Can Computer Playfulness and Cognitive Absorption Lead to Problematic Technology Usage?

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CAN COMPUTER PLAYFULNESS AND
COGNITIVE ABSORPTION LEAD TO
PROBLEMATIC TECHNOLOGY USAGE?

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Abstract

Prior IS research demonstrates that computer playfulness, personal innovativeness and cognitive absorption during technology use lead to a number of positive behavioral and affective outcomes. While early studies have warned that these individual traits and psychological states can lead to certain negative effects, little IS research has empirically investigated this possibility. Building on recent findings in psychological research, this study represents an initial effort to fill this gap. Following prior IS work and using the World Wide Web as the target technology, our survey data revealed that innovative, playful and cognitively absorbed technology users are more likely to 1) exhibit problematic usage behavior, and 2) engage in higher daily usage. However, this increased overall usage is likely a result of increased use for social and leisure purposes, rather than for work and study purposes. Managerial and research implications of our findings are discussed.

Keywords: Computer playfulness, personal innovativeness, cognitive absorption, problematic technology use, Internet addiction, technology acceptance, technology adoption

Introduction

Prior research has shown that individuals high in computer playfulness (Webster and Martocchio 1992) and personal innovativeness (Agarwal and Prasad 1998) are more likely to experience cognitive absorption (or engagement) during technology use. Defined as “a psychological state of deep involvement with software” (Agarwal and Karahanna 2000), cognitive absorption further leads to positive outcomes such as behavioral intentions to use technology (Agarwal and Karahanna 2000), increased satisfaction and decision performance (Hess, Fuller and Mathew 2006), and improved learning in software training (Martocchio and Webster 1992).
In contrast to the positive affective and behavioral outcomes reported in these IS studies, recent research in psychology on the same technologies (e.g., personal computer, the World Wide Web) has documented varying types and degrees of problematic usage behaviors associated with high cognitive involvement and other psychological states (e.g., Chou, Condron and Belland 2005; Davis 2001; Shotton 1989; Yellowlees and Marks 2007; Young 1996).

Curiously, despite their cognitive involvement, these users often do not experience the same positive outcomes reported in the IS literature (e.g., Hess et al. 2006; Martochhio and Webster 1992; Webster and Martochhio 1992). Instead, considerable levels of regret and guilt, and most importantly, interference with academic or work performance, and social lives have been observed (e.g., Brenner 1997; Chou et al. 2005; Scherer 1997; Shotton 1989; Young 1996). More severe cases of problematic usage behavior have been characterized as “computer dependency,” “computer addiction” (Shotten 1989), “Internet addiction” (Young 1996) or “problematic Internet use” (Davis 2001).

How should these findings be reconciled? Why do cognitively absorbed technology users experience positive outcomes in one stream of research, but negative outcomes in another? Are technology users who tend to experience high cognitive absorption also likely to engage in problematic technology use?

Although it has long been suggested that high cognitive involvement can lead to certain negative effects (e.g., longer time to task completion, Sandelands; 1988; over-involvement, Csikszentmihalyi 1975; and non-productive play, Webster and Martochhio 1992), little IS research has empirically investigated such possibility.

This study builds on the disparate areas of IS and psychology research and examines an integrated model including, cognitive absorption, its antecedents (personal innovativeness and computer playfulness), and problematic technology usage behavior. Given the sometimes tenuous linkage between intentions and actual behavior (Davis and Warshaw 1992), we also investigate whether cognitive absorption leads to actual technology usage, in addition to behavioral intentions as found in earlier studies (e.g., Agarwal and Karahanna 2000).

Following prior IS research (Agarwal and Karahanna 2000) and using the World Wide Web as the target technology, our survey data confirm the potentially negative outcomes of cognitive absorption and suggest that more innovative, playful and cognitively absorbed technology users are more likely to 1) exhibit problematic usage outcomes, and 2) engage in higher daily usage. However, this increased usage is likely a result of higher use for social and leisure purposes, rather than for work and study purposes.

The rest of the paper is organized as follows. We first discuss the theoretical background of cognitive absorption and its antecedents, and then introduce the psychological literature on problematic technology use. Next, we integrate these two streams of work and develop hypotheses. We then describe our research methodology and present our findings. The paper concludes with a discussion of contributions and implications for research and practice.

Theoretical Background

Cognitive absorption and its antecedents and outcomes

General traits 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 and Dilchert 2005) and are reasonably consistent over time (Buss 1991). The general trait of playfulness, also called “autotelic personality,” describes an individual's tendency to interact spontaneously, inventively, and imaginatively (Csikszentmihalyi 1990). In the IS context, computer playfulness, as a trait, has been defined as “the degree of cognitive spontaneity in microcomputer interactions” (Webster and Martochhio 1992, p. 204).

Psychological research suggests that playfulness results in immediate subjective experiences such as involvement (Csikszentmihalyi 1975; Sandelands et al. 1983), which has been found applicable in the IS context as computer playfulness is shown to be an antecedent to cognitive absorption during technology use (Agarwal and Karahanna 2000).
Also established as an antecedent of cognitive absorption is personal innovativeness in the domain of information technology, which is a trait that reflects a willingness to try out new technologies (Agarwal and Prasad 1998).

Cognitive absorption, related to the flow experience (Csikszentmihalyi 1975, 1990), is conceptualized as having five dimensions: temporal dissociation, focused immersion, heightened enjoyment, control, and curiosity (Agarwal and Karahanna 2000). Empirical work suggests that this psychological state leads to a number of positive outcomes such as, behavioral intention to use technology, increased learning in software training, and user satisfaction (e.g., Agarwal and Karahanna 2000; Venkatesh 2000; Webster and Ho 1997; Webster and Martocchio 1992, 1995; Trevino and Webster 1992).

The conceptual model above (Figure 1) illustrates the logic and main categories of constructs in this line of research. A user’s individual characteristics (e.g., demographics, traits) predispose one to experience certain psychological states during technology use, which in turn lead to certain behavioral and affective usage outcomes. Although prior IS research has primarily focused on the favorable usage outcomes of high cognitive involvement, there are likely negative outcomes as well (e.g., longer time to task completion, Sandelands 1988, Starbuck and Webster 1991; over-involvement, Csikszentmihalyi 1975; and non-productive play, Webster and Martocchio 1992). However, little empirical IS research has explored such possibility.

In the next paragraphs, we introduce the psychological research on problematic technology use and see how their findings may inform our understanding in this phenomenon.

### Problematic technology use

Modern information technologies, such as personal computers and the World Wide Web, have emerged as an essential part of daily work and life for many and have brought numerous benefits to organizations and the society as a whole. Along with the benefits that these technologies bring, it is not surprising that some users demonstrate problematic usage behavior, which has increasingly caught the attention of psychological researchers and practitioners alike (Davis, Flett and Besser 2002).

Among the many types of technologies that have been studied in the psychology literature are video games (Keepers 1990), amusement machines (Griffiths 1992), personal computers (Shotton 1989), and more recently, the Internet (Young 1996). Problematic usage behavior can be manifested in various ways, including intense preoccupation with technology use (Chou 2001; Treuer, Fabian and Furedi 2001), poor impulse control (Beard and Wolf 2001; Treuer et al. 2001), excessive amounts of usage time, compulsive use, increased anxiety if use is restricted, decreased social interaction with “real” people, and increased post-usage loneliness, depression and guilt (Chou et al. 2005; Kraut et al. 1998; Nalwa and Anand 2003; Whang, Lee and Chang 2003). A variety of psychological and occupational consequences such as, neglect of academic, work, and domestic responsibilities and disruption of social relationships, have been documented (e.g., Brenner 1997; Davis et al. 2002; Kraut et al. 1998; Shotton 1989; Young 1996; Widyanto and McMurran 2004). It is noteworthy that individuals who exhibit problematic usage behavior often report that, among the factors that motivate their usage is their psychological experience during technology use – total immersion, time distortion, and a sense of control – the same as the high cognitive involvement (absorption

![Figure 1. A Conceptual Model for Individual Technology Usage Experience](image-url)
and engagement) described in prior IS research as leading to positive behavioral and affective outcomes (e.g., Agarwal and Karahanna 2000; Webster and Martocchio 1992).

In fact, psychologists have characterized the more severe cases of problematic technology use as computer dependency, computer addiction (e.g., Shotton 1989), Internet addiction (e.g., Young 1996), Internet dependency (e.g., Scherer 1997), problematic Internet use (e.g., Davis 2001, Davis et al. 2002), and those who engage in such problematic use as “computer addicts” (Shotton 1989), “computer junkies” and “Internet addicts” (Beard and Wolf 2001).

Despite the continued debate regarding how the phenomenon of excessive technology use should be labeled and the extent of the phenomenon, there is a general agreement in the psychology literature over the nature of the phenomenon itself, and psychometrically sound measurement instruments have been developed (Chou et al. 2005; Davis et al. 2002).

In the context of Internet use, Davis (2001) offered a cognitive-behavioral view of the phenomenon and conceptualized problematic technology use as behaviors and cognitions associated with technology use that result in negative personal and professional consequences for the user. Davis et al. (2002) theorized the construct as having four dimensions: diminished impulse control (i.e., compulsive technology use), loneliness/depression (i.e., negative affective consequences of not using technology), distraction (i.e., procrastination and avoidance from social and occupational responsibilities through technology use), and social comfort (i.e., perceived social comfort during technology usage).

It is noted that problematic usage behavior may result when some psychological factor causes an individual to be vulnerable to dependence on technology use (Davis 2001). Research so far has studied a number of such psychological factors, from broad traits such as the Big Five personality factors (Landers and Lousbury 2006) to narrow traits such as work ethics (Landers and Lousbury 2006) and need for cognition (Amichai-Hamburger et al. 2007). However, IS-specific narrow traits such as, personal innovativeness and computer playfulness, have not been investigated in the psychological literature with the exception of one study which links playfulness with excessive play of online games (Chou and Ting 2003).

Consistent with the “Individual Technology Usage Experience” model in Figure 1, we integrate these two disparate areas of IS and psychology literature and develop hypotheses linking user traits such as computer playfulness and personal innovativeness, user psychological states such as cognitive absorption, and problematic technology use and actual usage activities.

**Hypothesis Development**

Based on the prior literature, a research model is developed (Figure 2). In the following paragraphs, we discuss the relationships proposed in the model. Our discussions will be brief in cases where the relationships have been established in the literature or already explored earlier in the paper.
Antecedents of cognitive absorption

We first seek to replicate findings from prior IS research that established personal innovativeness and computer playfulness as antecedents of cognitive absorption:

H1: Personal innovativeness is positively related to cognitive absorption with an information technology.

H2: Computer playfulness is positively related to cognitive absorption with an information technology.

Outcomes of cognitive absorption

As developed in the theory section, we hypothesize that cognitive absorption is a predictor of problematic technology use:

H3: Cognitive absorption with an information technology is positively related to problematic use of the technology.

The above hypothesis, in conjunction with H1 and H2, implies a mediated relationship and is thus restated as follows:

H3a: Cognitive absorption with an information technology will mediate the relationship between personal innovativeness and problematic use of the technology.

H3b: Cognitive absorption with an information technology will mediate the relationship between computer playfulness and problematic use of the technology.

As discussed earlier, prior IS research has linked cognitive absorption with behavioral intention to use (Agarwal and Karahanna 2000). Given the sometimes tenuous relationship between intentions and actual behavior (Davis and Warshaw 1992), we empirically test the linkage between cognitive absorption and the amount of actual use.

H4: Cognitive absorption with an information technology is positively related to the amount of actual daily usage of the technology.

The above hypothesis, in conjunction with H1 and H2, implies a mediated relationship and is thus restated as follows:

H4a: Cognitive absorption with an information technology will mediate the relationship between personal innovativeness and the amount of actual daily usage of the technology.

H4b: Cognitive absorption with an information technology will mediate the relationship between computer playfulness and the amount of actual daily usage of the technology.

In addition to the amount of daily usage, another approach to study usage is to examine the specific types of usage activities as technologies can be used for multiple purposes such as work/study, social, and leisure (Hamburger and Ben-Artzi 2000; Hills and Argyle 2003). We develop the following hypotheses to test whether personal innovativeness, computer playfulness and cognitive absorption predict specific types of usage activities:

H5a: Personal innovativeness, computer playfulness and cognitive absorption are positively related to use of an information technology for work/study purposes.

H5b: Personal innovativeness, computer playfulness and cognitive absorption are positively related to use of an information technology for social purposes.

H5c: Personal innovativeness, computer playfulness and cognitive absorption are positively related to use of an information technology for leisure purposes.
To summarize, through the above set of hypotheses, we seek to a) replicate prior research and confirm personal innovativeness and computer playfulness as antecedents of cognitive absorption, and b) establish that personal innovativeness, computer playfulness and cognitive absorption lead to outcomes such as, increased problematic technology usage behavior, amount of actual use, and specific types of usage activities. In the following sections, we describe the research methodology employed to test these relationships.

Methodology

A survey was conducted to examine the hypothesized relationships. Two hundred eighty eight students enrolled in a junior-level undergraduate business class at a public university were invited to participate for extra course credit.

In keeping with Agarwal and Karahanna (2000), the target technology chosen for this study was the World Wide Web, which is readily available on and off campus and is widely and voluntarily used by students. The technology also exemplifies the characteristics of contemporary IT that underscore the importance of notions of cognitive absorption (Agarwal and Karahanna 2000).

The survey was anonymous, and students were asked to respond to all items and in the way consistent with their perceptions and experience with the Web.

Measures

The measurement scales used in this study include Webster and Martocchio’s (1992) seven-item scale for computer playfulness (CP), Agarwal and Prasad’s (1998) four-item scale for personal innovativeness (PI), Agarwal and Karahanna’s (2000) twenty-item scale for cognitive absorption (CA), and Davis et al.’s (2002) thirty-six-item scale for problematic Internet use (PIU). (See Appendix for sample items from the PIU scales.) All the above were measured by seven-point Likert-type scales from “Strongly Disagree” to “Strongly Agree.”

Amount of actual daily usage was measured by the respondent’s number of hours of Web usage on a typical day. The extent of specific Web usage activities were assessed on the following three categories of usage developed in prior research (Hamburger and Ben-Artzi 2000; Hills and Argyle 2003): work/study (e.g., searching information related to work or study; email for work or study), social (e.g., real-time discussion and chat for social reasons, blogs and electronic billboards for social reasons) and leisure (e.g., random surfing, online games, adult websites). Five-point scales from “Never” to “A Lot” were used to capture the three types of usage activities.

In addition, demographic information such as gender, major, and prior Web experience was also collected.

Data Analysis

Hierarchical regression was used to analyze the data. The major advantage of this technique is that incremental validity of the predictor variables can be tested as they are entered sequentially into the regression model, i.e., the increased proportion of variance explained in the dependent variable ($R^2$ and its $p$-value) can be examined to assess whether newly entered predictor variables are significant (Hair et al. 1998).

Results

Useable responses consist of 283 students including 185 males (65%) and 97 females (35%). In addition, 191 students (67%) are business majors. The individuals in the sample use the Web for an average of 2.84 hours per day ($s.d. = 1.54$) and have an average of 7.49 years of Web experience ($s.d. = 1.93$), thus are likely to have well-formed attitudes and beliefs about the target technology.

Descriptive statistics, scale internal consistency reliability and correlation matrix are shown in Table 1. Though certain specific Web usage scales only have modest reliability, they are sufficient for exploratory studies such as ours.
The effect of demographic variables (gender, major, and Web experience) on the outcome variables (CA, PIU, actual daily Web usage, and specific types of usage) was first examined. Because respondent’s major is not significantly correlated with any of these outcome variables, it was dropped from subsequent analyses while gender and Web experience were retained.

To rule out the potential threat of multicollinearity, variance inflation factor (VIF) values were examined in all subsequent hierarchical regression models. With the largest VIF value for independent variables in all regression equations at 2.4, which is well within the threshold of 10 (Neter et al. 1996), multicollinearity is not likely an issue.

### Antecedents of Cognitive Absorption

Based on the hierarchical regression results shown in Table 2, gender and prior Web experience are significant predictors of cognitive absorption (CA). After controlling for their effect, personal innovativeness explained another significant portion of variance in cognitive absorption ($R^2 = 0.195$). These results suggest that technology users who are male, with long Web experience, and personally innovative, are more likely to experience high cognitive absorption during Web use. Thus, H1 is supported.

### Table 2. Personal Innovativeness and Cognitive Absorption (H1)

<table>
<thead>
<tr>
<th>Variables Added</th>
<th>$b$</th>
<th>$t$</th>
<th>Sig.</th>
<th>$AR^2$</th>
<th>Total $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step1 Gender</td>
<td>.223</td>
<td>2.234</td>
<td>.026</td>
<td>0.036</td>
<td>0.036</td>
</tr>
<tr>
<td>Web Exp</td>
<td>.050</td>
<td>2.064</td>
<td>.040</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2 Gender</td>
<td>-.039</td>
<td>-.414</td>
<td>.679</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Web Exp</td>
<td>.027</td>
<td>1.228</td>
<td>.221</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI</td>
<td>.302</td>
<td>8.026</td>
<td>.000</td>
<td>0.195</td>
<td>0.231</td>
</tr>
</tbody>
</table>

The same procedure was performed to test computer playfulness as a predictor of cognitive absorption (H2). Hierarchical regression results in Table 3 suggest that after controlling for gender and Web experience, computer playfulness accounted for a significant portion of variance in cognitive absorption ($AR^2 = 0.382$). Thus, H2 is supported. (Note that the small difference in the regression coefficients of the control variables in Tables 2 and 3 (as well as subsequent tables) is a result of listwise deletion of missing data. The coefficients will be equal if missing data are replaced with mean scores.)
Table 3. Computer Playfulness and Cognitive Absorption (H2)

<table>
<thead>
<tr>
<th>Variables Added</th>
<th>b</th>
<th>t</th>
<th>Sig.</th>
<th>ΔR²</th>
<th>Total R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.221</td>
<td>2.234</td>
<td>.026</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Web Exp</td>
<td>.044</td>
<td>1.838</td>
<td>.067</td>
<td>0.033</td>
<td>0.033</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-.115</td>
<td>-1.417</td>
<td>.158</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Web Exp</td>
<td>.027</td>
<td>1.417</td>
<td>.158</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP</td>
<td>.519</td>
<td>12.899</td>
<td>.000</td>
<td>0.382</td>
<td>0.415</td>
</tr>
</tbody>
</table>

The above results supported prior research findings that identified personal innovativeness and computer playfulness as antecedents of cognitive absorption (Agarwal and Karahanna 2000; Webster and Martocchhio 1992).

Cognitive Absorption as a Mediator

A hierarchical regression model was estimated to test whether cognitive absorption mediates the relationship between personal innovativeness and problematic Internet use (H3a). Results in Table 4 were examined to see whether Baron and Kenny’s (1986) three-step mediation procedures were satisfied.

Table 4. Hierarchical Regression Results for Problematic Internet Use (H3a)

<table>
<thead>
<tr>
<th>Variables Added</th>
<th>b</th>
<th>t</th>
<th>Sig.</th>
<th>ΔR²</th>
<th>Total R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Gender</td>
<td>.376</td>
<td>3.232</td>
<td>.001</td>
<td></td>
<td></td>
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<tr>
<td>WebExp</td>
<td>.026</td>
<td>.908</td>
<td>.365</td>
<td>0.045</td>
<td>0.045</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.217</td>
<td>1.797</td>
<td>.074</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WebExp</td>
<td>.010</td>
<td>.354</td>
<td>.724</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI</td>
<td>.181</td>
<td>3.816</td>
<td>.000</td>
<td>0.054</td>
<td>0.099</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.234</td>
<td>2.226</td>
<td>.027</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WebExp</td>
<td>-.009</td>
<td>-3.80</td>
<td>.704</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI</td>
<td>-.006</td>
<td>-1.22</td>
<td>.903</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>.619</td>
<td>8.845</td>
<td>.000</td>
<td>0.221</td>
<td>0.320</td>
</tr>
</tbody>
</table>

First, the predictors (PI) must be related to the mediator (CA). This requirement has been met as H1 is supported. Second, the predictors (PI) must be related to the dependent variable (PIU). This requirement is met in view of the significant regression coefficient for PI (t = 3.816, p < 0.000 in Step 2). Third, when the mediator (CA) is added to the regression equation, the relationship between the predictors (PI) and the dependent variable (PIU) must become weaker (partial mediation) or non-significant (full mediation). This requirement is also met because the regression coefficient of PI decreased from 0.181 (t = 3.816, p < 0.000) to -0.006 (t = -0.122, n.s.) after CA is entered into the equation (Step 3). Therefore, personal innovativeness leads to problematic Internet use, and the relationship is fully mediated by cognitive absorption. Thus, H3a is supported.

The above procedure was repeated to test whether cognitive absorption mediates the relationship between computer playfulness and problematic Internet use (H3b) using Baron and Kenny’s (1986) criteria. We note that the linkage between computer playfulness and cognitive absorption was already supported (H2). Hierarchical regression results in Table 5 confirm a significant relationship between computer playfulness and problematic
Internet use ($p < 0.000$ in Step 2). Though the regression coefficient for computer playfulness remained significant after cognitive absorption was entered into the equation, it decreased from 0.518 ($t = 10.314, p < 0.000$) to 0.328 ($t = 5.364, p < 0.000$). Cognitive absorption also explained significant incremental variance in problematic Internet use. The above results satisfied Baron and Kenny’s criteria for mediation. Therefore, playfulness leads to problematic Internet use, and the relationship is partially mediated by cognitive absorption. H3b is supported.

Table 5. Hierarchical Regression Results for Problematic Internet Use (H3b)

<table>
<thead>
<tr>
<th>Variables Added</th>
<th>b</th>
<th>t</th>
<th>Sig.</th>
<th>$\Delta R^2$</th>
<th>Total $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gender</td>
<td>.362</td>
<td>3.162</td>
<td>.002</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>Web Exp</td>
<td>.018</td>
<td>.641</td>
<td>.522</td>
<td>.041</td>
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<td></td>
<td></td>
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<td>.041</td>
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<tr>
<td>2</td>
<td>Gender</td>
<td>.031</td>
<td>.306</td>
<td>.760</td>
<td>.000</td>
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<tr>
<td></td>
<td>Web Exp</td>
<td>-.006</td>
<td>-.261</td>
<td>.794</td>
<td>.000</td>
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<tr>
<td></td>
<td>CP</td>
<td>.518</td>
<td>10.314</td>
<td>.000</td>
<td>.292</td>
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<td>.066</td>
<td>.685</td>
<td>.494</td>
<td>.000</td>
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<tr>
<td></td>
<td>Web Exp</td>
<td>-.017</td>
<td>-.770</td>
<td>.442</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>CP</td>
<td>.328</td>
<td>5.364</td>
<td>.000</td>
<td>.063</td>
</tr>
<tr>
<td></td>
<td>CA</td>
<td>.370</td>
<td>5.010</td>
<td>.000</td>
<td>.396</td>
</tr>
</tbody>
</table>

In summary, the above results (Tables 4 and 5) suggest that technology users, who are male and more personally innovative and playful, are more likely to experience cognitive absorption, and exhibit problematic Internet usage behaviors, manifested as compulsive use, negative affects when use is restricted, procrastination and avoidance from social and occupational responsibilities through usage, etc. Prior Web experience does not predict problematic Internet use.

**Actual technology usage**

Data for the amount of actual daily Web usage (in hours) were first log-transformed to correct for skewness before the hierarchical regression procedure was repeated to test cognitive absorption as the mediator between personal innovativeness/computer playfulness and actual daily usage.

Regression results in Table 6 suggest that, after controlling for gender and Web experience, personal innovativeness is a significant predictor of actual Web usage ($p < 0.001$ in Step 2) and that the relationship is fully mediated by cognitive absorption (Step 3). H4a is supported.
Table 6. Hierarchical Regression Results for Actual Daily Usage (H4a)

<table>
<thead>
<tr>
<th>Variables Added</th>
<th>b</th>
<th>t</th>
<th>Sig.</th>
<th>( \Delta R^2 )</th>
<th>Total  ( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Gender</td>
<td>-.035</td>
<td>-.490</td>
<td>.625</td>
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<td></td>
</tr>
<tr>
<td>Web Exp</td>
<td>.054</td>
<td>3.093</td>
<td>.002</td>
<td>.037</td>
<td>.037</td>
</tr>
<tr>
<td>2 Gender</td>
<td>-.125</td>
<td>-1.663</td>
<td>.098</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Web Exp</td>
<td>.046</td>
<td>2.674</td>
<td>.008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI</td>
<td>.103</td>
<td>3.471</td>
<td>.001</td>
<td>.044</td>
<td>.080</td>
</tr>
<tr>
<td>3 Gender</td>
<td>-.118</td>
<td>-1.607</td>
<td>.109</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Web Exp</td>
<td>.041</td>
<td>2.438</td>
<td>.015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI</td>
<td>.046</td>
<td>1.413</td>
<td>.159</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>.191</td>
<td>3.946</td>
<td>.000</td>
<td>.053</td>
<td>.134</td>
</tr>
</tbody>
</table>

Similarly, as shown in Table 7, computer playfulness is also a significant predictor of actual daily Web usage (Step 2) and that the relationship is fully mediated by cognitive absorption (Step 3). Thus, H4b is supported.

Table 7. Hierarchical Regression Results for Actual Daily Usage (H4b)

<table>
<thead>
<tr>
<th>Variables Added</th>
<th>b</th>
<th>t</th>
<th>Sig.</th>
<th>( \Delta R^2 )</th>
<th>Total  ( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Gender</td>
<td>-.034</td>
<td>-.479</td>
<td>.632</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Web Exp</td>
<td>.049</td>
<td>2.830</td>
<td>.005</td>
<td>.031</td>
<td>.031</td>
</tr>
<tr>
<td>2 Gender</td>
<td>-.105</td>
<td>-1.413</td>
<td>.159</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Web Exp</td>
<td>.046</td>
<td>2.650</td>
<td>.009</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP</td>
<td>.110</td>
<td>2.973</td>
<td>.003</td>
<td>.032</td>
<td>.063</td>
</tr>
<tr>
<td>3 Gender</td>
<td>-.079</td>
<td>-1.085</td>
<td>.279</td>
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<td></td>
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<tr>
<td>Web Exp</td>
<td>.040</td>
<td>2.355</td>
<td>.019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP</td>
<td>-.010</td>
<td>-.222</td>
<td>.824</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>.231</td>
<td>4.150</td>
<td>.000</td>
<td>.059</td>
<td>.123</td>
</tr>
</tbody>
</table>

The above results suggest that while gender is not a significant predictor of daily use, individuals with longer prior Web experience tend to engage in more daily use of the Web. Controlling for experience, individuals who are more innovative, playful and cognitively absorbed tend to engage in more Web use. These results suggest that personal innovativeness and computer playfulness not only predict behavioral intention to use as found in prior IS research (Agarwal and Karahanna 2000), they also predict actual use.

Specific types of Web usage (H5a,b,c)

A technology sometimes can be used for multiple purposes such as work/study, social and leisure (Hamburger and Ben-Artzi 2000; Hills and Argyle 2003). To test whether personal innovativeness, computer playfulness and cognitive absorption predict these specific types of Web use, we first noted from the correlation matrix (Table 1) that none of these predictor variables (or the demographic variables) is significantly correlated with work/study use of the Web. Thus, it can be concluded that personal innovativeness, computer playfulness and cognitive absorption do not predict work/study Web use. Thus, H5a is not supported.
Since the predictor variables, personal innovativeness, computer playfulness and cognitive absorption, are significantly correlated with social and leisure Web use, further analysis was warranted. Hierarchical regression results in Table 8 suggest that while both gender and prior experience have a significant effect on leisure use, gender is not a significant factor in social use (Step 1). Further, the results confirm that personal innovativeness, computer playfulness and cognitive absorption are significant predictors of both social and leisure use (Steps 2-4). Thus, H5b and H5c are supported.

<table>
<thead>
<tr>
<th>Variables Added</th>
<th>Social Use</th>
<th>Leisure Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b</td>
<td>t</td>
</tr>
<tr>
<td>1 Gender</td>
<td>-0.10</td>
<td>-0.70</td>
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<tr>
<td>Web Exp</td>
<td>0.071</td>
<td>2.014</td>
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<tr>
<td>2 Gender</td>
<td>-0.199</td>
<td>-1.315</td>
</tr>
<tr>
<td>Web Exp</td>
<td>0.055</td>
<td>1.578</td>
</tr>
<tr>
<td>PI</td>
<td>0.217</td>
<td>3.617</td>
</tr>
<tr>
<td>3 Gender</td>
<td>-0.258</td>
<td>-1.695</td>
</tr>
<tr>
<td>Web Exp</td>
<td>0.055</td>
<td>1.601</td>
</tr>
<tr>
<td>PI</td>
<td>0.135</td>
<td>1.946</td>
</tr>
<tr>
<td>CP</td>
<td>0.199</td>
<td>2.319</td>
</tr>
<tr>
<td>4 Gender</td>
<td>-0.213</td>
<td>-1.398</td>
</tr>
<tr>
<td>Web Exp</td>
<td>0.048</td>
<td>1.400</td>
</tr>
<tr>
<td>PIIT</td>
<td>0.104</td>
<td>1.491</td>
</tr>
<tr>
<td>CP</td>
<td>0.077</td>
<td>0.772</td>
</tr>
<tr>
<td>CA</td>
<td>0.269</td>
<td>2.334</td>
</tr>
</tbody>
</table>

Our earlier analysis suggests that more personally innovative, playful and cognitively absorbed technology users tend to engage in more overall Web usage (H4a,b). However, a closer examination of specific types of Web usage (H5a,b,c) reveals that such increased overall usage is likely for social and leisure purposes, rather than for work/study-related use.

Consistent with the above results, in a post hoc examination of the relationship between problematic Internet use and the types of Internet usage, individuals with more problematic usage behaviors reported significantly higher social and leisure use (both p < 0.000), but not work/study-related use (p = n.s.).

**Limitations**

This study has a number of limitations to be acknowledged before we can discuss the implications of our findings. The cross-sectional design does not allow us to demonstrate causality. There was also potential for common method variance. However, it should not be a concern because the correlation coefficients among perceptual variables are mostly moderate to low (Table 1).
Similar to Agarwal and Karahanna (2000), this study was conducted in an educational setting with undergraduate students as respondents. As Agarwal and Karahanna (2000) pointed out, the use of student subjects may be an issue when students differ systematically from the target population in general about their perceptions of the phenomenon of interest, such as in cases where students have uncrystallized attitudes, or where social norms may play an important role in the theoretical model of interest (Sears 1986). However, this is unlikely to be an issue as this research concerns “an individual (versus organizational) level phenomenon that examines a state resulting from the interaction of an individual with a specific system and the subjects are asked about an object about which they have well-formed perceptions and attitudes” (Agarwal and Karahanna 2000, p. 686). However, the extent of generalizability to users in other settings and other technologies is best assessed through future research.

**Implications and Contributions**

This research is among the first empirical IS studies to investigate the potential negative outcomes of technology use. Complementing prior work that linked personal playfulness, computer playfulness and cognitive absorption with positive usage outcomes (e.g., Agarwal and Karahanna 2000; Webster and Martocchio 1992), this study provides initial evidence that these same traits and cognitive states can also lead to problematic outcomes, manifested as excessive and compulsive use,crastination and avoidance of social and occupational responsibilities, etc. Our findings thus contribute to a deeper understanding of individuals’ intrinsic motivation to use technology and user reactions during technology use.

This study also contributes to IS research by replicating and extending prior findings – it confirms personal innovativeness and computer playfulness as antecedents of cognitive absorption (Agarwal and Karahanna 2000; Webster and Martocchio 1992) and demonstrates that cognitive absorption not only leads to behavioral intention to use a technology (Agarwal and Karahanna 2000) but also leads to actual use.

One of our intriguing results is that although high personal innovativeness, computer playfulness and cognitive absorption lead to increased overall technology usage, such increased use is likely for social (e.g., real-time discussion and chat, blogs and electronic billboards) and leisure (e.g., random surfing, online games, adult websites) purposes, rather than for work/study. This result is not surprising considering that many users may have lower intrinsic motivation in technology use for work/study than for social or leisure purposes, and cognitive absorption is thus less frequently observed in work/study settings.

This result has important research and managerial implications. Although computer playfulness is likely to lead to increased cognitive involvement in software training and more favorable learning outcomes, especially when such training is framed as “play” (Martocchio and Webster 1992), it may be difficult to extend these benefits to other organizational contexts since many work tasks cannot be realistically framed as play. If technology users only experience cognitive absorption and its associated positive outcomes to the extent that their technology use can be framed as play, then the managerial applicability of the cognitive absorption construct will be limited.

What perhaps deserves more managerial attention is the finding that individuals are more likely to experience cognitive absorption during social and leisure use of a technology, rather than during work use. This perhaps explains why the most common nonproductive Web usage activities identified in recent research are all for social and leisure purposes (Young and Case 2004). Playful employees who simply wanted to do a “quick” check of their personal email or online stock quotes may become easily absorbed and neglect their job responsibilities. One large company tracked all its Internet traffic and discovered that only 23% of the usage was business-related (Young 1998). Indeed, it has been argued that those who are more open to experience (a broad trait related to playfulness) engage in more personal use of the Web during work time, or cyberloafing (Jia et al. 2007).

Managers may also need to weigh the risk of problematic technology use by personally innovative employees against the benefits associated with their innovativeness and creativity. The perceived balance of benefits and risks likely depends on the profession and the organization.

Personal innovativeness in the domain of information technology and computer playfulness were shown as antecedents of cognitive involvement in prior research (Agarwal and Karahanna 2000; Webster and Ho 1997).
Although there exist some conceptual differences between the two constructs, there is likely overlap between them in the context of computer use as they are highly correlated in this study as well as in Agarwal and Karahanna (2000). Future research should examine to what extent they are separate constructs.

Future research should investigate the applicability of our findings in the organizational setting, clarify the boundary conditions of the cognitive absorption construct, and further delineate its positive as well as negative effects.

As IS researchers continue to assess benefits of technology adoption and use, more research attention should be given to the potentially negative consequences of technology use, which is necessary in order to achieve a thorough understanding of this phenomenon. We hope that our initial attempt at filling the gap in this literature stimulates more future research in this area.

Appendix. Sample items from the Problematic Internet Use scale (Davis et al. 2002)

**Diminished impulse control**
- I can’t stop thinking about the Internet.
- Even though there are times when I would like to, I can’t cut down on my use of the Internet.

**Loneliness/depression**
- I am less lonely when I am online.
- I feel helpless when I don’t have access to the Internet.

**Social comfort**
- I am most comfortable online.
- I feel safest when I am on the Internet.

**Distraction**
- I sometimes use the Internet to procrastinate.
- Using the Internet is a way to forget about the things I must do but don’t really want to.

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