Addiction to Mobile Phone or Addiction through Mobile Phone?

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Abstract

The current study aims to distinguish between two perspectives dominating the mobile phone addiction literature; addiction to a mobile phone and addiction through a mobile phone (i.e. addiction to mobile phone application). We extend state-of-the-art addiction literature by building on dual-systems theory and investigating both perspectives in the same theoretical model. We empirically test our model (n=333) and results provide support for all of the hypothesized relationships. Results indicate that addiction to mobile phones can't be fully explained by addiction to mobile phone applications. Theoretical and practical contributions of the study is discussed.

1. Introduction

Mobile phones are an inseparable part of our lives. In April 2014, the number of active mobile numbers in the United States exceeded 327 million [1], which is greater than the US population. According to another research project, as of January 2014, 90% of American adults have a mobile phone and 65% of them use smartphones [2]. On average, people check their mobile phones 150 times a day for different purposes [3].

Information systems literature examines different phases of IT use, such as adoption and continuous use. Adoption of technology is widely studied where several models have been proposed in the literature to explain users' technology adoption behaviors [4], [5]. After adoption, researchers focus on how continuous use of technology is embedded or routinized in users' life. Several IS continuance models explain post-adoption behavior and identify the factors affecting their usage intentions [6], [7]. Repetitive usage of a technology artifact, in medium or long-term scenarios, can lead to forming automatic usage behaviors. This phenomenon is defined as habit in the IS literature [8], [9]. These IS habits by themselves can have some positive or negative consequences. Whenever habitual behaviors result in a loss of

control, the negative consequences outweigh the positive ones [9]. One such situation recently studied in IS research is known as IS addiction [10]. Several recent studies have explored negative consequences of mobile habit and addiction. For instance, Turel and Serenko [11] enumerate some of the negative effects of "Mobile Email Addiction" on individuals' personal and professional life; also, several studies have emphasized the role of mobile habit/addiction in car accidents [12], [13].

In spite of the recent attention to technology addiction there is no consensus in the literature on its conceptualization or operationalization. Moreover, in the specific case of mobile phone addiction, there is no consensus even on the independent existence of such addiction. Some researchers consider mobile phone addiction as a kind of technology addiction characterized by technology addiction symptoms (i.e. conflict, withdrawal, relapse, and behavioral salience) [9]. Others strongly believe that mobile phone addiction is some other kind of behavioral addiction (e.g. addiction to game, shopping, gambling, etc.) manifested through excessive mobile phone usage [14]–[17]. Thus, to the second group, individuals are not addicted to the mobile device, but through the device by experiencing addiction to the applications. The main purpose of this research is to differentiate between "addiction to the device" (simply referred to as mobile addiction) and "addiction through the device" (i.e. application addiction) for mobile phones. We investigate the role of application addiction in the formation of mobile addiction to illustrate that even though they both may occur in high degrees simultaneously, it is also likely that each can exist at high degrees absent the other one.

In this study we pursue two main objectives: 1) to investigate antecedents of mobile phone addiction as a kind of technology addiction; and 2) to demonstrate the differentiation between mobile addiction and application addiction signifying that addiction to the mobile device does really exist and is likely to happen in high degrees apart from other addictions.

The remainder of this paper is as follows: in the next section mobile addiction and application

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addiction are discussed and definitions are provided. Following that our model, hypotheses, and method are discussed. The last two sections discuss the results and implications of the study.

2. Mobile Addiction

The excessive usage of technology artifacts is reported in the literature to lead to some negative consequences such as decreasing social quality of life [11], reduced productivity, tardiness for appointments, insomnia, financial losses, family issues [9], [13], [15], [18], and risky and illegal behaviors like using mobile phones while driving [19], [20]. One of the critical negative consequences of this excessive usage identified in the literature is technology addiction which can encompass many of the mentioned consequences and affect various aspects of a person's life and even require treatment [21].

Technology addiction is a special type of behavioral addiction [16] that encapsulates a psychological dependency on the use of an IT artifact [17]. Based on this, most of the definitions proposed for technology addiction are mainly based on a number of symptoms just like the symptoms of substance addictions despite how much they vary [14]. In one of the most accepted definitions, Turel et al. [17] define *technology addiction* as a psychological state of maladaptive dependency on the use of technology to such a degree that the following symptoms arise: salience (i.e. domination of users' thoughts and behaviors by the technology), withdrawal (i.e. arising negative emotions if a person cannot use the technology), conflict (between the use of technology and other personal tasks), relapse and reinstatement (inability of the technology user to voluntarily reduce her use), tolerance (the need to use the technology to a greater extent to produce thrill), and mood modification [17].

This inconsistent conceptualization of technology addiction has bred two different conceptualizations: technology addiction as a zero-or-one phenomenon where an individual is either an addict or not [22], or viewed as a spectrum with different levels of severity [9], [10], [17]. We employ the latter view as we believe it is not possible to define a specific threshold for such a subjective phenomenon. Addiction can be manifested in different ways for different individuals where some of the symptoms might not develop at all like with substance addiction where some of the highly addictive substances do not develop all the symptoms in the addict [16]. We believe that behavioral addictions must be viewed as a spectrum with different levels of severity where the emergence

of the symptoms to any degree should be considered as addiction. We believe that behavioral addictions, just like any other psychological state (e.g. depression, self-efficacy, self-regulation, etc.) exist in every individual in variable degrees. What is known as addiction for ordinary people is in fact the "higher-than-norms" degree of this state manifested in one's behavior.

While the existence of a general concept of technology addiction seems to be accepted in both IS and neuroscience, there is still a debate over the sensibility of addiction to some specific kinds of technology like the Internet and mobile devices. Some researchers believe that addiction to the internet or mobile phones does not make much sense as most of the individuals who excessively use these technologies are not addicted to the physical device but use them as a medium to fulfill other addictions (e.g. social networking, gambling, shopping, porn, gaming, etc.) [15]–[17], [23]; while others acknowledge this, they believe that these technologies themselves can be addictive as well [9], [12], [22]. We examine the latter view as we believe that in many cases individuals can show highly addictive behaviors towards the device while they are not highly addicted to any of the specific applications or activities on those devices. It is exactly like being highly addicted to eating as a medium to access foods, without being highly addicted to any specific meal. However, to the authors' knowledge, none of the prior studies has investigated this issue to show whether addiction to these mediums should really be considered as a problematic behavior or they are only mediums for developing other kinds of behavioral addiction. In this study we propose a model to investigate this issue in the specific case of mobile phones.

To this end, we first distinguish between addiction "to" and "through" the mobile phone. Based on the previous arguments , for both concepts, we adapted the mentioned definition of technology addiction proposed by Turel et al. [17] with some slight alterations. The following two sections provide our specific definitions.

2.1. Addiction to the Mobile Device

The first addiction concept we deal with in this paper is addiction to the mobile phone.

Based on the recent discussion, we define *mobile phone addiction* as a psychological state of maladaptive dependency on the use of a mobile phone to such a degree that some of the following six behavioral addiction symptoms arise to any degree:

salience, withdrawal, conflict, relapse and reinstatement, tolerance, and mood modification. Mobile addiction as a psychological state exists in any individual who uses a mobile device. What differentiates individuals in terms of their addiction to the mobile phone is the "severity" of symptoms manifested in their behavior.

2.2. Addiction through the Mobile Device

The other addiction concept we deal with in this study is addiction through a mobile phone. As we are focusing on smartphones with complex applications we consider mobile phones supported by an operating system (e.g. Windows, Android, iOS, etc.). In recent years almost all of the operating systems provided to the market by mobile manufacturers have an application-based framework. A *mobile application* can be defined as a software program that resides on mobile devices, which provides users with a specific experience and a set of supporting functions (e.g. a specific game, getting banking services from a specific bank, shopping from a specific website, etc.).

We define *application addiction* as a psychological state of maladaptive dependency on a specific dominant life activity context (i.e. DLAC) to such a degree that some of the following behavioral addiction symptoms arise to any degree: salience, withdrawal, conflict, relapse and reinstatement, tolerance, and mood modification.

For example, if an individual's highest level of addiction is to gaming (i.e. her DLAC is gaming), 'application addiction' for this particular person refers to her psychological dependency on gaming and not to other life activity contexts (LAC).

Similar definitions are also proposed in the literature for other life activity contexts. For instance Turel et al. [17] propose a definition (based on their original technology addiction definition) for 'online auction addiction' as a life activity context.

3. Model and Hypotheses

Within the Technology Usage literature, habit is defined as the extent to which people tend to use technology automatically because of learning [8], and is known in the IS literature as the main factor in developing technology addiction [24]–[26]. Even some researchers believe that habit and addiction are both on the same continuum where addiction is the extreme, out of control mode of usage [10]. Considering habit and addiction as the two ends of the same continuum it then makes sense to consider antecedents of habit as antecedents of addiction as

well. Nevertheless, some other factors seem to be required to shift an individual along this continuum from a habit towards an addictive behavior.

Demonstrating habit's effect on mobile phone use, Soror et al. [9] have demonstrated that when habit is beyond normal control it increases negative consequences due to deficient self-regulation . They argue that mobile phone habit and self-regulation (i.e. overriding one's action tendency in order to attain another goal [27]) can be considered as the reflexive and reflective systems of a dual-system respectively. The reflective system acts as an impulse control, overriding automatic responses in the reflexive system. When these habits conflict with already established goals, the reflective system (i.e. self-regulation) needs to be engaged to prevent negative consequences. Conducting a critical review and discussion of studies of the psychology of gambling, Evans et al. [28] elaborate that the dual-systems theory of thinking and reasoning can be utilized to explain behavioral addictions. They argue that such addictions may reflect a process of implicit learning resulting in compulsive and irrational behavior that may conflict with the individual's consciously expressed beliefs and desires. The characteristics they describe for the two systems of thinking in their dual-systems perspective (unconscious vs. conscious, shared with animals vs. uniquely related to human, rapid and parallel vs. slow and sequential, independent of working memory vs. related to working memory) are very similar to the characteristics of the reflexive and reflective systems in Soror et al. study. So it seems reasonable to rely on dual-systems theory to explain individual's addiction to mobile device as well.

Based on these findings, in this study we consider both factors as direct antecedents of mobile addiction. In line with previous research, we hypothesize that while habit positively affects individuals' psychological dependency to their mobile phones (i.e. mobile phone addiction), their regulatory mechanisms can act in the opposite way and reduce their dependency on the mobile phone. It also could be the case for application addiction where higher degrees of self-regulation can reduce individuals' dependency on her dominant life activity context.

Hypothesis 1: Individuals' mobile phone habit positively affects their level of mobile addiction.

Hypothesis2: Individuals' self-regulation negatively affects their level of mobile addiction.

Hypothesis3: Individuals' self-regulation negatively affects their general dependency to their dominant life activity context.

Using habit as the main antecedent of addiction, it is reasonable to take into account habit's antecedents in an addiction formation model. Among several papers focusing on habit in the IS literature [10], [12], [26], [29] the paper by Limayem et al. [8] seems to be the most comprehensive in terms of explaining IS habit formation and identifying its drivers. They derived three primary antecedents to habit development: frequent repetition of the behavior, the extent of satisfaction with the outcomes of the behavior, and relatively stable contexts. Also, they illustrate that for the specific context of IS, comprehensiveness of usage (i.e. the extent to which an individual uses the various features of the IS system) is another important factor in forming IS habits.

In this study the frequent repetition of behavior is removed from our model as we believe incorporating usage (either frequency or duration) in a habit formation model only makes sense when it is considered with reference to individuals' self-standards of usage; that is, what is perceived to be a high amount of usage by one person is not necessarily high to another user; So the tendency to automatically use the technology requires higher amounts of usage in the latter while the former may have a high tendency even with lower amounts of usage.. Due to this fact, and since to the best of our knowledge, the prior IS research does not provide any measures to capture usage with respect to self-standards, we decided not to consider frequency of past usage as an antecedent of habit . However, we still incorporate this factor as a control variable in our model. But in line with Limayem et al. we consider satisfaction and comprehensiveness of usage as two main antecedents of habit. So:

Hypothesis 4: the individuals' satisfaction of the outcomes of prior usage, positively affects their tendency to automatically use mobile phones (i.e. habit).

Hypothesis 5: the comprehensiveness of usage of mobile phones (i.e. the number of different functionalities being used) positively affects the individuals' tendency to use mobile phones automatically.

As part of the habit formation process, Limayem et al. [8] include perceived usefulness and confirmation as the antecedents of satisfaction, which

previously had been identified as an antecedent of IS habit. This is based on Bhattacherjee's IS post-acceptance model (originally based on expectation-confirmation theory) wherein the expectation of perceived usefulness, if confirmed upon usage, leads to satisfaction [6]. These relationships are included in our model.

Hypothesis 6: the extent of confirmation of users' expectations about the mobile phone positively affects their perception of its usefulness.

Hypothesis 7: the extent of confirmation of users' expectations about the mobile phone positively affects their satisfaction of using it.

Hypothesis 8: the individuals' perception of the usefulness of mobile phone positively affects their satisfaction of using it.

As mentioned in previous sections, while a group of IS experts believe that mobile phone addiction does not exist independently and individuals' psychological dependency to their mobile phones is just a manifestation of some other kind of addiction[1], a second group believes that addiction to mobile phones can develop and emerge in high levels even in the absence of high degrees of addiction to any specific life activity context. This second group argues that the mobile phone, as a collection of applications, adds up the little amounts of individuals' dependency on applications (i.e. to the life activity contexts underlying those applications) so that the sum of those dependencies yields considerable addiction symptoms. The authors do agree with the second group; however, this issue needs to be investigated in some statistical way to be clarified.

The approach used in this study to clarify this issue is to conceptualize mobile addiction and application addiction as two distinct constructs and investigate the extent to which the latter explains variations in the former. Therefore we hypothesize:

Hypothesis 9: Individuals' application addiction positively affects mobile addiction.

In addition to the mentioned hypotheses derived from prior research, we also consider another hypothesis which (to the best of our knowledge) has not been tested before in the IS literature. That as an

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[1] Some of the experts in this group like Griffith also believe that mobile phone addiction does exist, but it is very unlikely to emerge in the absence of addiction to at least one specific functionality.

individual uses a greater number of different LACs (e.g. shopping, banking, gaming, etc.) for which an individual uses her mobile phone, the more useful she perceives her mobile phone to be.

Hypothesis 10: the mobile phone usage comprehensiveness positively affects individuals' perception about usefulness of the mobile phone to them.

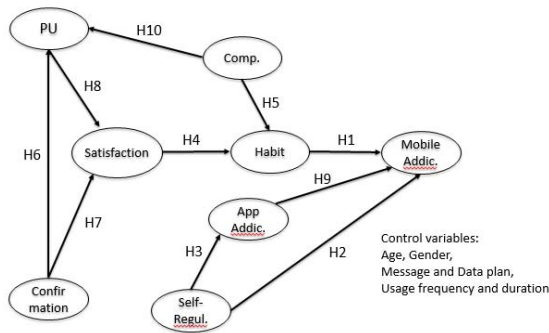Figure 1 illustrates the hypothesized relationships.

Figure 1- Proposed Model

4. Method

4.1. Sample

In order to examine the hypotheses developed in the previous section, a cross-sectional survey was employed. Around 700 undergraduate students were invited by sending email flyers to participate in an online survey and an award of 10 course credit points was offered to the students for completing the survey. We targeted undergraduate students because a large number of Americans in this age group (i.e. 18-29) are reported to be heavily dependent on a smartphone for online access [30]. Participants were requested to reflect on their mobile phone use experience and answer the questions accordingly. After a period of 10 days, 356 responses were collected, but in 23 of them, at least one of the three validation questions was answered incorrectly and so those records were omitted from the dataset. After removing these invalid answers we ended up with a final dataset consisting of 333 responses. Respondents' ages were in the range of 18 to 31 with a mean of 19.95 (s.d. =2.55). The sample included approximately 46% male and 54% female respondents. Approximately 98.2% of the respondents indicate their main purpose of using a mobile phone was personal use and only

1.8% reported that they use their mobile phones mainly for job purposes.

4.2. Measures

To measure the constructs used in the proposed model, we employed well-stablished, reliable measures from the literature. The measures for mobile phone use habit and mobile phone usage comprehensiveness were based on measures developed by Limayem et al. [8]. Also satisfaction and confirmation were measured using the instruments developed by Bhattacherjee [6]. For measuring perceived usefulness and self-regulation we adopted measures developed by Davis [31] and Eysneck & Eysneck [32] respectively.

To capture mobile phone addiction as well as application addiction we employed the behavioral technology addiction scale developed by Charlton [33]. All the constructs were assessed on 7-point Likert-type scales.

In order to operationalize application addiction we considered six reportedly highly addictive LACs (i.e. social networking, gaming, music playing, video streaming, online shopping, and messaging) and asked each participant to identify whether or not he or she has at least one application representing each of the mentioned LACs on his or her mobile phone. Based on each participant's response (Yes/NO), and for each LAC with a 'Yes' response, the participant then was given the questionnaire items measuring his or her level of addiction to the LAC. Finally, the DLAC for each participant was identified on the basis of his or her addiction levels to the corresponding LACs and the participant responses to the DLAC addiction items were considered as his or her application addiction responses. For instance if someone stated that she has at least one gaming and one social networking application (and none applications representing other LACs) installed on her mobile phone, we captured her addiction level to both gaming and social networking, and the if her addiction to gaming was higher than her addiction to social networking, we considered her responses to the gaming addiction items (i.e. the DLAC) as her application addiction responses in our analysis.

We included a series of control variables that have been found to potentially influence the hypothesized relationships within the model (i.e. age, gender, message and data plan limitations, and self-reported usage frequency and duration).

5. Results

5.1. Measurement Model

A covariance-based Structural Equation Modeling (SEM) was conducted using Mplus 7.0 to test both measurement and structural models. All constructs were modeled using reflective indicators. The following control variables were coded as dichotomous dummy variable: Gender, Text Message Plan, and Data Plan; Age, Usage frequency, and Usage duration were coded as continuous variables.

Regarding the measurement model, the composite reliability scores as well as the Cronbach's alphas for each measure, indicated in Table 1, show that construct reliability was acceptable as they exceed the recommended threshold of 0.7 [34].

A confirmatory factor analysis was conducted on the data to investigate convergent and discriminant validity. The convergent validity was assessed by examining if the Average Variance Explained (AVE) score exceeds 0.50 for each construct [35], [36] (see Table 1). To assess discriminant validity the square root of the AVE needs to exceed the inter-construct correlations in the study [37]; as seen in Table 2 this condition was established for all the constructs .

Variable	Mean	SD	AVE	CR	CAR
1. Age	19.95	2.55	-	-	
2. Gender	1.54	0.5	-	-	
3. Text Message plan	1.03	0.22	-	-	
4. Data plan	2.19	0.92	-	-	
5. Usage Frequency	43.24	71.26	-	-	
6. Usage Duration	8.21	14.27	-	-	
7. Perceived Usefulness	6.15	1.1	0.694	0.872	0.864
8. Habit	6.23	1.05	0.771	0.902	0.9
9. Mobile addiction..	3.64	1.78	0.558	0.791	0.771
10. Self- Regulation	3.24	1.72	0.663	0.853	0.874
11. App addiction	3.45	1.77	0.546	0.782	0.778
12. Satisfaction	5.85	1.1	0.783	0.935	0.933
13. Confirmation	5.19	1.12	0.658	0.851	0.842

Table 1. Sample Statistics

Based upon the examination of the reliabilities, both convergent and divergent validities of our measurement model and the results presented in Tables 1 and 2, we find significant evidence supporting the validity and reliability of our measurement model.

5.2. Assessment of Method Biases

To assess the potential for common method bias in our model, we conducted the Harman's single factor test and examined the difference between the Chi-Square test statistic in the original CFA model and the single factor model. The Harman single-factor test requires loading all the measures in a study into an exploratory factor analysis, with the assumption that the presence of CMV is indicated by the emergence of either a single factor or a general factor accounting for the majority of covariance among measures [38].

A difference of 3182.54 units was observed in the Chi-Square statistic while the difference in degrees of freedom was only 43. The very low p-value for the Chi-Square difference test means that common method variance (CMV) is not problematic and we do not have common method bias (CMB) in our data as the single-factor model is significantly worse than the original measurement model.

5.3. Structural Model

Following the measurement model analysis, a structural equation model using maximum likelihood was estimated with Mplus 7.0. Model fit measures indicated acceptable fit (RMSEA= 0.055, CFI= 0.93, SRMR= 0.07). The model estimates are shown in Figure 2. The model explains 55.2% of the variance in the mobile addiction.

	PU	Habit	Mobile Add.	Self-Reg.	App Add.	Satisfcn.	Confirm.
PU	0.833*						
Habit	0.516	0.878					
Mob. Add.	-0.150	0.141	0.747				
Self-Reg	0.018	0.004	-0.449	0.814			
App. Add.	-0.161	0.001	0.648	-0.311	0.739		
Satisfcn.	0.452	0.305	-0.060	-0.026	-0.165	0.885	
Confirm.	0.466	0.367	-0.091	-0.012	0.023	0.466	0.811

Diagonal values represent the squared root of AVE

Table 2. Correlation Matrix and Discriminant Validity Assessment

The significant positive effect of habit on mobile addiction (β=0.115, p<0.05) provides support for H1. Also the significant negative effect of self-regulation on mobile addiction (β= -0.245, p<0.001) provides support for H2. Additionally, the results provide support for the negative effect of self-regulation on application addiction (β= -0.279, p<0.001).

Moreover there is sufficient support in the model results for the two other hypothesized antecedents of habit (β= 0.289, p<0.001 for satisfaction and β=

0.267, p<0.001 for usage comprehensiveness). Hence H4 and H5 are both supported.

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Also the part of our model derived from expectation-confirmation theory (H6, H7, and H8) is supported as our data shows significant positive effects of confirmation on both perceived usefulness and satisfaction (β= 0.443, p<0.001 and β= 0.319, p<0.001 respectively) as well as the positive significant effect of perceived usefulness on satisfaction.

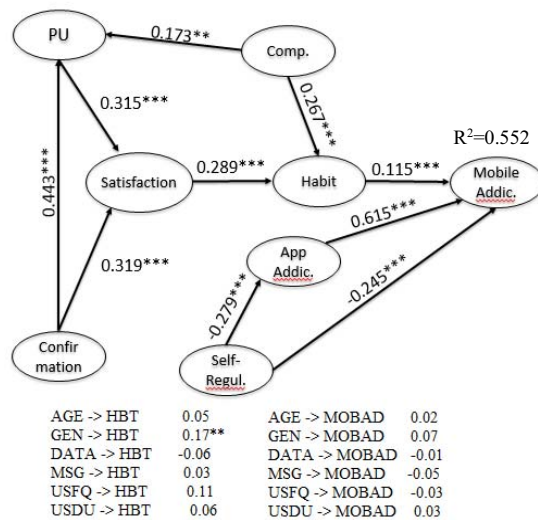|	
AGE -> HBT	0.05
GEN -> HBT	0.17**
DATA -> HBT	-0.06
MSG -> HBT	0.03
USFQ -> HBT	0.11
USDU -> HBT	0.06
AGE -> MOBAD	0.02
GEN -> MOBAD	0.07
DATA -> MOBAD	-0.01
MSG -> MOBAD	-0.05
USFQ -> MOBAD	-0.03
USDU -> MOBAD	0.03

Figure 2- Model Results

The significant positive effect of application addiction on mobile addiction provides support for H9 (β= 0.615, p<0.001). Additionally the significant positive effect of usage comprehensiveness on perceived usefulness provides support for the last hypothesis, H10 (β= 0.173, p<0.001).

6. Discussion and Conclusion

In this study by taking together some previously tested arguments from IS habit and addiction literature, we proposed an integrative model for explaining formation of addiction to the mobile devices. The results from testing the proposed model were then used to demonstrate the likelihood of emergence of high levels of addiction to the mobile device, even in the absence of high levels of behavioral addiction to any of the dominant life activity contexts.

6.1. Theoretical Implications

The main contribution of this study is the design of the test it has employed to empirically test a highly debated issue in the IS addiction field. While many IS researchers had made some arguments about the issue and most of them had theorized that mobile phone addiction is only the manifestation of some other behavioral addiction [13], [15], [17], this issue was never been tested before. In this study, by differentiating between addiction to the mobile device, and addiction through the mobile device and incorporating them as separate constructs in our model, we empirically demonstrated that although the latter has a significant effect on the formation of the former (explaining around %37.8 of its variation in this study), however still a considerable portion of variation in mobile addiction is due to other (mostly unknown) factors. In other words, it's not reasonable to say that mobile phone addiction is purely the manifestation of another behavioral addiction.

Moreover, as it was hypothesized in our study, comprehensiveness of mobile phone usage showed to have a significant effect on the perceived usefulness of mobile phone to the respondents. Although this relationship seems to be evident (i.e. when someone typically uses her mobile phone for many different purposes, her perception about the usefulness of this device will be reinforced), but to the best of our knowledge it was not tested in the IS literature before.

Another contribution of this study is the dynamic conceptualization of addiction through mobile devices (i.e. application addiction) and consequently dynamic operationalization of this construct in an empirical study. It can be said that today, mobile applications, are the means by which users' access to various life activity contexts (LACs) (e.g. shopping, banking, gambling, gaming, etc.) is realized. Addiction through mobile phones, is actually using mobile phone device as a medium to develop individuals' addiction to one of these LACs (realized in the form of mobile applications). Since mobile applications represent many various LACs in the modern mobile phone devices and since it's not possible to take into account individuals' addiction to all these contexts in a model, the only way to conduct this study was to provide a dynamic definition of application addiction that is able to incorporate all these various LACs. Although we captured individuals' addiction to several highly addictive LACs, we only accounted for the dominant LAC for

each individual (differing from person to person) in our analyses. We believe it is sufficient to examine only the effect of DLAC addiction level on the mobile addiction level because if the idea that mobile addiction is purely the manifestation of another behavioral addiction is true, that behavioral addiction must be addiction to the DLAC.

The results also provide support for all the hypothesized effects derived from prior research. Dennis and Valacich [39] in their IS replication manifesto argue that while replication of research findings in the physical sciences is a critical condition for them to be considered valid, yet social science research has not traditionally followed this approach. They believe that generalizing the findings of social science research without replicating the experiments under different or even similar conditions does not make much sense. Based on this argument, the replication of prior research and providing extra validation to those findings can be considered as another contribution of this study to the IS research.

6.2. Practical Implications

The results of this study indicate that mobile phone devices that used to be considered only as a medium for developing individuals' behavioral addictions, can be addictive by themselves. This opens a new window to the IS research community and provides several research opportunities to identify the drivers of addiction to the mobile phones and eventually to propose effective treatments for this ever-increasing issue. Future research could focus on studying the role of mobile device-related factors such as portability, user interface characteristics, hardware and software technical features, etc. on forming addiction to the mobile device. Such a study could help to clarify the reasons why people are more tended to get addicted to mobile phone in comparison to other technological devices (e.g. tablets, laptops, etc.).

The results indicate a relatively low effect for mobile use habit in developing mobile addiction. Although this effect is still significant, but its lower magnitude compared to the application addiction and self-regulation attenuates the view which suggests mobile use habit as the main driver of mobile addiction. This attenuates the justification to incorporate mobile use habit antecedents in a mobile addiction model. Due to the higher effect of self-regulation compared to habit, it seems more reasonable to account for factors affecting individuals' self-regulation in an addiction formation model instead. The significant deterrent effect of self-

regulation not only directly on mobile addiction, but also indirectly through reducing the level of addiction to the life activities, makes it a critical factor in controlling mobile addiction and suggests its potential to be used as a practical intervention (i.e. enhancing self-regulation through regular practice) to reduce the level of addiction to both mobile phone and life activity contexts.

7. Limitations and Future Research

First, a potential limitation of this research is that we collected our data from college students. Although collecting data from the individuals in this age group can be justified as they are the most potential mobile phone addicts [30], however it seems required to replicate this study in the future with a more general sample in terms of age, education, and social stratification in order to investigate the generalizability of the results.

Second, as a pilot study, we only focused on the pre-existed measurement instruments in this study while we believe that some new instruments are needed to more effectively measure some of the constructs incorporated in our proposed model in the future. This is specially the case for the comprehensiveness of usage for which we only could find a unidimensional measure in the IS literature. It is likely that designing a multidimensional measure for this construct can help us to get more reliable and even unexpected results in the future.

Moreover, some new measures seem to be needed for taking into account some mobile-phone-specific features as the potential constructs in forming mobile phone addictions. For instance designing a measure to evaluate the preference of mobile phones for the users compared to other technologies with similar applications (e.g. laptops and tablets) could help us to answer this question that while most of the applications of the mobile phones are accessible via those devices as well[2], why mobile phones are reported to be more addictive than laptops or tablets?

Another limitation of this study is accounting for only six life activity contexts in operationalization of application addiction construct. Although the captured LACs are reported to be highly addictive in the literature, there are still many other LACs (e.g. exercise, gambling, reading, etc.) that are worth further research. Future research can focus on

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[2] With emerging internet-based communication software platforms, this is true even for the two basic functionalities of mobile phones (i.e. calling and messaging).

proposing more dynamic ways to operationalize the application addiction construct and replicate this study using them.

Another critical factor that should be examined in the future research is technological specification of the mobile phones. A higher underlying level of technology in individuals' mobile phones potentially provides their access to more variety of mobile phone applications which otherwise they were either not able or hardly able to use them due to technical reasons (e.g. low amount of memory, low processing capability, or low graphical specifications of mobile phones). Hence designing a new measure for taking into account such factors can be another opportunity for future research.

Finally, future research can focus on replicating the proposed model in this study by concentrating on the factors that turned up to be more effective on mobile addiction (i.e. self-regulation and application addiction) with the aim of providing a reason-based definition for mobile addiction instead of the several extant symptom-based definitions. Because the final destination of this line of research must be to propose some treatments for this developing issue among societies and this is not feasible until we identify and manipulate the real causes of the problem.

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