

Computer playfulness, Internet dependency and their relationships with online activity types and student academic performance

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Background and aims: Prior research on Internet dependency has examined various individual traits as contributing factors. Since domain-specific traits tend to have higher abilities to explain outcome variables, this study investigates a technology-related specific trait, i.e., computer playfulness, as a predictor of Internet dependency, and their influence on Internet usage patterns and academic performance. **Methods:** A sample of 267 college students was surveyed to examine these relationships. In addition to demographic information, the questionnaire contained measurement scales to assess playfulness, Internet dependency as well as work/study-related and social-related uses of the Internet. **Results:** Survey data indicate that playfulness significantly predicts Internet dependency ($\Delta R^2 = 19\%$). Playfulness is also significantly related to students' grade point average ($p < .001$), as well as Internet use for social purposes ($p < .022$), and its impacts are fully mediated by Internet dependency. It was also found that neither playfulness nor Internet dependency is significantly associated with Internet use for work/study purposes. **Conclusions:** Playfulness, as a domain-specific individual trait, is a powerful predictor of Internet dependency, which is positively related to social use of the Internet, and negatively related to student academic performance.

Keywords: Internet dependency, Internet addiction, computer playfulness, individual trait

INTRODUCTION

As our lives become increasingly tethered to modern technologies (Turkle, 2008), varying types and degrees of psycho-behavioral dependency on the use of these technologies, particularly the Internet, have been documented from all walks of life, from school children to working adults (see review by Chou, Condrón & Belland, 2005). Though different labels have been used in various contexts to describe the phenomenon (e.g., problematic Internet use, Davis, Flett & Besser, 2002; pathological Internet use, Morahan-Martin & Schumacher, 2000; Internet dependency, Scherer, 1997; computer dependency, Shotton, 1989; Internet addiction, Young, 1996), cumulative work emerges in this area over the nature of the phenomenon, its various manifestations (e.g., Chou et al., 2005; Kraut et al., 1998), as well as its psychological and occupational consequences (e.g., Davis et al., 2002; Kraut et al., 1998; Widyanto & McMurren, 2004; Young, 1996). A number of validated measurement instruments have also become available (e.g., Demetrovics, Szeredi, & Rózsa, 2008; Demetrovics et al., 2012; Jia & Jia, 2009; Meerkerk, Van Den Eijnden, Vermulst & Garretsen, 2009).

In the literature on Internet dependency, researchers have examined various factors that may contribute to this phenomenon. One stream of work concerns individual traits, which refer to individual attributes that consistently distinguish people from one another in terms of their basic tendencies to think, feel, and act in certain ways (Ones, Viswesvaran & Dilchert, 2005). Since traits are reasonably consistent over time (Buss, 1991), they are a particularly useful approach to studying individual behavior.

Internet dependency has been associated with a number of traits in prior work, ranging from broad traits, such as the

Big Five personality factors (Landers & Lounsbury, 2006), to narrow traits such as shyness (Ebeling-Witte, Frank & Lester, 2007) and need for cognition (Amichai-Hamburger, Kaynar & Fine, 2007). Though domain-specific, narrow traits tend to have higher abilities to explain outcome variables (Webster & Martocchio, 1992), technology-related specific traits have so far not been extensively examined in the literature. This study seeks to investigate one such domain-specific trait, i.e., computer playfulness, its relationship with Internet dependency, and their influence on Internet usage patterns and academic performance.

Computer playfulness, as a trait, refers to the degree of cognitive spontaneity in microcomputer interactions (Webster & Martocchio, 1992). Play is fun and satisfying (Agarwal & Karahanna, 2000) and can help one escape from real life into fantasy (Kuss & Griffiths, 2012). Since many computer dependents view computers as a toy, their computing activities are inherently playful (Shotton, 1989). In addition, the psychological state of playfulness has also been found to be empirically related to excessive computer use and play of online games (Chou & Ting, 2003). Not surprisingly, a recent literature review (Kuss & Griffiths, 2012) shows that playing online games, amongst all online activities, has a strong association with Internet dependency, and that many Internet dependents are compulsive gamers with a high intrinsic motivation to play games. It is thus hypothesized that trait playfulness leads to Internet dependency.

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H1: Playfulness is positively related to Internet dependency.

Since overuse or excessive use is a hallmark of Internet dependency (Chou et al., 2005), individuals high in Internet dependency will engage in greater amounts of daily Internet use. This study examines the specific types of online activities that individuals engage in, such as social use and work/study use (Hamburger & Ben-Artzi, 2000; Hills & Argyle, 2003). Since there exists evidence that common non-productive Internet usage activities are related to social purposes (Young & Case, 2004), it is hypothesized that Internet dependency is significantly associated with social activities online, rather than work/study-related ones.

H2: Internet dependency is positively related to Internet use for social purposes, but not related to Internet use for work/study purposes.

A number of studies have documented negative impacts of excessive Internet use on work and school (see Chou et al., 2005 and Kuss & Griffiths, 2012 for reviews). It is thus hypothesized that Internet dependency will lead to decreased academic performance.

H3: Internet dependency is negatively related to academic performance.

METHODS

Participants

An anonymous survey was distributed to 288 students in a junior-level undergraduate course in a public university in the US Midwest. After excluding those returning incomplete surveys, a total of 267 students, consisting of 173 males (65%) and 94 females (35%), were included in the sample. The average participant was 21.12 years old ($s.d. = .52$), had 7.49 years of online experience ($s.d. = 1.93$) and used the Internet for 2.84 hours per day ($s.d. = 1.54$).

Measures

In addition to questions related to demographic information such as gender, age, years of Internet experience, typical Internet usage hours per day and grade point average (GPA), the survey included the following measurement scales.

Playfulness was measured by Webster and Martocchio's (1992) four-item *Computer Playfulness Scale* as refined by Serenko and Turel (2007). Sample items include, "When using the Web I am Playful," and "When using the Web I am

spontaneous." The scale has shown satisfactory reliability in prior research (Serenko & Turel, 2007, Cronbach's alpha = .83) as well as in this study (alpha = .88).

Internet dependency was assessed by the ten-item *Online Cognition Scale* (Davis et al., 2002) as refined by Jia and Jia (2009). Sample items include, "When I am not online, I often think about the Internet," and "My use of the Internet sometimes seems beyond my control." The scale has also exhibited its reliability in prior work (Shi, Chen & Tian, 2011, Cronbach's alpha = .87) as well as in this research (alpha = .88). Both measures above used seven-point Likert-type scales from "Strongly Disagree (1)" to "Strongly Agree (7)".

The *Internet Services Scale* (Hamburger & Ben-Artzi, 2000) was used to assess the two specific types of online activities, including work/study (two items: How often do you "search for work-related information" and "search for study-related information") and social (two items: How often do you participate in "online chat for social reasons" and "online discussion groups for social reasons"). Five-point scales from "Never (1)" to "A Lot (5)" were used to capture the two types of use. The Cronbach's alphas for this study are .61 and .68, respectively, which were not as high as desired, but were deemed acceptable.

Procedure

The participants were informed that the objective of the study was to investigate the relationships between individual characteristics and Internet usage patterns and their implications. The participants filled out the anonymous survey in class and received extra course credit for their participation. The study was approved by the University's Human Subjects Committee.

RESULTS

Descriptive statistics and correlation matrix are presented in Table 1. As shown in the correlation matrix, playfulness is significantly correlated with Internet dependency, GPA, and social Internet use ($p < .01$ in all cases), but not with work/study related use. These zero-order correlational statistics provided initial support for the hypotheses. Further analyses using hierarchical regression were conducted to formally test the relationships because it can control for the effects of covariates and assess incremental validity of the predictors as they are entered sequentially into the model (Hair, Black, Babin, Anderson & Tatham, 1998). Hierarchical regression also makes it convenient to test mediated relationships.

To further examine the relationship between playfulness and Internet dependency (H1), gender was first entered into

Table 1. Descriptive statistics and correlation matrix

	Mean	SD	1	2	3	4	5
1 Gender	—	—					
2 Playfulness	4.02	.97	.32**				
3 Work/study use	3.79	.75	-.10*	-.01			
4 Social use	2.28	1.09	.02	.22**	.04		
5 GPA	3.10	.55	-.19**	-.19**	.02	-.06	
6 Internet dependency	2.72	1.19	.24**	.49**	.03	.34**	-.29**

* Correlation is significant at the 0.05 level (1-tailed).

** Correlation is significant at the 0.01 level (1-tailed).

Table 2. Hierarchical regression results

Variables added		Social Internet use					GPA				
		β	t	Sig.	ΔR^2	Total R^2	β	t	Sig.	ΔR^2	Total R^2
Step 1	Gender	.02	.29	.769	.00	.00	-.17	-2.86	.005	.03	.03
Step 2	Gender	-.05	-.85	.397	.05	.05	-.13	-2.01	.046	.02	.05
	Playfulness	.22	3.58	.001			-.14	-2.30	.022		
Step 3	Gender	-.08	-1.37	.173	.08	.12	-.10	-1.69	.093	.05	.09
	Playfulness	.08	1.12	.265			-.03	-.43	.666		
	Internet dependency	.32	4.90	.001			-.25	-3.68	.001		

the hierarchical regression equation as a control. Results show that males are more likely to exhibit Internet dependency ($p < .001$). Controlling for gender, playfulness has a significant positive relationship with Internet dependency ($p < .001$), explaining considerable incremental variance ($\Delta R^2 = 19\%$).

As observed earlier from the correlation matrix, neither playfulness nor Internet dependency is significantly related to work/study use, thus no further regression analysis was necessary. Since they are both significantly correlated with social use (both $p < .01$), further regression analysis was conducted to assess their relationships. Results in Table 2 show that while gender is not a significant predictor of social Internet use (Step 1: $p = .769$), both playfulness (Step 2: $p < .001$) and Internet dependency (Step 3: $p < .001$) are.

Though playfulness is significantly related to social Internet use (Step 1), it becomes non-significant (Step 2: $p = .265$) after Internet dependency is entered into the equation. According to Baron and Kenny's (1986) criteria for mediation (see Appendix for details), Internet dependency fully mediates the relationship between playfulness and social Internet use. This means that the impact of playfulness on social use is only through Internet dependency.

With regard to student academic performance, hierarchical regression results (Table 2) indicate that, males (Step 1: $p = .005$) and playful individuals (Step 2: $p = .022$) are likely to have lower GPA. When Internet dependency is entered into the equation, it shows a significant negative relationship with GPA (Step 3: $p < .001$) as playfulness becomes non-significant ($p = .666$). Thus, Internet dependency is again a full mediator (Baron & Kenny, 1986), which means that the negative impact of playfulness on academic performance is only through Internet dependency.

LIMITATIONS

When interpreting the above results, one must keep the following caveats in mind. The sample size is moderate, and all participants come from one junior-level undergraduate course, which may have implications for the generalizability of these results. Future studies should replicate this work with larger samples from different settings. Since all measurements were taken in one survey, there was potential for common method variance. As with other research employing a cross-sectional survey design, this study could not establish causality.

DISCUSSION

Though domain-specific traits tend to have higher abilities to explain outcome variables (Webster & Martocchio, 1992), they have not received much attention in the literature on Internet dependency. This study investigated one such technology-related specific trait, i.e., computer playfulness, as a predictor of Internet dependency, and their influence on individual online activity types and academic performance.

Data from a sample of college students supported all hypothesized relationships. Playfulness proved to be a significant predictor of Internet dependency, explaining a considerable amount of its variance after controlling for gender. This result confirms the efficacy of the domain-specific trait approach as well as the explanatory power of trait playfulness in this area of research.

Survey data also indicated that while males tend to exhibit higher playfulness and Internet dependency, no gender difference was found in social use of the Internet, though females engage in more work/study related use than males (Table 1). Corroborating prior studies (e.g., Hills & Argyle, 2003), Internet dependency was also found to be related to social use, but not with work/study use.

It was also found that playfulness is associated with increased social Internet use as well as decreased academic performance. However, since both relationships are fully mediated by Internet dependency, the influence of playfulness is manifested only through Internet dependency.

As our work and daily lives become increasingly shaped by modern technologies, Internet dependency is likely to become a more salient phenomenon. Only when this behavioral addiction is comprehensively understood, can risk variables be targeted and preventative means implemented (Kuss & Griffiths, 2012). The finding that computer playfulness, as a stable personality trait, is a significant predictor of Internet dependency, has important implications for research as well as prevention efforts. Since one's personality traits are formed early in life (e.g., fixed from the first grade, Nave, Sherman, Funder, Hampson & Goldberg, 2010), the earlier intervention efforts are initiated for those vulnerable to Internet dependency, the greater the chance that they are protected from its ramifications (Kuss & Griffiths, 2012). After one has reached adolescence or beyond, it may already be too late for intervention programs to be effective. As Kuss and Griffiths (2012) suggested, prevention efforts may include both psycho-education as well as provision of information and tools that focus on developing healthy ways to cope with social interaction and daily stress.

REFERENCES

- Agarwal, R. & Karahanna, E. (2000). Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. *MIS Quarterly*, 24, 665–694.
- Amichai-Hamburger, Y., Kaynar, O. & Fine, A. (2007). The effects of need for cognition on Internet use. *Computers in Human Behavior*, 23, 880–891.
- Baron, R. & Kenny, D. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173–1182.
- Buss, D. M. (1991). Evolutionary personality psychology. *Annual Review of Psychology*, 42, 459–491.
- Chou, C., Condrón, L. & Belland, J. C. (2005). A review of the research on Internet addiction. *Educational Psychology Review*, 17, 363–368.
- Chou, T. J. & Ting, C. C. (2003). The role of flow experience in cyber-game addiction. *CyberPsychology & Behavior*, 6, 663–675.
- Davis, R. A., Flett, G. L. & Besser, A. (2002). Validation of a new scale for measuring problematic Internet use: Implications for pre-employment screening. *CyberPsychology & Behavior*, 5, 331–345.
- Demetrovics, Z., Szeredi, B. & Rózsa, S. (2008). The three-factor model of Internet addiction: The development of the Problematic Internet Use Questionnaire. *Behavior Research Methods*, 40, 563–574.
- Demetrovics, Z., Urbán, R., Nagygyörgy, K., Farkas, J., Griffiths, M. D. et al. (2012). The development of the Problematic Online Gaming Questionnaire (POGQ). *PLoS ONE*, 7, e36417. doi:10.1371/journal.pone.0036417.
- Ebeling-Witte, S., Frank, M. L. & Lester, D. (2007). Shyness, Internet use, and personality. *CyberPsychology & Behavior*, 10, 713–716.
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E. & Tatham, R. L. (1998). *Multivariate data analysis*. Upper Saddle River, NJ: Prentice Hall.
- Hamburger, Y. A. & Ben-Artzi, E. (2000). The relationship between extraversion and neuroticism and the different uses of the Internet. *Computers in Human Behavior*, 16, 441–449.
- Hills, P. & Argyle, M. (2003). Uses of the Internet and their relationships with individual differences in personality. *Computers in Human Behavior*, 19, 59–70.
- Jia, R. & Jia, H. H. (2009). Factorial validity of problematic Internet use scales. *Computers in Human Behavior*, 25, 1335–1342.
- Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukopadhyay, T. & Scherlis, W. (1998). Internet paradox: A social technology that reduces social involvement and psychological well-being? *American Psychologist*, 53, 1017–1031.
- Kuss, D. J. & Griffiths, M. D. (2012). Online gaming addiction in children and adolescents: A review of empirical research. *Journal of Behavioral Addictions*, 1, 3–22.
- Landers, R. N. & Lounsbury, J. W. (2006). An investigation of Big Five and narrow personality traits in relation to Internet usage. *Computers in Human Behavior*, 22, 283–293.
- Meerkerk, G.-J., Van Den Eijnden, R. J. J. M., Vermulst, A. A. & Garretsen, H. F. L. (2009). The Compulsive Internet Use Scale (CIUS): Some psychometric properties. *CyberPsychology and Behavior*, 12, 1–6.
- Morahan-Martin, J. & Schumacher, P. (2000). Incidence and correlates of pathological Internet use among college students. *Computers in Human Behavior*, 16, 13–29.
- Nave, C. S., Sherman, R. A., Funder, D. C., Hampson, S. E. & Goldberg, L. R. (2010). On the contextual independence of personality: Teachers' assessments predict directly observed behavior after four decades. *Social Psychological and Personality Science*, 1, 327–334.
- Ones, D. S., Viswesvaran, C. & Dilchert, S. (2005). Personality at work: Raising awareness and correcting misconceptions. *Human Performance*, 18, 389–404.
- Scherer, K. (1997). College life on-line: Healthy and unhealthy Internet use. *Journal of College Student Development*, 38, 655–664.
- Serenko, A. & Turel, O. (2007). Are MIS research instruments stable? An exploratory reconsideration of the computer playfulness scale. *Information & Management*, 44, 657–665.
- Shi, J., Chen, Z. & Tian, M. (2011). Internet self-efficacy, the need for cognition, and sensation seeking as predictors of problematic use of the Internet. *Cyberpsychology, Behavior, and Social Networking*, 14, 231–234.
- Shotton, M. A. (1989). *Computer addiction? A study of computer dependency*. Bristol, PA: Taylor & Francis.
- Turkle, S. (2008). Always-on/Always-on-you: The tethered self. In J. E. Katz (ed.), *Handbook of mobile communication studies*. Cambridge, MA: MIT Press.
- Webster, J. & Martocchio, J. J. (1992). Microcomputer playfulness: Development of a measure with workplace implications. *MIS Quarterly*, 16, 201–226.
- Widyanto, L. & McMurran, M. (2004). The psychometric properties of the Internet Addiction Test. *CyberPsychology & Behavior*, 7, 443–450.
- Young, K. S. (1996). Psychology of computer use: XL. Addictive use of the Internet: A case that breaks the stereotype. *Psychological Reports*, 79, 899–902.
- Young, K. S. & Case, C. J. (2004). Internet abuse in the workplace: New trends in risk management. *CyberPsychology & Behavior*, 7, 105–111.

APPENDIX

Details regarding Baron and Kenny's (1986) three-step mediation criteria:

First, the predictor (computer playfulness, CP) must be related to the mediator (Internet dependency, ID). This requirement has been met as H1 is supported.

Second, the predictors (CP) must be related to the dependent variable (Social use). This requirement is met in view of the significant regression coefficient for CP ($t = 3.58, p < .001$ in Table 2, Step 2).

Third, when the mediator (ID) is added to the regression equation (Table 2, Step 3), the relationship between the predictor (CP) and the dependent variable (Social use) must become weaker (i.e., partial mediation) or non-significant (i.e., full mediation). This requirement is also met because the regression coefficient of CP decreased to non-significant ($t = 1.12, p = .265$) after the mediator (ID) is entered into the equation (Step 3).

Therefore, the relationship between playfulness and social Internet use is fully mediated by Internet dependency.