Compulsive Smartphone Use: The Roles of Flow, Reinforcement Motives, and Convenience

Completed Research Paper

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Abstract

Along with its rapid growth of penetration, smartphone has become highly prevalent in recent years. Meanwhile, compulsive smartphone use emerges as a rising concern. Given that research on compulsive smartphone use is scarce in the information systems literature, this paper aims to reveal its significant determinants to enrich the theoretical development in this area. In particular, we incorporate flow, reinforcement motives (i.e., instant gratification and mood regulation), and convenience in the research model to examine their influences on compulsive smartphone use. We conduct an empirical online survey with 384 valid responses to assess the model. The findings show that flow and reinforcement motives have direct and significant effects on compulsive use. Convenience affects compulsive use indirectly through flow, while flow further mediates the effects of reinforcement motives on compulsive use. Implications for both research and practice are offered.

Keywords: Flow, motivation, IT adoption, user behavior, smartphones, compulsive use

Introduction

Smartphone has become one of the top-rated communication technologies in recent years (Lapointe et al. 2013). Meanwhile, smartphone use may become addictive and develop in the form of compulsive use (Salehan and Negahban 2013). Compulsive smartphone users check their devices continuously anytime and anywhere (Hoetjes 2013; Lapointe et al. 2013). In this circumstance, they may have physiological and psychological disorders (Thomée et al. 2007, 2011), as well as social problems (Bianchi and Phillips 2005; Park and Lee 2011).

In the information systems (IS) literature, the dark side of information technology (IT) usage/addition is an emerging research area (Cheung et al. 2013). IT addiction refers to "a psychological state of maladaptive

dependency on the use of a technology" (Turel et al. 2011, p. 1044). Some recent studies have addressed the effects of personality traits and demographics (e.g., Park and Lee 2011), and the measurement of IT addiction (e.g., Kwon et al. 2013). However, much still remains unclear regarding why users become addicted to ITs, and certainly to smartphones (Lapointe et al. 2013; Turel and Serenko 2010).

In this study, we *investigate the significant determinants of compulsive smartphone use*. Compulsive IT use is a manifestation of IT addiction (Xu et al. 2012), and also a behavioral aspect of problematic IT use (Young 1998). Caplan (2010) defined compulsive use as a core component of problematic Internet use. That is, users are unable to control their repetitive use of Internet. Accordingly, this study refers to compulsive smartphone use as a form of problematic smartphone use behavior. It denotes the extent to which people use smartphones repetitively and fail to control the use. Similar to previous studies (e.g., Caplan 2002, 2010), and to highlight the role of ITs, we examine compulsive smartphone use in general, instead of compulsive use of a specific function via smartphones (e.g., using Facebook via smartphones).

To address our research objective, we follow the perspective of the desirability-feasibility framework. Desirability refers to the value or motives of performing an action, whereas feasibility denotes the degree to which it is feasible or difficult to perform the action (Jia et al. 2012). People are likely to perform an action if the levels of desirability and feasibility are high. In this study, we consider two types of desirability factors: the positive and negative reinforcement motives (i.e., instance gratification and mood regulation), and one feasibility factor: convenience. We hypothesize that these factors are important drivers of compulsive smartphone use. We also contend that flow may mediate the influence of these factors. Flow is a positive internal state that is likely to occur in smartphone usage (Khang et al. 2013). Prior research has emphasized the positive consequences of flow (Hsu and Lu 2004; Zhou 2013). However, the negative aspects of flow are largely uninvestigated (Thatcher et al. 2008). We expect that incorporating the role of flow will enrich our understandings of compulsive smartphone use.

This paper is structured as follows. We first present the theoretical background. Then, we develop the research model and hypotheses. Next, we describe the research design and empirically test the model. Finally, we discuss the implications for research and practice, limitations, and opportunities for future research.

Theoretical Background

Flow Theory

Psychologist Csikszentmihalyi (1975) proposed the concept of flow, which refers to "the holistic experience that people feel when they act with total involvement" (Csikszentmihalyi 1975, p. 36). Individual who is in the flow state will perceive pleasurable and find the activity to be worth doing (Admiraal et al. 2011; Park and Hwang 2009). According to prior research, perceived enjoyment and concentration are the salient dimensions often used to measure flow (Novak et al. 2000; Webster et al. 1993; Zaman et al. 2010).

Flow has been found to bring positive outcomes in education, game playing, IT acceptance, and continuance adoption in online environments (Admiraal et al. 2011; Chang and Zhu 2012; Ho and Kuo 2010; Jung et al. 2009; Lu et al. 2009; Zhou and Lu 2011). In contrast, the dangers of flow are relatively little investigated. Recent research points out that flow may actually lead to the addiction of ITs (e.g., Khang et al. 2013; Park and Hwang 2009; Voiskounsky 2008). However, inconsistent empirical findings exist in this respect. For instance, Wan and Chiou (2006) found that flow has no significant impact on the addition of online games. Kim and Davis (2009) showed that flow only has an indirect effect on problematic Internet use.

Reinforcement Motives

Reinforcement motives, including positive and negative ones, are important antecedents of substance problematic behaviors. Positive reinforcement refers to the positive motives of substance use or abuse, whereas negative reinforcement means the motives of alleviating negative emotion (Koob 2004; Woicik et al. 2009). In the smartphone context, users may be motivated to achieve instant gratification by using various powerful functions via the devices (Brynjolfsson et al. 2013; Tillmann et al. 2012). Lee et al. (2014) revealed that checking repetition on smartphones may be reinforced because of the quickly accessible rewards (e.g., communication and social networking). Hence, this study refers to instant gratification as a

positive reinforcement motive, which highlights the extent to which rewards or needs can be achieved immediately with smartphones. On the other hand, this study considers mood regulation as a negative reinforcement motive, which highlights the process where people use smartphones for alleviating negative moods. Extant literature suggests that mood regulation is not only a symptom of IT addiction (Caplan 2010; Turel et al. 2011), but also a significant predictor of excessive IT usage (Caplan et al. 2009; Caplan 2010; Khang et al. 2013).

Convenience

Prior research refers to convenience as the perceived effort and time that are needed to perform a task (Collier and Sherrell 2010). In the smartphone context, convenience is found to be a major factor that promotes the rapid development of smartphones (Turel and Serenko 2010). Compared to desktop or laptop computers, smartphones are more convenient because they provide similar functions with few time and space constrains (Ting et al. 2011).

Collier and Kimes (2013) contended that convenience is similar to perceived ease of use and is also a more comprehensive factor. Ease of use means the extent to which the interface of ITs is free of effort (Davis 1989). In contrast, convenience highlights the effort and time required before, during, and after using ITs (Collier and Kimes 2013). Convenience considers both interface and situational components that relate to users' time and effort. For instance, convenience also considers situational issues like the location and accessibility of ITs.

Research Model and Hypotheses

Building upon the theoretical background, we propose that instant gratification, mood regulation (the two desirability factors), and convenience (the feasibility factor) are important determinants of compulsive smartphone use. Further, we argue that flow may mediate the influence of these factors. Figure 1 depicts our research model.

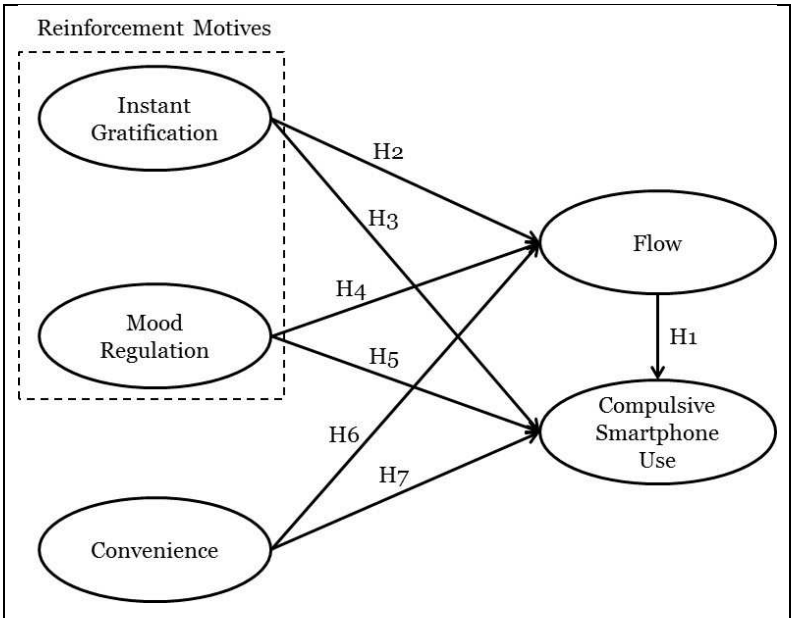

Figure1. Research Model

Flow

While a majority of prior research emphasizes the positive consequences of flow experience, recent research provides some empirical support to show that the optimal state of flow may also bring negative

outcomes. For instance, Chou and Ting (2003) found that flow affects cyber-game addiction significantly. In this research, we propose that flow may affect compulsive smartphone use in a similar manner. We expect that flow may function as an important stage prior to users' compulsive use (Khang et al. 2013). We provide the following hypothesis.

H1: Flow is positively associated with compulsive smartphone use.

Instant Gratification

As a positive reinforcement, instant gratification contributes to immediate satisfaction (Femenia 2000; Peterson et al. 2007). Research shows that if a system is designed to meet users' needs (e.g., entertainment and immediate feedback) instantly, then users are more likely be satisfied and reach to the flow state (Hoffman and Novak 1996; Lu et al. 2009). Thus, we propose that:

H2: Instant gratification is positively associated with flow.

Prior research shows that using smartphone may yield the feeling of immediate satisfaction, which accompanies with excessive usage behavior (Thomée et al. 2011). Scholars also show that the capability of smartphones to access rewards immediately may induce repetitive checking behaviors (Lee et al. 2014). Therefore, we hypothesize that:

H3: Instant gratification is positively associated with compulsive smartphone use.

Mood Regulation

As a negative reinforcement, mood regulation contributes to reduced dysphoric moods (Turel et al. 2011). It captures an escape from the uncomfortable feelings. Prior research finds that an online game player who desires to escape from real-life problems may engage in immersive role playing (Ryan et al. 2006). In a similar vein, this study provides the following hypothesis:

H4: Mood regulation is positively associated with flow.

Mood regulation also reflects the need of escaping from the real world. Xu et al. (2012) indicated that this motive may drive users to become addicted to online games. Larose et al. (2003) showed that users who have the needs of reducing negative feelings (e.g., anxiety, loneliness, and depression) may suffer from problematic Internet use. Therefore, we propose that:

H5: Mood regulation is positively associated with compulsive smartphone use.

Convenience

Prior research shows that feasibility factors posit important effects on flow (e.g., Ghani 1995; Zaman et al. 2010). In a similar vein, we expect that if users find using smartphones requires little effort and is free of time or space constrains (i.e., convenience), then they are more likely to become attentive and enjoyable in using the devices (i.e., the flow state). Thus, we hypothesize that:

H6: Convenience is positively associated with flow.

Turel and Serenko (2010) found that convenience is an key driver for the penetration and even addiction of mobile email use. Ting et al. (2011) contended that university students often find it convenient to use smartphones and then develop problematic usage of the devices. Similarly, we propose the following hypothesis in this study:

H7: Convenience is positively associated with compulsive smartphone use.

Methodology

To empirically assess the research model, we conducted a cross-sectional online survey. Details are presented as follows.

Data Collection

We developed an online questionnaire and collected data from a convenient sample of smartphone users at two universities in China. Before conducting our survey, we translated the original questionnaire from English to Chinese, and then translated it back to English. The two English versions were compared, and any inconsistencies were resolved to improve the translation quality. Invitation messages and flyers with the URL of the questionnaire were distributed. Finally, 384 valid responses were collected. Table 1 describes the demographic characteristics of the sample.

Table 1. Demographic Characteristics

		Number	Percentage
Gender	Male	209	54.4%
	Female	175	45.6%
Age	Below 18	7	1.8%
	18-24	244	63.5%
	25-30	106	27.6%
	Above 30	27	7.1%
Education	Senior high school or below	15	3.9%
	Specialty	29	7.6%
	Bachelor	152	39.6%
	Postgraduate or above	188	49%
Income (RMB)	Below 1000	195	50.8%
	1000-2000	43	11.2%
	2001-3000	41	10.7%
	Above 4000	105	27.4%
Usage duration per day	Below 30 minutes	34	8.9%
	30 minutes – 59 minutes	62	16.1%
	1 hour – 1 hour and 59 minutes	73	19.0%
	Above 2 hours	215	55.9%

Measures

Existing measures from previous studies were adapted with slight modifications to fit our context. The measures used seven-point Likert scales. Table 2 lists the measures in this study.

Table 2. Measures of Constructs

Construct	Items	References
Compulsive Smartphone Use (CSU)	CSU1: I have made unsuccessful attempts to reduce the time using smartphone. CSU2: I find it difficult to control my smartphone use. CSU3: When not using smartphone, I have a hard time trying to resist the urge to use it.	(Caplan 2010; Cheung et al. 2013)
Flow (FL)	FL1: Using smartphone is enjoyable. FL2: Using smartphone is fun. FL3: Using smartphone is interesting. FL4: When using smartphone, I am deeply engrossed. FL5: When using smartphone, I am absorbed intensely. FL6: When using smartphone, I concentrate fully on it.	(Zaman et al. 2010)
Instant Gratification (IG)	IG1: I use smartphone because it fulfills my needs immediately. IG2: The reason I use smartphone is to gain immediate gratification. IG3: I often use smartphone because it brings me immediate enjoyment.	(Liu et al. 2013)
Mood Regulation	MR1: I have used smartphone to make myself feel better when I	(Caplan

(MR)	was down. MR2: I have used smartphone to make myself feel better when I felt upset. MR3: I have used smartphone to forget worries. MR4: I have used smartphone to forget about problems.	2010; Stewart et al. 2006)
Convenience (CO)	CO1: I can use smartphone whenever I want. CO2: I can use smartphone wherever I am. CO3: Using smartphone is effortless for me. CO4: I find it convenient to use smartphone.	(Yoon and Kim 2007)

Data Analysis and Results

We adopted Partial Least Squares (PLS), which is a robust and one of the most used techniques in IS research (Goodhue et al. 2012). We followed the two-step process to analyze the data: the measurement and structural models (Hair et al. 1998).

Measurement Model

We calculated convergent and discriminant validity for the measurement model. Convergent validity is represented by composite reliability (CR) and average variance extracted (AVE). To ensure convergent validity, CR values should be more than 0.7, and AVE values should be above 0.5 (Fornell and Larcker 1981). After deleting CO1 for its low factor loadings, all CR and AVE values met the requirements. It indicated that convergent validity was adequate in this study (in Table 3).

Table 3. Descriptive Statistics of Constructs

Construct	Items	Loading	Mean	SD
Compulsive Smartphone Use CR=0.910; AVE=0.772	CSU1	0.872	3.95	1.665
	CSU2	0.921	3.76	1.655
	CSU3	0.841	3.72	1.627
Flow CR=0.916; AVE=0.646	FL1	0.850	4.72	1.261
	FL2	0.827	4.68	1.272
	FL3	0.801	4.98	1.199
	FL4	0.775	4.31	1.373
	FL5	0.793	4.21	1.363
	FL6	0.772	4.03	1.390
Instant Gratification CR=0.953; AVE=0.870	IG1	0.928	4.30	1.381
	IG2	0.961	4.11	1.325
	IG3	0.909	4.40	1.332
Mood Regulation CR=0.935; AVE=0.783	MR1	0.844	4.45	1.513
	MR2	0.859	4.18	1.476
	MR3	0.913	4.28	1.515
	MR4	0.921	4.24	1.530
Convenience CR=0.871; AVE=0.699	CO2	0.625	5.94	0.962
	CO3	0.939	5.23	1.447
	CO4	0.908	5.18	1.429

Discriminant validity examines the degree of differences between any two constructs. Table 4 shows that all items had high loadings on their corresponding constructs and low loadings on other constructs. Meanwhile, we examined the AVE analysis (in Table 5). The results showed that the square root of AVE for each construct was higher than the correlations with other constructs. Thus, discriminant validity was also sufficient in this study. We further employed Harman's single-factor test to detect possible common method bias (Podsakoff et al. 2003). The result showed that no single factor was extracted, and none of the factors explained a majority of the variances. Hence, this bias was less likely to be a serious concern in this study.

Table 4. Confirmatory Factor Analysis					
	CSU	FL	IG	MR	CO
CSU1	**0.872**	0.516	0.515	0.509	0.264
CSU2	**0.921**	0.491	0.475	0.537	0.226
CSU3	**0.841**	0.379	0.309	0.463	0.188
FL1	0.475	**0.850**	0.542	0.611	0.292
FL2	0.484	**0.827**	0.544	0.622	0.270
FL3	0.479	**0.801**	0.561	0.507	0.317
FL4	0.349	**0.775**	0.456	0.376	0.315
FL5	0.347	**0.793**	0.467	0.389	0.342
FL6	0.392	**0.772**	0.470	0.405	0.341
IG1	0.461	0.545	**0.928**	0.377	0.329
IG2	0.488	0.616	**0.961**	0.452	0.362
IG3	0.457	0.613	**0.909**	0.421	0.404
MR1	0.451	0.483	0.399	**0.844**	0.186
MR2	0.492	0.547	0.423	**0.859**	0.186
MR3	0.545	0.559	0.369	**0.913**	0.164
MR4	0.540	0.588	0.399	**0.921**	0.173
CO2	0.106	0.233	0.184	0.046	**0.625**
CO3	0.259	0.367	0.371	0.208	**0.939**
CO4	0.254	0.348	0.389	0.205	**0.908**

Table 5. Correlations of Constructs					
	CSU	FL	IG	MR	CO
CSU	**0.879**				
FL	0.532	**0.804**			
IG	0.503	0.635	**0.933**		
MR	0.575	0.617	0.448	**0.885**	
CO	0.260	0.385	0.392	0.199	**0.836**

Notes: The diagonal values in bold are square roots of AVEs

Structural Model

Figure 2 exhibits the results of the structural model. Flow (β=0.134, t=2.05) was found to be a significant predictor of compulsive smartphone use. Instant gratification positively affected flow (β=0.392, t=8.13) and compulsive use (β=0.231, t=3.98). Similarly, mood regulation placed significant impacts on flow (β=0.412, t=9.47) and compulsive use (β=0.380, t=7.34). Convenience had a significant effect on flow (β=0.149, t=3.32), but not on compulsive use (β=0.042, t=0.85). Hence, all hypotheses except for H7 were supported. Overall, our research model explained 56.1% of variances in flow and 41.7% of variances in compulsive use.

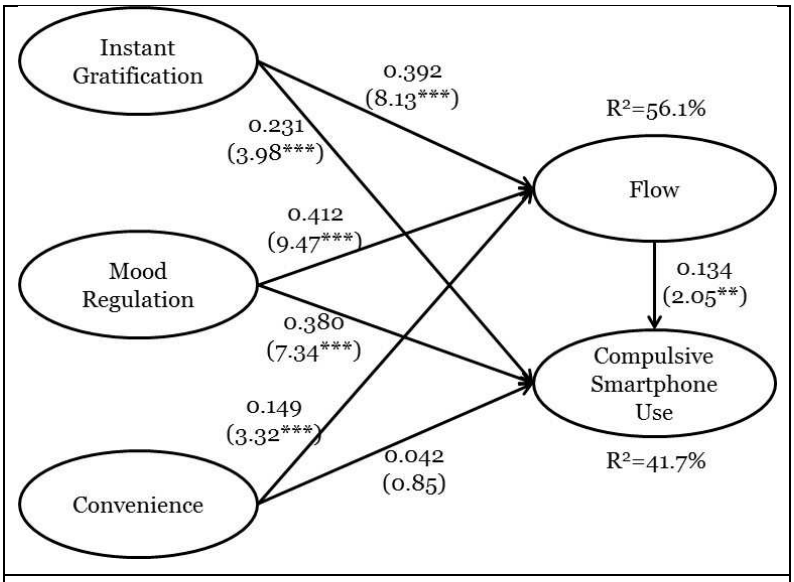

Figure 2. Structural Model

Notes: * denotes p<0.05; ** denotes p<0.01; *** denotes p <0.001.

Discussion and Conclusions

Motivated by the need to understand compulsive smartphone use, this study identifies its key driving factors. Our findings show that flow, instant gratification, and mood regulation positively affect compulsive smartphone use. Flow is also predicted by instant gratification, mood regulation, and convenience. Interestingly, convenience only affects compulsive use indirectly through flow. It implies that it is the desirability factors, rather than the feasibility factor, that directly stimulate compulsive use. Among the determinants of flow, mood regulation demonstrates the strongest effect. Mood regulation also places the strongest effect on compulsive use. These findings imply that it will be important to shed light on negative reinforcement motives in people's compulsive smartphone use.

Implications

This paper provides important theoretical implications in several aspects. First, given the limited research on compulsive smartphone use, this study adds to the extant literature by investigating its key determinants. Second, we highlight the role of flow in this study. We reveal the transition process from an optimal state (i.e., flow) to a negative consequence (i.e., compulsive smartphone use). We expect that this study is one of the first ones that examine the influence of flow on compulsive smartphone use. Third, the effects of reinforcement motives were consistent, in part, with recent research on IT addiction (Turel and Serenko 2012). Convenience is found to indirectly affect compulsive smartphone use through flow. The findings also show that mood regulation consistently demonstrates the strongest effects in the model. These findings enrich our understanding regarding how desirability and feasibility factors may lead to compulsive smartphone use.

The findings of this study further provide insights to the professional and public awareness of compulsive smartphone use. Recent survey reports show the increasing concerns of this compulsive behavior. Hence, it will be imperative to address this issue and provide possible prevention guidelines. According to our findings, compulsive smartphone use may be weakened if users are persuaded to use smartphones not for mood regulation. To decrease the level of instant gratification and flow experience, it may be helpful to interrupt smartphone usage behavior in an appropriate manner.

Limitations and Further Research

This study also has some limitations. The main limitation is related to the convenient sample of this study. To increase generalizability, future research may enlarge the sample size by considering respondents in

other sectors of the population or in other countries. Another limitation is that there may be other important factors missing in our model. Further research is thus suggested to explore possible factors (e.g., personality) that influence flow and compulsive smartphone use. Finally, this study employs a cross-sectional survey. Thus, future work may consider adopting a longitudinal research design to better explicate the cause-effect relationships associated with compulsive smartphone use.

Acknowledgements

The work described in this study was partially supported by grants from National Natural Science Foundation of China (No. 71201149) and China Postdoctoral Science Foundation (No. 2012M511426 and No. 2014T70601).

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