, is the sample size influencing factorial solutions. In the aforementioned studies samples between n = 86 (Widyanto & McMurran, 2004) to n = 1825 (Korkeila et al., 2010) have been used. In addition, the method used to extract the number of factors in an exploratory factor analysis was also different across studies and, at least in some of them, does not match well current standards. For example, four studies (Chang & Law, 2008; Ferraro et al., 2007; Widyanto et al., 2011; Widyanto & McMurran, 2004) used the Kaiser criterion of computing the eigenvalues from the correlation matrix to define how many of the eigenvalues are greater than 1, which is then the number of the factors extracted. However, this method for defining the number of factors has been criticized for several reasons (Fabrigar, Wegener, MacCallum, & Strahan, 1999), one of them is that it can result in an overestimation of the number of factors found. Other methods, such as the parallel analysis
(Horn, 1965) or the minimum average partial (O'Connor, 2000) or the maximum likelihood method (overview in Fabrigar et al., 1999) are more appropriate to define the number of factors in an exploratory factor analysis, but these methods have only been used by two of the studies on the IAT structure (Khazaal et al., 2008; Korkeila et al., 2010). Moreover, in most of the studies mentioned, the confirmatory factor analysis was done with either the same sample used in the exploratory analysis or the sample had been divided into two halves prior to the analyses.

With respect to the validity of the IAT, and in particular on the incremental validity of the single factors extracted, empirical findings are even more limited. Khazaal et al. (2008) reported some zero-order correlations between their IAT score (one factor solution) and the daily duration of Internet usage, some demographic variables (age and gender), and the fact of being an online gamer (all having low to moderate effect sizes). Chang and Law (2008) also analyzed relationships between their three factors of the IAT and the Internet usage in hours per week, Internet experience in years, and academic performance (most of the correlations were extremely low with one exception that was the correlation between academic performance and the factor “reality substitute” which reached a low to moderate effect). Correlations between IAT factors and demographic variables as well as some variables that coded the excessiveness of the Internet usage were also reported in other studies (Korkeila et al., 2010; Widyanto & McMurran, 2004). Widyanto et al. (2011) reported correlations between their three IAT factors and the four factors found for the Internet Related Problems Scale (Armstrong, Phillips, & Saling, 2000). These correlations were high to very high (the total scores of both instruments were correlated with $r = .9$) speaking for a good convergent validity of the IAT. However, what is missing in the literature, so far, is a study which showed convergent and divergent validity of the IAT and its factors in terms of other psychological symptoms (e.g., depression, anxiety, social phobia etc.), personality variables (e.g., extraversion, neuroticism) and other variables (e.g., impulsivity). These variables seem to be
appropriate to check the IAT’s validity, since it has been shown by several authors that Internet addiction may co-vary with depression (Bessiere, Kielser, Kraut, & Boneva, 2008; Ha et al., 2007), social anxiety and shyness (Caplan, 2002; Chak & Leung, 2004; Ebeling-Witte, Frank, & Lester, 2007), and further personality variables and clinical symptoms (Yang, Choe, Baity, Lee, & Cho, 2005). In addition, when different factors of the IAT are found in a factor analysis, their incremental validity should also be demonstrated, for instance, using hierarchical regression analyses and several criterion variables.

There are also some content-based issues which may have to be considered. Most of the IAT’s 20 items are phrased with respect to the Internet “in general”. This means that no differentiation between single applications has been done, which is fine when aiming at diagnosing a generalized pathological Internet use (Davis, 2001). However, some items refer to specific facets of Internet usage, such as the item “How often do you check your e-mails before something else that you need to do?” that addresses particularly a kind of online communication. Given the current debate on the necessity of a differentiation between specific forms of pathological Internet usage (Block, 2008; Purty, Hembram, & Chaudhury, 2011; Young, 1999, 2004), it makes sense to have one general form of the IAT without Items addressing specific Internet facets (like the “e-mail item”). This general IAT may then be modified in order to investigate a specific form of Internet addiction, as has been done previously (Brand et al., 2011; Chan & Rabinowitz, 2006; Kim et al., 2008; Pawlikowski & Brand, 2011).

The aims of the current investigation are: 1) to analyze the factorial structure of a German version (Brand et al., 2011) of the IAT with exploratory factor analysis and – if necessary and appropriate – reduce the items to those with sufficient factor loadings and item characteristics, 2) to check the factorial structure using confirmatory factor analysis, and 3) to analyze convergent and divergent validities for both the single factors and the overall IAT score as well as to analyze incremental validity of the single factors. Therefore, we report four
studies, all with new and independent samples: One study for the exploratory factor analysis and modifications of the IAT, the second study for the confirmatory analysis of the “new” IAT version and the third and fourth study for the calculation of several validity indices.

Study 1

Methods

Participants

We examined 584 participants which were recruited through local advertisements at the University of Duisburg-Essen and Internet advertisements. Of the 584 participants, 386 were male and 198 were female, the average age was M=25.62 (SD=6.88) years and school education Median=13 (range=9-13) years. On average, a computer was used for the first time M=11.79 (SD=4.52) years ago and the Internet was used for the first time M=9.27 (SD=3.32) years ago. The Internet was used for M=10.35 (SD=16.44) hours per week for private purposes. At the time of the assessment 363 (66%) participants were in a relationship.

Instruments

Internet Addiction Test

The Internet Addiction Test (IAT) by Young (see Widyanto & McMurran, 2004; Young, 1998a) consists of 20 items which are rated on a 5-point-likert scale from 1 (“rarely”) to 5 (“always”), with a total score range between 20 to 100. The items comprise several facets of Internet addiction, such as loss of control, preoccupation and psychological dependence. The whole questionnaire was carefully translated to German and then backward translated by a bilingual clinical psychologist (Brand et al., 2011).

Specific information concerning computer and Internet usage
The issue about the time spent on the Internet per week (in hours) was assessed by two questions. The first question concerns about the average time spent with the Internet per day (in hours) for private purposes and second refer to the question how many days were spent with the Internet per week. Both answers were multiplied to get the average time spent per week on the Internet in hours for private purposes.

**Statistical analyses**

An exploratory factor analysis (EFA) was conducted by SPSS version 19.0 for Windows (IBM SPSS Statistics). Horn's parallel analysis (Horn, 1965) and the minimum average partial (MAP) test (Velicer, 1976) were used to determine the appropriate number of factors.

**Results**

An EFA with principal component analysis and varimax rotation was conducted to assess the dimensionality of the original IAT. The criteria of Horn's parallel analysis and the MAP-test suggested a two-factor solution. Thus, only eigenvalues exceeding the eigenvalue derived in the parallel analysis were extracted. The empirical eigenvalue of the first factor (8.86) was higher compared to the eigenvalue obtained in the parallel analysis (1.37). Analogous, the empirical eigenvalue of the second factor (1.59) was higher compared to the eigenvalue derived in the parallel analysis (1.30). The third factor was not extracted even if the empirical eigenvalue was higher than 1 (1.04), because it was not higher than the eigenvalue obtained in the parallel analysis (1.27). The two factor solution explained 52.25% of the variance. Afterwards, a second EFA with principal axis analysis and promax rotation was conducted to prove the factor loadings for each item in the two factor solution of the IAT. An exclusion of items was carried out to enhance the validity and reliability of the IAT on the basis of empirical based criteria (Smith & McCarthy, 1995). Items with low factor loadings (<.60) and/or high parallel loadings (> .20) on other factors were excluded from further analysis.
(Ferguson & Cox, 1993). In accordance with this procedure, we have excluded the following items: 10, 4, 12, 7, 5, 11. Furthermore, item 8 and 3 were excluded because of content overlaps with other items, which showed higher factor loadings. After excluding the aforementioned items and again conducting the EFA, a short 12 item version of the IAT with a two factor structure remains (see Table 1). The first factor contained 6 items with high loadings on the main factor (> .50) and low loadings on the other factor (< .20) and related to loss of control and time management impairments, so we named this factor “loss of control/time management”. The second factor consists of 6 items with high loadings on the main factor (> .50) and low loadings on the other factor (< .20), and all items related to urgency of Internet usage and social problems, so we named this factor “craving/social problems”.

For the additional studies, we also adjusted the IAT rating scale, because of a positive skewness of the given answers in the original IAT. We kept the original 5-point-likert scale and adjusted it to “never”, “rarely”, “sometimes”, “often” and “very often” (Cohen & Swerdlik, 2009; Rohrmann, 2007). Furthermore, after reviewing the remaining 12 items, we have changed the wording in one item from “How often do you lose sleep due to late-night log-ins?” into “How often do you lose sleep due to being online late at night”. Both factors have good reliability (Cronbach’s Alpha = .876 and .836). The reliability for the overall score is also good (Cronbach’s Alpha = .897). Furthermore, the time which were spent on average for Internet usage per week (in hours) was significantly correlated with the s-IAT overall score (r = .436, p < .001) as well as with both the factor “loss of control/time management” (r = .412, p < .001) and “craving/social problems” (r = .374, p < .001).

- please insert Table 1 here -

**Study 2**
The purpose of study 2 was to confirm the two factor structure of the new, short version of the IAT (including the new rating scale, see study 1). Therefore, a confirmatory factor analysis (CFA) was performed on a new sample.

**Methods**

**Participants**

465 participants (253 males) were assessed with the new short version of the IAT (s-IAT), which were recruited through local advertisements at the University of Duisburg-Essen and Internet advertisements. The mean age was \( M=31.84 \) (SD=13.54) years, the school education was Median=13 (range=9 -13) years and the participants used the Internet in average for \( M=16.76 \) (SD=13.71) hours per week for private purposes.

**Instruments**

*Short and modified Internet Addiction Test*

The shortened (12 items) and modified (with respect to the rating scale) version of the original IAT (s-IAT, see Table 1) was applied in this examination to validate the two factor structure.

**Statistical analyses**

The confirmatory factor analysis was conducted via LISREL 8.80. Out of the three proposed categories of fit indices to verify the model fit (Brown, 2006; Schermelleh-Engel, Moosbrugger, & Müller, 2003), the following fit indices were calculated: 1) absolute fit-indices like the \( \chi^2 \)-index and the standardized root mean square residual (SRMR), 2) parsimony fit-indices like the root mean square error of approximation (RMSEA), and 3) the comparative fit index (CFI). There is an ongoing debate about the right cut-off scores for the different fit-indices (Brown, 2006; Hair, Black, Babin, & Anderson, 2009; Hu & Bentler, 1999; Schermelleh-Engel et al., 2003; Tabachnick & Fidell, 2007). We used the most
established cut-off scores to evaluate the model fit. A SRMR < .08 indicates a good model fit and a SRMR < .10 indicates an acceptable model fit, when the SRMR is > .10 the model has to be rejected (Hu & Bentler, 1999). A RMSEA ≤ .08 indicates a good model fit, a RMSEA between .08 and .10 indicates an acceptable model fit and the model has to be rejected when RMSEA > .10. Finally, a CFI ≥ .95 indicates a good model fit (Hu & Bentler, 1999). Because the $\chi^2$ statistic is sensitive for sample size, we calculated the $\chi^2$ to degrees of freedom ratio ($\chi^2$/df) to assess the general model fit. A $\chi^2$/df ration of < 2 indicates a good model fit and a $\chi^2$/df ration around 3 indicates an acceptable model fit. To determine the model fit, the robust maximum likelihood (RML; Satorra & Bentler, 1994) method instead of the maximum likelihood method were used to perform the CFA, because of non-multinormal distribution of the data.

**Results**

For the two-factor CFA model the $\chi^2$ statistic was significant $\chi^2(53)=$173.58, $p<.001$. The $\chi^2$/df ratio was with 3.28 slightly over 3 but barely acceptable. Furthermore, the fit-indices CFI=.95 and SRMR=.064 showed a good model fit for the two-factor model and the RMSEA=.079 indicated an acceptable model fit. The completely standardized loadings and the standardized residuals are shown in Figure 1. Overall, the CFA showed a good model fit for the two-factor solution of the modified and shortened IAT. Beyond that, the s-IAT exhibits a high discriminatory power (.50 to .71) and the item difficulty was in a good range (0.26 to 0.63) for all 12 items. The two factors of the s-IAT were also significantly correlated (r=.572, $p<.001$). In addition, the two factors of the s-IAT revealed a high internal consistency: “loss of control/time management” $\alpha=.812$, “craving/social problems” $\alpha=.743$ and for the whole s-IAT $\alpha=.848$. Again, the time which were spent on average for Internet usage per week (in hours) was significantly correlated with the s-IAT overall score (r=.400,
p<.001) as well as with both the factor “loss of control/time management” (r=.378, p<.001) and “craving/social problems” (r=.325, p<.001).

- please insert Figure 1 here -

**Study 3**

To determine the convergent and divergent validity of the s-IAT we used the method of destructive testing (Anderson & Anderson, 1996). Accordingly, we used different validation constructs based on theoretical considerations (see the Introduction’s section on previous studies which examined psychological correlates of Internet addiction) and conducted multiple hierarchical regression analyses to analyze the specific predictive value of the two factors of the s-IAT for the different validation constructs.

**Methods**

**Participants**

We examined a new large sample of 803 subjects (409 males) with the s-IAT and different additional questionnaires. However, due to practical reasons, not all subjects have completed the whole battery of questionnaires. The participants were recruited through local advertisements at the University of Duisburg-Essen and Internet advertisements. The mean age was M=29.15 (SD=12.30) years, the school education was Median=13 (range=9 -13) years and the participants used the Internet in average for M=16.95 (SD=15.24) hours per week for private purposes.

**Instruments**

*Short and modified Internet Addiction Test*
The shortened (12 items) and modified (with respect to the rating scale) version of the original IAT (s-IAT, see Table 1) was applied in this examination.

**Brief Symptom Inventory (BSI)**

Psychological-psychiatric symptoms were assessed by the Brief Symptom Inventory (BSI; Derogatis, 1993) in which the participants rate 53 items using a 5-point-likert scale (0="no problem" to 4="very serious"). This self-rating scale measures the extent to which individuals have experienced psychological-psychiatric symptoms in the last seven days. The BSI consists of nine subscales: somatization, obsessive-compulsiveness, interpersonal sensitivity, depression, anxiety, anger-hostility, phobic anxiety, paranoid ideation and psychoticism. Furthermore, the global severity index (GSI) can be calculated, which measures the overall severity of the individual’s psychological-psychiatric symptoms. Higher scores on the BSI indicate greater psychological distress. We have data of \( n = 675 \) for the BSI variables.

**Barratt Impulsiveness Scale 11 (BIS-11)**

Impulsivity was assessed by a German version of the Barratt Impulsiveness Scale in the 11th version (BIS-11; Patton, Stanford, & Barratt, 1995) in which the participants rate 30 items using a 4-point-likert scale (1="rarely/never" to 4="almost always/always"). The BIS-11 can be divided into three subscales: attentional impulsiveness, motor impulsiveness and non-planning impulsiveness. Furthermore, all items can be summed to determine an overall impulsiveness score, with higher scores indicating greater impulsiveness. 229 subjects have completed the BIS-11.

**10-item short version of the Big Five Inventory (BFI-10)**

The 10-item short version of the Big Five Inventory (BFI-10; Rammstedt & John, 2007) assess the big five personality facets: openness, consciousness, extroversion, agreeableness
and neuroticism using a 5-point-likert scale (1=“disagree strongly” to 4=“agree strongly”).

Studies have shown that the BFI-10 is a reliable and valid instrument for assessing the Big Five personality traits (Rammstedt & John, 2007). Here, we have data of 128 subjects.

**Statistical analyses**

All statistical analyses were carried out with SPSS version 19.0 for Windows (IBM SPSS Statistics). We analyzed the bivariate correlations and conducted multiple hierarchical regression analyses with the two factors of the s-IAT as independent variables and the different validation constructs as dependent variables. Appropriate to the method of destructive testing (Anderson & Anderson, 1996), competing validation constructs were successively included in the multiple hierarchical regression analyses to determine the specific convergent and divergent validities.

**Results**

**Sociodemographics and Internet usage**

Age was significantly correlated to the s-IAT overall score ($r=-.239$, $p<.001$) as well as to the factor “loss of control/time management” ($r=-.254$, $p<.001$) and “craving/social problems” ($r=-.155$, $p<.001$) of the s-IAT. In the s-IAT, females had a significant lower overall score than males, females: $M=21.55$, $SD=6.39$; males: $M=24.02$, $SD=7.46$; $t(790.59)=-5.03$, $p<.001$, $d=0.36$. In accordance with these results, females had a lower mean score in the “loss of control/time management” factor of the s-IAT in comparison to males, females: $M=13.06$, $SD=4.42$; males: $M=14.21$, $SD=5.01$; $t(794.92)=-3.47$, $p=.001$, $d=0.24$. The scores of the “craving/social problems” factor of the s-IAT was also significantly different between females and males, females: $M=8.49$, $SD=2.66$; males: $M=9.80$, $SD=3.31$; $t(775.83)=-6.18$, $p<.001$, $d=0.43$. Education was not correlated to the s-IAT overall score ($r=.050$, $p>.05$) and to the factor “craving/social problems” ($r=-.048$, $p>.005$) of the s-IAT. Only the relationship
between education and the factor “loss of control/time management” of the s-IAT was significant \((r=.105, p=.003)\) but had a very low effect size. Furthermore, the time which were spent on average for Internet usage per week (in hours) was significantly correlated with the s-IAT overall score \((r=.370, p<.001)\) as well as with the factors “loss of control/time management” \((r=.340, p<.001)\) and “craving/social problems” \((r=.321, p<.001)\) of the s-IAT.

**Correlations with the psychometric test variables**

In order to evaluate the relationship between both the s-IAT overall score and the two factors with the validation constructs, e.g., psychological-psychiatric symptoms, impulsivity and personality, we first conducted correlation analyses. The s-IAT overall score was significantly correlated with the global severity index (GSI) and all subscales of the BSI. Additionally, the two s-IAT factors were also correlated significantly with the GSI and all subscales of the BSI. The comparison of the correlations (Fisher’s Z-scores) across the two factors of the s-IAT revealed significant differences for the BSI subscale “obsessive-compulsiveness”. All correlations and Fisher’s Z-scores can be found in Table 2.

Moreover, the s-IAT overall score as well as the two s-IAT factors correlated significantly with the BIS overall score and the BIS subscales, with one exception (“craving/social problems” was unrelated to “non-planning impulsiveness”, see Table 3). No significant differences (Fisher’s Z-score) were found between the correlations of the two factors of the s-IAT and the BIS overall score and its subscales (see Table 3).

- please insert Table 2 here -

- please insert Tables 3 and 4 here -
Finally, the s-IAT overall score was correlated with neuroticism ($r=.352$, $p<.001$) and conscientiousness ($r=-.311$, $p<.001$). All other correlations between the s-IAT overall score and the personality facets were not significant (see Table 4). Comparable results were found for the two s-IAT factors and the various personality facets (see Table 4). The comparison of the correlations (Fisher’s Z-score) across the two factors of the s-IAT and the various personality facets revealed no significant differences (see Table 4).

**Regressions analyses**

To verify the specific predictive value of the s-IAT factors with respect to the validation constructs, hierarchical regression analyses were conducted, which is the most appropriate method of destructive testing (Anderson & Anderson, 1996). Given the literature on clinical symptoms in individuals with Internet addiction as well as the studies, which addressed differences between Internet addicted and non-addicted subjects in personality traits (see Introduction), we concentrated on the following variables for the hierarchical regression analyses: “obsessive-compulsiveness”, “interpersonal sensitivity”, “paranoid ideation”, “impulsivity”, “neuroticism”, and “agreeableness”. The s-IAT factor “loss of control/time management” should be the main predictor for “obsessive-compulsiveness” as well as for “impulsivity”, while the s-IAT factor “craving/social problems” should be the main predictor for “interpersonal sensitivity”, “paranoid ideation”, “neuroticism”, and “agreeableness”.

In the first multiple hierarchical regression analysis, we examined the convergent and divergent validity of the s-IAT factors regarding “obsessive-compulsiveness”. In the first step, the factor “loss of control/time management” of the s-IAT was a significant predictor of “obsessive-compulsiveness”, $R^2=.111$, $F(1, 673)=84.17$, $p<.001$. When adding (second step) the factor “craving/social problems” of the s-IAT as a predictor, the changes in $R^2$ were not significant, $\Delta R^2=.001$, $F(1, 672)=1.01$, $p=.315$, resulting in an overall explanation of the “obsessive-compulsiveness” score’s variance of 11.3% (see Table 5 for further values). In a
second multiple hierarchical regression analysis, as a first step, the factor “loss of control/time management” of the s-IAT was a significant predictor of “impulsivity”, $R^2=.099$, $F(1, 227)=24.91$, $p<.001$. When adding (second step) the factor “craving/social problems” of the s-IAT as a predictor, this did not lead to significant changes in $R^2$, $\Delta R^2<.001$, $F(1, 226)=0.01$, $p=.961$, resulting in an overall explanation of the “impulsivity” score’s variance of 9.9% (see Table 5 for further values).

In a third multiple hierarchical regression analysis the predictive value of the factor “craving/social problems” of the s-IAT concerning “interpersonal sensitivity” was evaluated (first step) and showed a significant variance explanation, $R^2=.047$, $F(1, 673)=33.02$, $p<.001$. By entering the “loss of control/time management” factor of the s-IAT, the changes in $R^2$ were significant, resulting in an overall variance explanation of 5.3% of “interpersonal sensitivity” score, $\Delta R^2=.007$, $F(1, 672)=4.68$, $p=.031$ (see Table 5 for further values). In a fourth multiple hierarchical regression analysis the factor “craving/social problems” of the s-IAT (first step) was a significant predictor of “paranoid ideation”, $R^2=.092$, $F(1, 673)=68.02$, $p<.001$. In step 2, we included the factor “loss of control/time management” of the s-IAT. Results show no significant increase of variance explanation in “paranoid ideation”, $\Delta R^2=.001$, $F(1, 672)=0.66$, $p=.416$. The overall variance explanation in “paranoid ideation” was 9.3% (see Table 5 for further values). In a fifth multiple hierarchical regression analysis the factor “craving/social problems” of the s-IAT (first step) was a significant predictor of “neuroticism”, $R^2=.162$, $F(1, 126)=24.38$, $p<.001$. In step 2, we included the factor “loss of control/time management” of the s-IAT. Results show no significant increase of variance explanation in “neuroticism”, $\Delta R^2<.001$, $F(1, 125)=0.26$, $p=.873$. The overall variance explanation in “neuroticism” was 16.2% (see Table 5 for further values). In a further multiple hierarchical regression analysis the predictive value of the factor “craving/social problems” of the s-IAT concerning “agreeableness” was evaluated (first step) and showed a significant variance explanation, $R^2=.039$, $F(1, 126)=5.16$, $p=.025$. By entering the “loss of control/time management” factor of the s-IAT, the changes in $R^2$ were significant, resulting in an overall variance explanation of 3.9% of “agreeableness” score, $\Delta R^2=.002$, $F(1, 125)=4.41$, $p=.042$. In step 2, we included the factor “craving/social problems” of the s-IAT. Results show no significant increase of variance explanation in “agreeableness”, $\Delta R^2<.001$, $F(1, 124)=0.57$, $p=.452$. The overall variance explanation in “agreeableness” was 3.9% (see Table 5 for further values).
management” factor of the s-IAT, the changes in $R^2$ were significant, resulting in an overall variance explanation of 5.6% of “agreeableness” score, $\Delta R^2 = .016$, $F(1, 125) = 2.16$, $p = .144$ (see Table 5 for further values).

- please insert Table 5 here -

**Study 4**

**Methods**

**Participants**

We examined a new large sample of 552 subjects (291 males) with the s-IAT and different additional questionnaires. The participants were recruited through local advertisements at the University of Duisburg-Essen and Internet advertisements. The mean age was $M=25.95$ (SD=8.21) years, the school education was Median=13 (range=9 -13) years.

**Instruments**

*Short and modified Internet Addiction Test*

The shortened (12 items) and modified (with respect to the rating scale) version of the original IAT (s-IAT, see Table 1) was applied.

*Compulsive Internet use scale (CIUS)*

The compulsive Internet use scale (CIUS; Meerkerk et al., 2009) is another measurement to assess Internet addiction with a one factor solution. The CIUS consists of 14 items which are rated on a 5-point-likert scale from 0 (“never”) to 4 (“very often”), with a total score range between 0 to 56.
Statistical analyses

The analyzed bivariate correlations were carried out with SPSS version 19.0 for Windows (IBM SPSS Statistics).

Results

The mean s-IAT overall score was M=24.56 (SD=7.84) and the mean CIUS score was M=13.69 (SD=10.03). Both, the s-IAT overall score and the CIUS score showed a high correlation (r=.897, p<.001). Additionally, also the “loss of control/time management” factor of the s-IAT were correlated to the CIUS (r=.818, p<.001) as well as the “craving/social problems” factor of the s-IAT with the CIUS score (r=.781, p<.001). The correlations between the “loss of control/time management” factor of the s-IAT and the s-IAT overall score (r=.919, p<.001) as well as the “craving/social problems” factor of the s-IAT and the s-IAT overall score (r=.862, p<.001) were comparable.

Discussion

Our main aim was to specify the factorial structure of the IAT by both exploratory and confirmatory factor analysis using different samples. In addition, we aimed at investigating convergent and divergent validity of the IAT. What came out is a short version of the IAT, which consists of 12 items, has a two factors solution and good reliability. The two factors solution was confirmed by the confirmatory factor analysis and we have good indices for convergent, divergent and incremental validity.

Why may be two factors more appropriate than three or more factors?

At a first inspection, one may wonder why we have found a two factor solution, given that previous studies mainly reported more factors (but note that Korkeila et al., 2010, also found a two factor solution). Indeed, the most recent studies with acceptable sample sizes found three
factors (Chang & Law, 2008; Widyanto et al., 2011). However, as pointed out in the introduction, some methodological aspects have to be considered when comparing previous studies with respect to the factors found in the analyses. Beyond the varying sample sizes in previous studies, the most important point is the method applied to define a factor or the number of factors, respectively. In most studies, the Kaiser criterion of computing the eigenvalues has been used which is a subjective/heuristic approach and which usually leads to an overestimation of the number of factors (Fabrigar et al., 1999). Here, we used Horn's parallel analysis (Horn, 1965) and the minimum average partial (MAP) test (Velicer, 1976) to determine the number of factors, which are statistical/analytical procedures suggested by Fabrigar et al. (1999). Indeed, the empirical findings would have resulted in three factors when using the Kaiser criterion, but in two factors when applying the parallel analysis and the MAP test. When comparing our two factors with those found by, for example, Chang and Law (2008) and Widyanto et al. (2011) as well as Korkeila et al. (2010), a very good commonality can be seen (see Table 6). Indeed, all our six items, which load on “loss of control/time management” were also the items loading on the “loss of control” factor in Korkeila et al. (2010). In addition, five out of the six items of this factor also loaded on the factor “time management and performance” found by Chang and Law (2008). The other item (Q14) loaded on the third factor by Chang and Law (2008). Again, most of our “loss of control/time management” items loaded on the factor “time management problems” found by Widyanto et al. (2011) (but note that one of the items, Q14 had very high parallel loadings in the study by Widyanto et al., 2011). A comparable picture emerges when looking at our second factor “craving/social problems”. All of our six items loading on this factor where also included in the second factor by Korkeila et al. (2010) and Chang and Law (2008). The other items not included in our 12 item version had a somehow divergent pattern of loadings across the other studies (see Table 6). In conclusion, we think that the two factors extracted in our current study are in line with the most convergent findings across previous studies and seem
therefore to be a reliable representation of the assessment of the Internet addiction’s key elements.

- please insert Table 6 here -

**Why a short version of the IAT?**

Although we initially have not necessarily intended to develop a short version of the IAT, the empirical data strongly convinced us that the 12 items are much better in assessing the phenomenon than the original 20 items. We applied rather strong criteria with respect to the main loadings and parallel loadings for including/excluding items from the scale (no main loading lower than .50 and no parallel loading higher than .20) (Ferguson & Cox, 1993). When comparing these criterions with those applied in previous studies, one can see that a sum of items would not have been included in other studies. For instance, in the study by Widyanto et al. (2011), some of the items with main loadings on their third factor “mood modification” had high parallel loadings on other factors. For example, Q20 had a main loading of .49 on the third factor, but also a loading of .44 on the first factor. In addition, Q8 had a loading of .49 on both the first and the second factor, Q11 had a rather low main loading of .40 on factor 1 and a high parallel loading of .37 on factor 3. The same picture emerges for Q3 (main loading of .49 on the first factor and .36 on the third factor) and Q15 (with .47 on the third factor and .40 on the first factor) (see Table 4 in, Widyanto et al., 2011). By contrast, the 12 items included in our short version of the IAT had also good empirical values (high loadings and low parallel loadings) in the previous studies mentioned, which emphasizes the reliability of the IAT factorial structure found in our current study and its 12 items.

In addition to these methodological issues, which have to be considered, there are also some content related aspects that led us believe that a shortened version of the IAT may be appropriate. Some questions of the original IAT seem to be a little bit out-dated, given the
current developments in technique and lifestyle. For instance, the question concerning
“checking your e-mails” is problematic for several reasons. First, there are several other ways
that have replaced – at least in some individuals – the communication via e-mail by other
electronic communication ways, for example via social media such as Facebook. In addition,
due to the accessibility of e-mails via Smartphones, it is no longer necessary to “check” e-
mails, but they are accessible mobile 24 hours a day. Indeed, this item had already been
excluded from the IAT by other researchers for the same reasons (see Chang & Law, 2008).
Furthermore, as spelled out in the Introduction, when using a modified version of the IAT to
assess a specific form of Internet addiction (such as experiencing problems in daily life due to
excessively playing Internet games or using Internet sex sites excessively) the former item
“checking your e-mails” is problematic, since it can not be “translated” appropriately.
Furthermore, there were several redundancies across some questions, which potentially led to
an overestimation of the IAT score or to an unequal weighting of some symptoms. In
conclusion, we think that the 12 items of the IAT represent the assessment of Internet
addiction adequately from both a methodological and content related manner.

Why a new scaling of the IAT answers?

We also suggest an adjusted IAT rating scale, because of a positive skewness of the answers
given in the original IAT. Although we suggest to keep the original 5-point-likert scale, we
adjusted it to “never”, “rarely”, “sometimes”, “often” and “very often”. From a
methodological point of view, it seems to be problematic to start the rating scale with a rather
moderate answer (“rarely”), because it can be a fundamental difference for an individual if
he/she has rarely, but not never, a problem in controlling her/his Internet use in comparison to
an individual who really never experience a loss of control, for example. In addition, the
extreme answer “always” is problematic (Cohen & Swerdlik, 2009; Rohrmann, 2007), in
particular because no concrete time for which the questions should be answered is given (e.g.,
“within the last 7 days” or “within the last 12 months”). Moreover, the original rating scale does not match perfectly the requirements for interval scale, which is important to consider when reporting scale’s mean scores. In summary, we believe that the adjusted answering format is more adequate from a methodological perspective.

**Validity of the s-IAT and the two s-IAT subscales**

In studies 3 and 4 of the current investigation, we have reported good convergent, divergent and incremental validity of the two factors of the s-IAT and the s-IAT overall score, respectively. The construct validity was good, in terms of the correlation between the time spent on the Internet and the s-IAT score. However, the relationship had a rather moderate effect, which means that experiencing problems in daily life due to using the Internet is more than just using the Internet excessively (measured by the time). This is in accordance with previous investigations which either found moderate correlations, e.g. between the CIUS or the IAT and time spent on the Internet (see meta-analysis by Tokunaga & Rains, 2010), or which found that the time spent on (specific) Internet sites did not explain additional variance of the IAT when considering other variables (such as psychological symptoms, variety of Internet applications used etc.) (Brand et al., 2011). Also with respect to construct validity, the s-IAT covers the main symptoms of Internet addiction, as suggested for example by other authors (Ko, Yen, Chen, Chen, & Yen, 2005; Ko et al., 2009; Meerkerk et al., 2009; Young, 2004). The main categories of symptoms derived from the diagnosis of substance dependency and pathological gambling are well reflected by the 12 items of the s-IAT. In particular, the loss of control domain and associated problems, such as neglecting other activities of daily life is reflected in the items of the first s-IAT factor. The also important domain of craving and withdrawal symptoms in combination with problems in social life is particularly reflected by the items of the second factor of the s-IAT. The convergent validity of the s-IAT is also
very good. The correlation between both the overall score and the s-IAT subscales with the CIUS (Meerkerk et al., 2009) is very high (see study 4).

Although the two s-IAT factors are inter-correlated, which allows for the building of an overall score, we found evidence that these two domains of addictive symptoms are – at least partially – divergently correlated with other psychological symptoms and personality facets. In addition, we found evidence for incremental validity of the two factors as hypothesized. The score in the factor “loss of control/time management” is the main predictor for obsessive-compulsive symptoms and impulsivity, while the factor “craving/social problems” predicts significantly paranoid ideation, neuroticism and (inversely) agreeableness. Both factors together explain variance only in interpersonal sensitivity (but note that the effects for interpersonal sensitivity are rather low given that the partial correlation is >.1 for the factor craving/social problems and <.1 for the factor loss of control/time management).

In conclusion, we think that studies 3 and 4 give good evidence for a good construct, convergent and incremental validity of the s-IAT. Given these results, we recommend to use the overall score of the s-IAT when examining an individual’s tendency to or degree of an Internet addiction. In studies, which address psychological correlates of symptoms related to Internet addiction, we suggest analyzing of the scores of the two subscales separately.

**Relationships between a tendency towards Internet addiction and sociodemographic characteristics**

With the 12 item version, we found significant inverse correlations (low to moderate effect) between the overall s-IAT score and both subscales and age (study 3), which is in line with previous investigations (Brenner, 1997; Kraut et al., 1998; Petrie & Gum, 1998; Wästlund, Norlander, & Archer, 2001), but see also the study by Widyanto et al. (2011), which did not find correlations between two of their three IAT factors and age. We also found that males had higher scores than females on both the two subscales and the overall score of the s-IAT.
This result is in accordance with a sum of previous studies (Ha et al., 2007; Korkeila et al., 2010; Morahan-Martin & Schumacher, 2000; Widyanto et al., 2011). Here, one has also to mention that Widyanto et al. (2011) did find correlations between age and IAT score when differentiating between males and females: while in males such a correlation was found, in females the IAT and age was unrelated (but the males were also significantly older than the females). In conclusion, in most of the studies with samples representative for the “digital natives”, an inverse correlation between a tendency towards Internet addiction and age has been reported as well as a stronger tendency in males compared to females. Our results match this pattern very well.

**Further developments when measuring Internet addiction**

Widyanto et al. (2011) pointed out that “instead of looking at Internet use in general, it would be more useful to research according to specific functions” (p. 147). We completely agree with this statement and would even strengthen their arguments. When looking at substance dependency research, it is widely regarded as appropriate to consider the first choice drug (e.g., alcohol, cocaine etc.) when studying, for example, cognitive functions, personality and clinical characteristics or the efficiency of therapeutic interventions in substance dependent individuals. For Internet addiction, a comparable distinction makes sense, which means that the first choice Internet usage should be considered. We have already started to investigate specific correlates and predictors of different facets of Internet addiction, e.g., Internet sex addiction (Brand et al., 2011) and Internet gaming addiction (Kim et al., 2008; Pawlikowski & Brand, 2011; Yang, 2001) using specific versions of the IAT. In these versions, only the words directly related to the Internet use have been replaced by words describing the specific facet. As an example: “How often do you find that you stay online longer than you intended?” (original IAT) was replaced by “How often do you find that you stay on Internet sex sites longer than you intended?” in the IATsex (Brand et al., 2011), and by “How often do you
find that you play World of Warcraft longer than you intended?” (in the IATwow) (Pawlikowski & Brand, 2011). We believe that with the 12 item version of the IAT and the good possibilities of specifying the facet of the Internet use easily, future studies can reliably assess the problems individuals experience in their daily life due to an excessive usage of the Internet or specific applications, respectively.
References


Figures

NQ = new question number of the s-IAT

Figure 1: Completely standardized factor loadings and residuals of the measurement model.
Table 1: Factor loadings and reliabilities of the two s-IAT factors, means of the rated items and the items numbers of the original IAT and the s-IAT.

<table>
<thead>
<tr>
<th>Item number</th>
<th>Item number</th>
<th>Item</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>M</th>
<th>(SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>s-IAT</td>
<td>original IAT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. factor: loss of control/time management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NQ1</td>
<td>Q1</td>
<td>How often do you find that you stay on-line longer than you intended?</td>
<td>.887</td>
<td>-.171</td>
<td>2.46</td>
<td>(1.21)</td>
</tr>
<tr>
<td>NQ8</td>
<td>Q16</td>
<td>How often do you find yourself saying &quot;just a few more minutes&quot; when on-line?</td>
<td>.792</td>
<td>.034</td>
<td>1.85</td>
<td>(1.09)</td>
</tr>
<tr>
<td>NQ2</td>
<td>Q2</td>
<td>How often do you neglect household chores to spend more time on-line?</td>
<td>.786</td>
<td>-.001</td>
<td>1.82</td>
<td>(1.00)</td>
</tr>
<tr>
<td>NQ9</td>
<td>Q17</td>
<td>How often do you try to cut down the amount of time you spend on-line and fail?</td>
<td>.633</td>
<td>.185</td>
<td>1.50</td>
<td>(0.86)</td>
</tr>
<tr>
<td>NQ3</td>
<td>Q6</td>
<td>How often do your grades or school work suffer because of the amount of time you spend on-line?</td>
<td>.587</td>
<td>.104</td>
<td>1.41</td>
<td>(0.74)</td>
</tr>
<tr>
<td>NQ6</td>
<td>Q14</td>
<td>How often do you lose sleep due to being online late at night?</td>
<td>.542</td>
<td>.170</td>
<td>1.56</td>
<td>(0.93)</td>
</tr>
<tr>
<td>2. factor: craving/social problems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NQ11</td>
<td>Q19</td>
<td>How often do you choose to spend more time on-line over going out with others?</td>
<td>-.023</td>
<td>.749</td>
<td>1.25</td>
<td>(0.63)</td>
</tr>
<tr>
<td>NQ10</td>
<td>Q18</td>
<td>How often do you try to hide how long you've been on-line?</td>
<td>-.042</td>
<td>.695</td>
<td>1.17</td>
<td>(0.53)</td>
</tr>
<tr>
<td>NQ5</td>
<td>Q13</td>
<td>How often do you snap, yell, or act annoyed if someone bothers you while you are on-line?</td>
<td>.118</td>
<td>.638</td>
<td>1.33</td>
<td>(0.69)</td>
</tr>
<tr>
<td>NQ12</td>
<td>Q20</td>
<td>How often do you feel depressed, moody, or nervous when you are off-line, which goes away once you are back on-line?</td>
<td>.031</td>
<td>.637</td>
<td>1.17</td>
<td>(0.53)</td>
</tr>
<tr>
<td>NQ7</td>
<td>Q15</td>
<td>How often do you feel preoccupied with the Internet when off-line, or fantasize about being on-line?</td>
<td>.114</td>
<td>.629</td>
<td>1.34</td>
<td>(0.67)</td>
</tr>
<tr>
<td>NQ4</td>
<td>Q9</td>
<td>How often do you become defensive or secretive when anyone asks you what you do on-line?</td>
<td>-.031</td>
<td>.628</td>
<td>1.30</td>
<td>(0.69)</td>
</tr>
</tbody>
</table>

Reliability | .876 | .836 |

NQ = new question number of the s-IAT
Q = question number of the original IAT
Table 2: Correlations between the s-IAT overall score with psychological-psychiatric symptoms (measured with the BSI) as well as the comparison of the correlations of the two s-IAT factors with the psychological-psychiatric symptoms.

<table>
<thead>
<tr>
<th>BSI (n=676)</th>
<th>s-IAT (sum)</th>
<th>s-IAT (control/time)a</th>
<th>s-IAT (craving/social)b</th>
<th>Fisher's Z</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somatization</td>
<td>.133**</td>
<td>.127**</td>
<td>.110**</td>
<td>0.017</td>
<td>0.315</td>
<td>.753</td>
</tr>
<tr>
<td>Obsessive-compulsiveness</td>
<td>.322**</td>
<td>.332**</td>
<td>.224**</td>
<td>0.117</td>
<td>2.112</td>
<td>.035</td>
</tr>
<tr>
<td>Interpersonal sensitivity</td>
<td>.223**</td>
<td>.194**</td>
<td>.211**</td>
<td>-0.018</td>
<td>-0.322</td>
<td>.748</td>
</tr>
<tr>
<td>Depression</td>
<td>.338**</td>
<td>.304**</td>
<td>.305**</td>
<td>-0.001</td>
<td>-0.019</td>
<td>.984</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.181**</td>
<td>.187**</td>
<td>.125**</td>
<td>0.064</td>
<td>1.159</td>
<td>.246</td>
</tr>
<tr>
<td>Anger-hostility</td>
<td>.261**</td>
<td>.221**</td>
<td>.256**</td>
<td>-0.037</td>
<td>-0.672</td>
<td>.502</td>
</tr>
<tr>
<td>Phobic anxiety</td>
<td>.171**</td>
<td>.122**</td>
<td>.203**</td>
<td>-0.0833</td>
<td>-1.518</td>
<td>.129</td>
</tr>
<tr>
<td>Paranoid ideation</td>
<td>.271**</td>
<td>.206**</td>
<td>.303**</td>
<td>-0.104</td>
<td>-1.876</td>
<td>.061</td>
</tr>
<tr>
<td>Psychoticism</td>
<td>.287**</td>
<td>.258**</td>
<td>.257**</td>
<td>0.001</td>
<td>0.019</td>
<td>.985</td>
</tr>
<tr>
<td>Global severity index (GSI)</td>
<td>.331**</td>
<td>.299**</td>
<td>.294**</td>
<td>0.006</td>
<td>0.099</td>
<td>.922</td>
</tr>
</tbody>
</table>

* p ≤ .05  
** p ≤ .01  

a "loss of control/time management“  
b "craving/social problems“
Table 3: Correlations between the s-IAT overall score with impulsivity (measured with the BIS) as well as the comparison of the correlations of the two s-IAT factors with the impulsivity.

<table>
<thead>
<tr>
<th>BIS (n=229)</th>
<th>s-IAT (sum)</th>
<th>s-IAT (control/time)(^a)</th>
<th>s-IAT (craving/social)(^b)</th>
<th>Fisher’s Z</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attentional impulsiveness</td>
<td>.283**</td>
<td>.282**</td>
<td>.212**</td>
<td>0.075</td>
<td>0.781</td>
<td>.435</td>
</tr>
<tr>
<td>Motor impulsiveness</td>
<td>.295**</td>
<td>.279**</td>
<td>.242**</td>
<td>0.039</td>
<td>0.415</td>
<td>.678</td>
</tr>
<tr>
<td>Non-planning impulsiveness</td>
<td>.153*</td>
<td>.205**</td>
<td>.039</td>
<td>0.169</td>
<td>1.792</td>
<td>.073</td>
</tr>
<tr>
<td>BIS overall score</td>
<td>.293**</td>
<td>.314**</td>
<td>.188**</td>
<td>0.135</td>
<td>1.411</td>
<td>.158</td>
</tr>
</tbody>
</table>

\(^{a}\) "loss of control/time management"
\(^{b}\) "craving/social problems"

* \(p \leq .05\)
** \(p \leq .01\)
Table 4: Correlations between the s-IAT overall score with personality facets (measured with the BFI-10) as well as the comparison of the correlations of the two s-IAT factors with the personality facets.

<table>
<thead>
<tr>
<th>BFI-10 (n=128)</th>
<th>s-IAT (sum)</th>
<th>s-IAT (control/time)&lt;sup&gt;a&lt;/sup&gt;</th>
<th>s-IAT (craving/social)&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Fisher’s Z</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraversion</td>
<td>-.016</td>
<td>.027</td>
<td>-.145</td>
<td>0.173</td>
<td>1.369</td>
<td>.171</td>
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<tr>
<td>Neuroticism</td>
<td>.352**</td>
<td>.264**</td>
<td>.403**</td>
<td>-0.157</td>
<td>-2.208</td>
<td>.227</td>
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<tr>
<td>Openness</td>
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<td>.106</td>
<td>.004</td>
<td>0.102</td>
<td>0.809</td>
<td>.418</td>
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<td>Agreeableness</td>
<td>-.104</td>
<td>-.026</td>
<td>-.198*</td>
<td>0.175</td>
<td>0.138</td>
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<td>Conscientiousness</td>
<td>-.311**</td>
<td>-.224*</td>
<td>-.371**</td>
<td>0.162</td>
<td>1.253</td>
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</table>

* p ≤ .05
** p ≤ .01
<sup>a</sup> "loss of control/time management"
<sup>b</sup> "craving/social problems"
Table 5: Specific predictive values if the two s-IAT factors (“loss of control/time management” and “craving/social problems”) with respect to the several validation constructs.

<table>
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<tr>
<th></th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>Partial-correlation</th>
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<tbody>
<tr>
<td><strong>“obsessive-compulsiveness“ (n=675)</strong></td>
<td></td>
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<tr>
<td>„loss of control/time management“</td>
<td>.306</td>
<td>6.73</td>
<td>&lt;.001</td>
<td>.251</td>
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<tr>
<td>„craving/social problems“</td>
<td>.046</td>
<td>1.01</td>
<td>.315</td>
<td>.039</td>
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<tr>
<td><strong>“impulsivity“ (n=229)</strong></td>
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<tr>
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<td>.312</td>
<td>3.99</td>
<td>&lt;.001</td>
<td>.257</td>
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<tr>
<td>„craving/social problems“</td>
<td>.004</td>
<td>0.05</td>
<td>.961</td>
<td>.003</td>
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<tr>
<td><strong>“interpersonal sensitivity“ (n=675)</strong></td>
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</tr>
<tr>
<td>„craving/social problems“</td>
<td>.155</td>
<td>3.31</td>
<td>.001</td>
<td>.127</td>
</tr>
<tr>
<td>„loss of control/time management“</td>
<td>.102</td>
<td>2.16</td>
<td>.031</td>
<td>.083</td>
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<tr>
<td><strong>“paranoid ideation“ (n=675)</strong></td>
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<tr>
<td>„craving/social problems“</td>
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<td>6.10</td>
<td>&lt;.001</td>
<td>.229</td>
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<td>0.81</td>
<td>.416</td>
<td>.031</td>
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<td>3.71</td>
<td>&lt;.001</td>
<td>.315</td>
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<td>0.16</td>
<td>.873</td>
<td>.014</td>
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<td><strong>“agreeableness“ (n=128)</strong></td>
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<tr>
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<td>.008</td>
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<td>.165</td>
<td>1.47</td>
<td>.144</td>
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Table 6: Overview of the different extracted factor structures and the associated items of the original IAT in comparison to the factor structure and the associated items of the s-IAT.

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</thead>
<tbody>
<tr>
<td></td>
<td>control/ time&lt;sup&gt;a&lt;/sup&gt;</td>
<td>craving/ social&lt;sup&gt;b&lt;/sup&gt;</td>
<td>control&lt;sup&gt;c&lt;/sup&gt;</td>
<td>salient&lt;sup&gt;d&lt;/sup&gt;</td>
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<td>Q1</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Q2</td>
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<td>x</td>
<td>x</td>
<td>x</td>
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<td>x</td>
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<td>Q14</td>
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<tr>
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<td>x</td>
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<td>x</td>
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<td>x</td>
<td>x</td>
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<td>x</td>
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<td>x</td>
<td>x</td>
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<tr>
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<td>x</td>
<td>x</td>
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<td>Q7</td>
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<td>x</td>
<td>x</td>
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<td>Q8</td>
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<td>Q10</td>
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<td>x</td>
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<tr>
<td>Q11</td>
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<td>Q12</td>
<td>x</td>
<td>x</td>
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</tr>
</tbody>
</table>

<sup>a</sup>“loss of control/time management”
<sup>b</sup>“craving/social problems”
<sup>c</sup>“loss of control”
<sup>d</sup>“salient use”
<sup>e</sup>“time management & performance”
<sup>f</sup>“withdrawal & social problems”
<sup>g</sup>“reality substitute”
<sup>h</sup>“psychological/emotional conflict”
"time-management problems"
"mood modification"