Want to Know Who's at Risk for Internet Addiction? Click Here

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Introduction

On February 4, 2012, the Taipei Times published the following article: "A 23-year-old man died in an Internet cafe in New Taipei City after 10 straight hours of gaming on Tuesday . . . About 10 other players were in the cafe, but said they only knew something had happened after the police started cordoning off the area for forensic sweeps, but to the police officers' surprise, most either stayed in front of their computers and kept on gaming or took little interest." Such stories, while fortunately uncommon, are on the rise. Although empirical research on internet addiction remains in its infancy, it is emerging as an area of considerable interest. Young (1999) has defined internet addiction as a problem of "pathological use" and as "an impulse-control disorder which does not involve an intoxicant." Her assessment measure, the Internet Addiction Test (IAT; Young, 1999), is used widely among internet addiction researchers. The IAT is not designed to classify persons as categorically addicted or non-addicted, but instead to assign them along a continuous spectrum of pathological behavior, with higher scores indicating more frequent problematic behavior and greater impact on everyday functioning. Using outcome measures such as the IAT, a few investigators have recently attempted to identify risk factors, including personality and neurocognitive processes associated with internet abuse. However, no study has yet tested a broad range of these factors, a task that remains necessary for the future assessment of this topic.

Two studies (Armstrong et al., 2000; Kim & Davis, 2009) found a negative association between self-esteem and problematic internet use, suggesting that people who reported higher levels of internet addiction also experienced poorer self-esteem. Similarly, Durak and Durak (2011) and Cao and colleagues (2011) reported that individuals highly addicted to the internet appeared to have experienced less satisfaction with life. In addition, earlier qualitative studies conducted by Morahan-Martin (1999) and Young et al. (1999) concluded that people would abuse the internet in response to a need for anonymity and the wish to hide behind online personas.

Recently a few studies have concluded that internet-addicted individuals act more impulsively. For example, Zhou et al. (2010), Lee et al. (2012), and Park et al. (2013) found that subjects with higher levels of internet addiction also scored higher on the Barratt Impulsiveness Scale compared to control subjects. Yoo et al. (2004) further demonstrated that as subjects' internet addiction level increased, so did their ADHD symptom scores.

In general, the above findings have provided preliminary evidence that personality features and neurocognitive factors are correlates of problematic internet use. However, fundamental questions about the nature and scope of internet addiction are still not fully known. In addition, while researchers have suggested the importance of

anonymity in motivating problematic internet use, this notion remains underdeveloped. The current study was designed to address two research questions:

1. Experiment 1: Are personality processes (i.e., appearance, performance, and social self-esteem; satisfaction with life; attributed oppression and felt oppression) a predictor of internet addiction?
2. Experiment 2: Is neurocognition (i.e., impulsivity, self-control, attentional blink, executive functioning, memory span, cognitive interference, and inhibition) a predictor of internet addiction?

Based on the existing literature, we hypothesized that aspects of self-esteem, life satisfaction, perceived oppression would be significant determinants of internet addiction. Specifically, we speculated that anonymity may be sought because persons addicted to the internet experience elevated perceptions of oppression. We also predicted that impulsiveness, self-control, attention, executive functioning, memory, cognitive interference and inhibition would be significant determinants of internet addiction. To our knowledge, this is the first empirical research to determine the role of a comprehensive profile of personality and neurocognitive processes in problematic internet use.

Methods

Experiments 1 and 2 were performed in different phases, and Experiment 2 remains an ongoing study. Consequently, the two sample sizes differ, and the sample size of Experiment 2 will continue to expand.

Experiment 1

Participants. A sample of 69 undergraduate students from California State University Channel Islands were recruited and tested. Demographic characteristics for participants are summarized in Table 1. Participation was voluntary and encouraged by the incentive of extra credit. Informed consent was obtained from each participant and the participant was debriefed at the end of testing.

Measures and Procedure. All participants were asked to complete a demographic questionnaire (which included gender, age, how far in school, race and ethnicity, and marital status) and the tests described below.

Participants' level of internet addiction was assessed using the Internet Addiction Test (IAT; Young, 1999). The test includes 20 self-report statements. Higher scores indicate greater levels of internet addiction. Their personality processes were assessed using the State Self-Esteem Scale (SSES; Heatherton & Polivy, 1991), Satisfaction with Life Scale (SWL; Diener et al., 1985), and Oppression Questionnaire OQ; Victoroff, 2005). The SSES consists of 20 self-report items in the three subdomains of appearance esteem, performance esteem, and social esteem, with higher scores indicating more self-esteem. The SWL measures overall life satisfaction using 5

self-report items, with higher scores indicating greater satisfaction with life. The OQ consists of 32 self-report items that measures perceptions of oppression in an attributed domain (thoughts of oppression) and a felt domain (feelings of oppression). Higher scores indicate that participants experience a greater perception of being oppressed.

Experiment 2

Participants. Thirty-seven undergraduate students from California State University Channel Islands were recruited and tested. Demographic characteristics for participants are summarized in Table 1.

Measures and Procedure. All participants were asked to complete a demographic questionnaire and the following battery of neurocognitive tests. As in Experiment 1, internet addiction level was assessed via the IAT.

The Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995) consist of 30 self-report items that measures impulsiveness in the domains of attentional impulsiveness, motor impulsiveness, and non-planning impulsiveness, with higher scores indicating more frequently impulsive behavior. The Self-Control Scale (SCS; Tangney et al., 2004) assesses self-control using 36 self-report statements, with higher scores corresponding to more self-control. The remaining neurocognitive tests were administered via a computer. The Attentional Blink Test (made available by the Rochester Institute of Technology at http://www.rit.edu/cla/gssp400/Blink/blinkinstr.html) requires participants to pick out two letters from a rapidly-displayed sequence of alphanumeric characters. The Berg's Card Sorting Test (BSCT; Berg, 1948) measures executive function (e.g., decision-making ability) by asking participants to sort cards according to a hidden series of rules they must work out as they go. The Corsi Block-Tapping Task (Corsi, 1973) evaluates working memory span by asking participants to remember and parrot back to the computer sequences of highlighted blocks; with each sequence becoming progressively longer until the participant can no longer hold them in memory. The Williams' Inhibition Test (WIT; Williams, 1992) probes participants for susceptibility to cognitive interference. Subjects match circles according to size, while attempting to ignore distracting information. The Stop-Signal Task (STOP-IT; Verbruggen et al., 2008) measures response inhibition. Participants answer prompts to identify shapes displayed onscreen. In some trials a tone is played, meaning the participant should not answer. The delay preceding this tone can be varied to affect the difficulty of the task. Participants who successfully inhibit their response would find the delay getting longer (and the task more difficult); those failing to inhibit would have the opposite experience.

Results

Experiment 1

A multiple regression analysis was computed to predict problematic internet use as a function personality processes. Table 2 depicts the regression coefficients for this analysis.

Internet addition was regressed on the six predictors (appearance, performance, and social self-esteem; satisfaction with life; attributed oppression and felt oppression), using a stepwise procedure. The regression was significant, $F(1, 65)=8.210$, $p=0.006$, $R2=0.112$. Among the predictors, only felt oppression ($B=0.425$, $t(69) = 2.865$, $p=0.006$) was a significant determinant of internet addiction. The other aspects of personality were not significant predictors of internet addiction.

Experiment 2

Figure 1 depicts a series of Pearson product-moment correlations between aspects of neurocognition and problematic internet use. Multiple significant correlations were found between errors committed during the cognitive interference task ($r=0.391$, $p=0.020$, $r2=0.152$), number of times subjects correctly identified both letters during the attentional blink task ($r= -0.382$, $p=0.024$, $r2=0.146$), and delay time during the stop-signal inhibition task ($r= -0.430$, $p=0.010$, $r2=0.185$) with internet addiction. None of the other correlations with impulsiveness, self-control, executive functioning, and memory span with internet addiction were statistically significant.

Discussion

For the current study, we attempted to examine the personality and neurocognitive determinants of problematic internet use in undergraduate students. The main findings revealed that only felt oppression significantly predicted internet addiction. Specifically, participants who reported higher levels of perceived oppression were more likely to abuse the internet.

Also, as we expected, poorer cognitive interference, attentional processes, and inhibition were significantly associated with higher levels of internet addiction. It seemed that individuals with higher levels internet addiction experienced more cognitive interference and thereby, committed more mistakes. In addition, these individual demonstrated impairments in attention and experienced problems in inhibiting their responses. Our hypotheses regarding the remaining variables were not supported. These findings suggest potential application in the realm of assessment. Although the IAT reliably identifies currently internet-addicted individuals, robust instruments do not yet exist for identifying those at risk for internet abuse. Our findings suggest that felt oppression may serve as a warning indicator. Furthermore, with increased sample size, future research may conclude that cognitive

interference, attentional processes, and inhibition are also strong indicators. An immediate goal of the present research is to continue to add more participants to the neurocognitive component of the investigation. As mentioned previously, our efforts represent the only attempt so far to build a comprehensive profile of factors predicting internet addiction.

As the current study did not probe causality, we can at present only speculate on the theoretical implications of these findings. It seems reasonable to suggest that the predictive power of felt oppression is in line with findings from with prior studies indicating that people are driven to internet abuse by the need for anonymity. Offering interpretations of the neurocognitive processes under consideration is more perilous. On the one hand, it is tempting to conclude that internet-addicted persons have decreased functioning in the areas of cognitive interference, attention, and response inhibition either because their internet abuse has precipitated these impairments, or because these deficits have made them more prone to internet abuse. However, it is just as reasonable to suggest that internet-addicted persons are betraying a lack of care or of motivation. Perhaps their time spent online has made computerized tasks less novel, and therefore less interesting to interact with.

Surprisingly, within our sample, we detected no strong associations between internet addiction and self-esteem, life satisfaction, or impulsiveness, making our study seemingly incongruent with the other research in our literature review. There are multiple possible reasons. First, only 6% of the sample in Experiment 1 and 3% of the sample in Experiment 2 fell in the moderately pathological usage range as categorized by Young (1999). No participants in either sample fit into the highly pathological range of internet addiction. This restricted range might have influenced our results. Second, prior studies examining self-esteem have used measures that model esteem as a trait variable, that is, a quality that is enduring and resistant to change. The SSES, by contrast, assessed self-esteem as state-dependent, meaning it is a variable that responds to the situation. Finally, with respect to impulsiveness, most prior studies were conducted with Asian populations; our demographic characteristics are sufficiently distinct to suggest that cultural differences may be in play.

To our knowledge, this study is the first to assess the broader scope of personality and neurocognitive functions in determining problematic internet use. Our findings may assist in identifying and predicting internet abuse patterns in order to construct prevention programs and prevent further development of pathological internet use.

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Table 1: Demographic Data

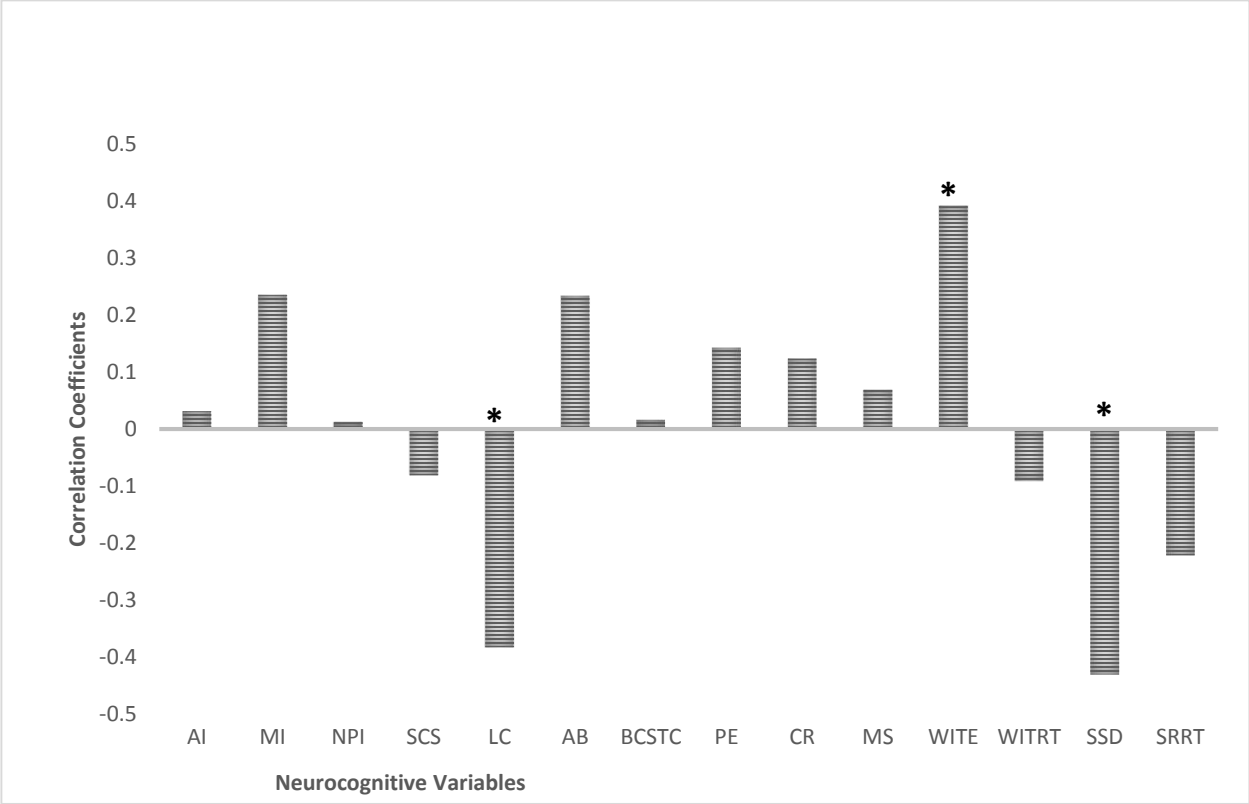
	Experiment 1	Experiment 2
Sample Size	69	37
Age	25.07(SD=6.09)	25.17(SD=6.58)
Gender		
Male	25	10
Female	44	27
Ethnicity		
Caucasian	31	16
Hispanic/Latino	24	18
Asian	6	2
Other	5	1
American Indian	2	0
Native Hawaiian /Pacific Islander	1	0

Table 2. Regression Coefficients of Personality Processes

	β	***t***	***p***
Appearance Self-Esteem	-0.10	-0.86	0.391
Performance Self-Eteem	-0.06	-0.47	0.642
Social Self-Esteem	-0.15	-1.20	0.236
Satisfaction With Life	-0.09	-0.77	0.445
Attributed Oppression	-0.09	-0.21	0.837
Felt Oppression	**0.43**	**2.87**	**0.006***

***$p < 0.05$ (one-tailed test)

Figure 1. Correlations of Neurocognitive Variables to Internet Addiction Scores



*** p<0.05**

Legend

AI	Attentional Impulsiveness as measured on BIS-11
MI	Motor Impulsiveness as measured on BIS-11
NPI	Non-Planning Impulsiveness as measured on BIS-11
SCS	Self-Control Scale score
LC	Number of times both letters correctly identified during the attentional blink task
AB	Number of times subject displayed attentional blink during the attentional blink task
BSCTC	Number of categories completed during the BSCT
PE	Number of perseverative errors committed during the BSCT
CR	Number of conceptual-level responses given during the BSCT
MS	Memory Span, as measured by the Corsi Block-Tapping task
WITE	Total errors committed during the WIT
WITRT	Mean reaction time while completing the WIT
SSD	The mean stop-signal delay recorded during the stop-signal task
SRRT	The mean signal-respond reaction time recorded during the stop-signal task