

AN EMPIRICAL EXAMINATION OF THE “VICIOUS CYCLE” OF FACEBOOK “ADDICTION”

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ABSTRACT

The use of some hedonic information systems (IS) can be “addictive” and lead to addiction-like symptoms. This study seeks to examine the “vicious cycle” in such situations, i.e., the ways in which past growth of hedonic system use facilitate the development of one’s current level of addiction, which in turn drives further system use. These links are explicated using the theories of rational addiction and neural sensitization. The resultant model is then tested with structural equation modeling (SEM) techniques applied to data collected at two points in time from 284 Facebook users. The findings suggest that increases in hedonic IS activity over the past three months facilitate the development of higher levels of technology-related addiction at time 1 (t_1), which in turn influences five dimensions of system use at time 2 (t_2). These include general use frequency, active use frequency, use duration, usage comprehensiveness, and access device heterogeneity.

Keywords: System use, social networks, Facebook, technology-related addiction, negative aspects of IS use.

INTRODUCTION

The continued, increasingly frequent, and more comprehensive use of Information Systems (IS) typically indicates a successful implementation and reflects a better utilization of IS investments and resources [6]. However, recent studies suggest that some negative outcomes can emerge from intrinsically rewarding overuse patterns which mostly take place in the case of hedonic IS, i.e., IS that are used primarily for pleasure rather than for work-related tasks, such as video games and social networking websites [42]. Specifically, in such IS use contexts users can develop what was termed as technology-related addictions, i.e., strong maladaptive psychological dependency on using a technology artifact, which results in a pattern of excessive IS-seeking and IS-use behaviors that take place at the expense of other important activities, and deteriorates individuals’ normal functioning [39]. This phenomenon may be prevalent, and can have a broad range of detrimental social, personal and economic effects, such as sleep deprivation, impaired social and familial functioning, low job/school performance, and financial troubles, as demonstrated by numerous studies [10]. Consequently, the concept of “Internet Gaming Disorder” was included in the appendix (section 3, potential disorders requiring further research) of the forthcoming fifth edition of the American Diagnostic and Statistical Manual for Mental Disorders (DSM-V) published by the American Psychiatric Association.

The abovementioned two phenomena, namely system use and so-called addiction, have been mostly studied separately, or by using simple unidirectional models (e.g., in which addiction leads to increased system use). However, they can be intertwined in a more complex “vicious cycle”¹; i.e., a pattern of dynamic influences of system use on addiction and vice versa, that makes it hard for users to quit. In this cycle, system use is argued to be an essential ingredient in addiction formation, and addiction often results in further system use, which can further increase addiction. Thus, a person who is trapped in this cycle invests increasing amounts of time and possibly money on using a technology, which can have a negative influence on his or her other life roles (e.g., employee, student, family person). This study focuses on this cycle and tries to explain it through the lenses of analysis of the theories of rational addiction [4] and incentive (neural) sensitization [32]. To this end, the author theorizes how past increases in hedonic system use can contribute to the formation of addiction, and how such technology-related addictions result in an increase in a variety of system use facets, which include general use frequency, active use frequency, use duration, usage comprehensiveness, and device heterogeneity.

The proposed model was tested and validated with SEM techniques applied to data collected at two points in time from 284 Facebook users. Facebook was used as the hedonic IT artifact in this study because it has been shown to be an intrinsically rewarding addiction-prone technology, with which quite a few users can present addiction-like symptoms and perhaps even become addicted to it [15, 22, 28]. Overall, this study extends our understanding of the so-called vicious cycle in which some hedonic IS users are trapped and consequently develop addiction-like symptoms.

CONCEPTUAL BACKGROUND

Technology-Related Addictions

Technology-related addiction captures the level of maladaptive psychological dependency a user has on an IT artifact, which results in a range of negative symptomatic behavioral addiction outcomes [38]. While the term “addiction” is controversial and not yet well defined in the medical field [43], it is clear that it connotes some preoccupation with a behavior, strong impulsivity, dependency, weak control over performing a behavior, and a set of negative consequences. Applied to the use of technologies and media consumption, it can be associated to some extent, but not necessarily interchangeable with related phenomena, such as deficient self-regulation, strong habit, and obsession-compulsion [25]. Nevertheless, consistent with the vast literature on the topic [10], this study uses the term technology-related addiction to describe this phenomenon as defined above. In support of this view, several similarities between the neurobehavioral pathways in cases of such, so-called addictions, and substance addictions were identified [24], showing that it is likely that technology-related addictions exist.

The maladaptive psychological dependency which is at the heart of a technology-related addiction is often manifested through typical behavioral addiction (e.g., pathological gambling) symptoms, such as salience (i.e., the addictive activity dominates one’s thoughts and actions), mood modification (i.e., using the technology produces thrill and relief, and over time generate tranquilizing feelings of emptiness and mood changes), conflict (i.e., the addictive activity

¹ I use the term “vicious cycle” in quotation marks to indicate that while it connotes a pattern of ongoing increased use which is similar to this observed in substance use or other problematic behavioral cases, it is perhaps not as harmful and bad for most technology users.

conflicts with other tasks and generates inter-personal conflicts), withdrawal (i.e., negative feelings arise if the activity cannot be conducted), and relapse (i.e., difficulty in voluntarily reducing the activity) [9, 16].

The strength or frequency of these symptoms is typically used for calculating addiction levels [39]. Accordingly, technology addiction is often treated as a continuous concept capturing the strength or frequency of addiction symptoms. While some studies have proposed screening criteria for classifying individuals as addicted or not [36], this practice is currently imprecise because the medical mechanism and cutoff points by which a person could be classified as a technology addict are yet to be determined [8, 10]. The current study therefore maintains the present research tradition, and focuses on one's level of technology addiction (ranging from low to high) rather than on his or her binary classification as a technology addict or not.

Facebook Addiction

As stated in the introduction, this study focuses on Facebook as the IT artifact which is an instance of potentially addictive hedonic IT. Accordingly, rather than focusing on general technology-addiction, this study focuses on a relevant instance of it, namely Facebook addiction. Facebook addiction is a subcategory of the technology/ Internet spectrum addiction disorders [22]. It is defined as a state of maladaptive psychological dependency on the use of Facebook that results in typical behavioral addiction symptoms (salience, withdrawal, relapse, mood modification, and conflict), and ultimately impairs one's normal functioning and well-being [37]. Several studies have demonstrated that Facebook addiction is a plausible phenomenon [15, 22, 28], and that some Facebook users can have weak self-observation and self-reaction regarding the use of Facebook [25]. A recent report [22] exemplifies the potential attributes of Facebook addiction. The person described by these researchers has spent many hours a day interacting with Facebook, accumulated many virtual friends in a short period of time, ceased several essential activities, remained home most of the day such that she can interact with her Facebook, and lost her job due to repeat violations enacted in order to satisfy her Facebook cravings (i.e., she repeatedly left her shift for checking and updating her Facebook page). She even tried to access Facebook via her mobile device during the psychological evaluation. While no formal addiction diagnosis was established in this case, it highlights the types of symptomatic outcomes one may expect when a strong maladaptive psychological dependency on the use of Facebook is developed. Given the prevalence of Facebook use, it is also imperative to study and better understand this phenomenon.

RESEARCH MODEL

Unhealthy behaviors often progress in stages – starting from contemplation of the behavior, moving through occasional mild enactment of the behavior, and growing the behavior to be potentially uncontrollable [34]. This transition through stages in an addiction career has been demonstrated in cases such as drug use [5] and alcohol consumption [27]. IS users who engage in a behavior which has the potential to provide strong intrinsic rewards and ultimately become unhealthy, should therefore follow a similar pattern. That is, the rewards they obtain from their growing use patterns should help in facilitating growth in their levels of addiction to using the IS, which should further drive system use. Arguably, this is how the “vicious cycle” for some users of hedonic IS is formed.

Studies that describe the “vicious cycle” of “addiction careers” [i.e., the progress of addicts through stages; e.g., 5] imply that in order to transition into higher levels of addiction (i.e., stronger and more frequent symptoms) individuals would need to experience a growth in their potentially unhealthy behavior. For example, drug users will unlikely become addicted after a single use or even multiple uses; rather they would need to grow their problematic behavior before their habit becomes an addiction [30]. This effect of past growth in the enactment of the behavior on one’s level of addiction can be explained, as argued in the previous section, through the lenses of analysis of the theories of rational addiction and neural sensitization.

Rational addiction theory [4] as applied to IS use implies that an increase in the performance of an intrinsically rewarding IS use behavior can grow to become an addiction. This happens because the increase in the performance of the intrinsically rewarding IS use behavior reduces the attention individuals pay to future negative consequences, and adjusts their expectations for future rewards such that they develop a stronger current desire to engage in the addictive behavior. This process facilitates further growth in performing the addictive IS use behavior. The development in one’s addiction-career can also be explained through brain functioning, and the process of incentive sensitization. This theory implies that growth in past system use is essential for training and altering the reward circuits in one’s brain to be highly sensitive to system-use cues, and for ultimately forming a pathological state of “wanting” to use the system [33].

Taken together, these theories imply that increasing the frequency and duration of addiction-prone and thrilling behaviors is essential for the development of higher levels of addiction to these behaviors. In essence the vicious cycle closes on these individuals through neural sensitization and maladaptive preference and assessment processes. Hence:

H1: Past increases in the use of a potentially addictive IS contributes to the formation of one’s current level of addiction to the IS.

Both of the abovementioned theories imply that the enactment of an addictive act is dynamic, and that it often increases over time. This happens in response to neuroplasticity in one’s reward system in the brain as suggested by the neural sensitization theory [32, 33], and through changes in utility assessments as per rational addiction theory [4]. Both theories also imply that one’s level of addiction mediates the effects of growth in past use on future use patterns. The rational addiction theory is more explicit regarding this idea, because it states that people are addicted when an increase in past consumption translates into further increases in the consumption of an addictive good [14]. Thus, addiction not only develops, in part, through past enactment of an addictive behavior, but also leads to further performance of the addictive behavior.

Indeed, a key symptom of one’s current level of addiction is the excessive enactment of the problematic behavior [9]. This could happen through multiple mechanisms, all of which relate to the neural sensitization and rational addiction theories. First, from a neurobehavioral standpoint, addictions generate strong cravings to perform the target behavior, and unpleasant withdrawal symptoms if it is not performed. Under such conditions people want to avoid the expected pain of withdrawal, to address their cravings, and to obtain the intrinsic-rewards and relief associated with enacting the behavior [33]. All of these are achieved by continuing to perform the behavior, even when other signals indicate that this may not be the optimal course of action.

Second, consistent with rational addiction theory, it has been shown that addictions can create a distorted lens through which the addictive act seems to provide stronger benefits, and have fewer drawbacks [39]. Thus, it can inflate positive perceptions and deflate negative perceptions that influence reasoned action. This viewpoint implies that addicted users are rational decision makers who consider the benefits and drawbacks of their behaviors, but use a biased lens for

developing assessments. Consequently, it is reasonable to expect that one's level of addiction indirectly increases his or her use of the system, through multiple subjective cognitive assessments and neural changes in brain receptors.

In this paper it is argued that such cognitive and neural changes can lead to an increased use of an IS across multiple system use dimensions. The obvious dimensions include general use frequency, duration, and intensity or usage comprehensiveness [40]. General use frequency captures the times a system is used per unit of time (e.g., a day, a week). Duration captures the time spent on using an IS within a unit of time (e.g., hours per day). And, usage comprehensiveness captures the breadth of use of various features and capabilities under the umbrella of a single IS (e.g., the number of functionalities a user employs). Theories of substance abuse can apply to such dimensions, because they also exist in the case of substance abuse; e.g., the frequency of use, purposes of use and amount of substance used by individuals [18]. Ultimately, when one's brain becomes hypersensitive to system use cues and his or her assessment of the system is biased toward favoring current and immediate use, he or she will use a broader set of features, more often, and for longer durations. Hence:

H2: One's level of technology-related addiction increases his or her frequency of use of the technology.

H3: One's level of technology-related addiction increases his or her duration of use of the technology.

H4: One's level of technology-related addiction increases his or her usage comprehensiveness of the technology.

This study supplements the three-dimensional view of IS use by including two additional IS use facets, which are borrowed from the substance use literature. First, this literature suggests that there are passive and active behaviors that stem from one's addiction. For example, buying cigarettes (passive) and smoking cigarettes (active), are different behaviors that can manifest from a smoking habit [41]. Accordingly, this study suggests that there are two aspects of use frequency that can be taken into account. There is the often used concept of daily (or weekly) frequency of using an IS [26] – which is termed in this study, “general use frequency”. On top of this, one can also consider the number of active sessions in which users did not just check the system (e.g., browsed eBay, or checked Facebook), but rather were more active (e.g., posted bids on eBay, or posted updates on Facebook). The active use frequency is a portion of the general use frequency, and is defined as the frequency of beyond-browsing activity on a system. It is argued that this facet of system use can also be a symptom of technology addiction.

Actively using an IS, for example posting on Facebook, can help individuals better produce thrill and satisfy their use urges; and can also expose users to additional components, or features of the IS about which they would otherwise have no knowledge. For instance, bidding on eBay can produce thrill [29] and is cognitively engaging, presumably more so than just browsing eBay. Such active behaviors can also facilitate heavier use in the future, and ensure that a user maintains his or her active use of the system. For example, by posting on Facebook users facilitate ongoing interactions and create a justification for further checking and posting on Facebook later on. Thus, technology-related addiction can drive active use, beyond general use, because such behaviors better cater to the cravings of users. Therefore:

H5: One's level of technology addiction increases his or her frequency of active use of the technology

Second, the substance use literature also points to the possibility that addiction results in a broader range of consumption contexts and methods. For example, highly addicted individuals

consume substances not only more frequently, but also in a broader range of contexts (e.g., social, alone, at work) and possibly also by employing different consumption methods (e.g., smoking, injecting) [30]. Arguably, the same should apply to IS users with high levels of addiction; they are expected to consume the technology through a broader range of possible channels (i.e., access devices, such as mobile phones, computers at work, etc.), and in a wider range of use contexts. This, again, would be done to satisfy their persistent cravings and by using their biased belief system. From a neural sensitization standpoint, this implies that the range of potential system use cues is expanded, say from home settings to include work and other social settings. Cravings, in such cases would emerge in merely any situation in which a person can access his or her Facebook account. From a rational addiction standpoint, a broader set of access devices makes it easier for users to act upon their rational choice to keep on using the technology in the present rather than in the future.

To capture the variety of devices one uses, this study conceptualizes a construct termed “device heterogeneity”. Device heterogeneity is defined as a variety/diversity measure [17] capturing the variety of devices a person uses to access an application. Many applications nowadays (e.g., Facebook, eBay, email) can be accessed via multiple devices, such as home desktop, laptop, mobile device, work desktop, etc. This is an aspect of use that has been mostly omitted in past research, but can be associated with one’s level of psychological dependency on a technology, and plausibly with other system use constructs and models. Given the plethora of devices users can employ to access the addictive application from various locations and in various contexts, they are likely to use many access devices to satisfy their system use cravings. Indeed, it has been shown that highly addicted individuals abuse the technology in multiple situations, such as home and work [44], and presumably through the available devices in such contexts. It is therefore expected that highly addicted IS users would employ a broader range of access devices in multiple contexts, compared with less addicted users. Thus:

H6: One’s level of technology addiction increases his or her device heterogeneity with regards to the use of the technology artifact

The proposed research model is depicted in Figure 1.

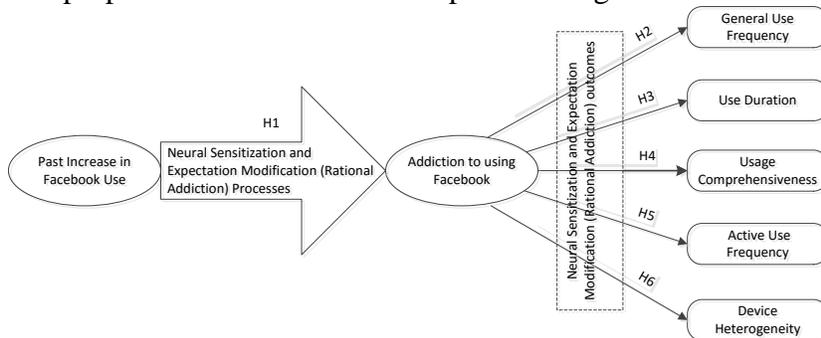


Figure 1: Research Model

METHODS

Procedure and Sample

Three hundred and sixty North American university students volunteered to participate in this study in exchange for two bonus points in a course, which is a common practice. The course was

not taught by the authors of this paper, and the subject matter in the course did not relate to this study. Data were captured at two points in time, one week apart, in order to alleviate single-source data deficiencies, and to be able to capture the hypothesized sequence of behaviors. Participants were asked to complete an online survey about Facebook use, which was followed by a second online survey after one week. Online invitations to complete the second online survey were sent using the email addresses provided in the first survey, one week after the completion of the first survey. Both surveys were completed online from unknown locations. This time-lag design was chosen to allow causal argumentation, and show that addiction at t_1 leads to use facets at t_2 . It should be noted that because this is a cyclical process, these use facets can inform the sensitization processes which sub-serve addiction formation and consequently determine future levels of addiction (which are not measured in this study).

Three hundred and forty eight participants completed the first survey, out of which 334 also completed the second survey. Forty-four records of students who do not use Facebook were removed, and six substantially incomplete records were deleted. The final dataset included 284 usable records of Facebook users who completed both surveys (clean response rate of 79%). The average age of participants was 23.1 (ranged from 18 to 46 years), and the sample included 52.8% women. They had on average 3.2 years of Facebook experience (between 0.5 to 7 years) and managed an average of 311 contacts (web friends) on their account (between 1 to 2000 contacts).

Survey Instrument

The survey instrument was based on well-established scales as adapted to the context of Facebook. To measure past increases in Facebook use, users were asked at t_1 to report on the increase in their Facebook activity along various use dimensions as identified in IS use research [21, 26, 40] over the last three months. The same works were used as the basis for measuring usage consequences of Facebook addiction at t_2 . Facebook addiction items were adapted from Charlton and Danforth's [12] measure of computing-related addictions, which has been successfully applied to the case of Facebook [37], and were used at t_1 .

Device heterogeneity was captured using the Blau index [7], which is an appropriate measure of a variety on an attribute [17]. The formula is based on the proportions of time users employ different devices ($k= 1$ to 5 in this study, because users were presented with five devices that can be used for accessing Facebook). The results can range from zero (a person using a single device) to $(k-1)/k$ which is $4/5$ in this study, implying a person equally uses all five listed devices. The survey items are presented in Table 1.

Table 1: Survey Items

<p><i>Survey at t₁</i></p> <p>Past Increase in Facebook Use (4 items, 7 point Likert scale from “Negative change” to “more than 200%”) Please estimate the increase in activity you experienced over the LAST 3 MONTHS</p> <ul style="list-style-type: none"> - Increase in times per day I use this website - Increase in the duration of use of each session with the website - Increase in the time per day I spend on this website - Increase in the features of the website I use
<p>Addiction to using Facebook (9 items, 7 point Likert scale from “Strongly Disagree” to “Strongly Agree”)</p> <ul style="list-style-type: none"> - I sometimes neglect important things because of my interest in this social networking website. - My social life has sometimes suffered because of me interacting with this social networking website. - Using this social networking website sometimes interfered with other activities. - When I am not using this social networking website I often feel agitated. - I have made <u>UNsuccessful</u> attempts to reduce the time I interact with this social networking website. - I am sometimes late for engagements because I interact with this social networking website. - Arguments have sometimes arisen because of the time I spend on this social networking website. - I think that I am addicted to this social networking website. - I often fail to get enough rest because I interact with this social networking website.
<p><i>Survey at t₂ – Capturing post t₁ behaviors</i></p> <p>Daily General Use Frequency (Numerical response) - Considering your typical behavior for the previous 7 days, how many times per day did you use this social networking website?</p> <p>Daily Use Duration (Numerical response) - Considering your average behavior for the previous 7 days, how many HOURS per day did you spend on this social networking website?</p> <p>Daily Active Use Frequency (Updates) (Numerical response) - Considering your average behavior for the previous 7 days, how many updates on average did you make per day?</p> <p>Usage Comprehensiveness - What were your primary uses of this social networking website in the last 7 days? (Select all that apply) 12 Options: Meeting new people, staying in touch with friends and relatives, staying in touch with people I have met on this social networking website, posting messages, reading messages sent by others, browsing the pages of people in my network, sending “gifts,” expressing myself, playing online video games, posting videos, watching videos, other (please explain).</p> <p>Device Heterogeneity - Over the last 7 days, you may have accessed Facebook via different devices. Please recall your use pattern, and allocate the time you spent on using this social networking website via each device. The total should be 100%. - My home desktop, My own laptop (or tablet PC such as iPad), My work computer, A university computer, My mobile device (e.g., iPhone)</p>

RESULTS

Descriptive statistics, reliability scores and correlations were calculated for the data (see Table 2). All multi-item constructors were reliable with Cronbach’s alphas and composite reliability scores over 0.80, and Average Variance Extracted (AVE) scores over 0.5. Sufficient discriminant validity was demonstrated by the fact that the square root of the AVE score for each multiple-item construct was larger than the corresponding correlations. Moreover, all correlations were in the expected direction and not too strong ($r = 0.11$, NS to 0.28 , $p < 0.01$), which indicated low likelihood of a significant common method variance component (which is reduced anyhow by the temporal separation between the surveys). This was supported by a Harman’s single factor test which produced five principal components explaining 62% of the variance, out of which the first component explained only 28% of the variance. This was further reinforced by the inclusion of a Common Method Variance (CMV) factor in a confirmatory factor analysis (CFA) model as per Podsakof et al. [31], which was estimated with AMOS 19 [3]. Factor loadings with and without the CMV factor were compared, and the differences were marginal (0.007 to 0.16; average of 0.08), and below the suggested cutoff of 0.2. Thus, multiple tests indicated that CMV is unlikely to be significant in the collected data, and should not be controlled for in the model.

Table 1: Descriptive statistics, reliabilities[†], and correlations.

	Mean	Std. Dev.	CR (AVE)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Past Increase in Facebook Use	2.17	.91	0.93 (0.76)	0.92							
(2) Addiction to using Facebook	2.49	1.18	0.90 (0.51)	.28**	0.89						
(3) General Use Frequency	4.33	4.06	-	.12	.19**	-					
(4) Use Duration	1.90	2.59	-	.13*	.27**	.17**	-				
(5) Active Use Frequency	1.45	2.17	-	.15*	.19**	.23**	.21**	-			
(6) Usage Comprehensiveness	3.49	1.92	-	.17**	.26**	.24**	.21**	.24**	-		
(7) Device Heterogeneity	.33	.23	-	.15*	.17**	.18**	.13*	.11	.16**	-	
(8) Age	23.11	4.37	-	.04	-.03	-.15*	-.01	.07	.02	-.02	-
(9) Gender	-	-	-	-.07	-.17**	0.11	-.07	-.04	-.04	.04	.01

* $p < 0.05$ ** $p < 0.01$

[†] Reliabilities are reported only for multiple-item scales. Cronbach alphas are reported on the diagonal. Average Variance Extracted (AVE) and Composite reliability (CR) are given in the designated column.

Model Estimation

The research model was estimated with the two-step approach [2] using AMOS 19. First, a CFA model in which all constructs were allowed to freely correlate was tested. The model presented good fit ($\chi^2(144) = 220.38$, $\chi^2/DF = 1.53$, CFI = 0.97, IFI = 0.97, RMSEA = 0.043, and SRMR = 0.038), and in addition, all loadings were significant (over 0.66, $p < 0.001$). These indices meet recommended fit criteria [19], and together with the loadings information, indicate that the measurement model is valid. As such, a structural model which included age and gender as potential control variables was estimated. The model yielded good fit indices ($\chi^2(117) = 178.52$, $\chi^2/DF = 1.53$, CFI = 0.97, IFI = 0.97, RMSEA = 0.043, and SRMR = 0.042). However, age had a significant effect only on one's general use frequency, and gender had significant influences only on general use frequency and Facebook addiction. For parsimony reasons the non-significant control variable paths were removed, and the model as depicted in Figure 2 was specified and estimated. This model presented good fit indices ($\chi^2(153) = 224.65$, $\chi^2/DF = 1.47$, CFI = 0.97, IFI = 0.97, RMSEA = 0.041, and SRMR = 0.043), and the factor loadings were still strong and significant (over 0.66, $p < 0.001$). The structural model provided support for all hypotheses.

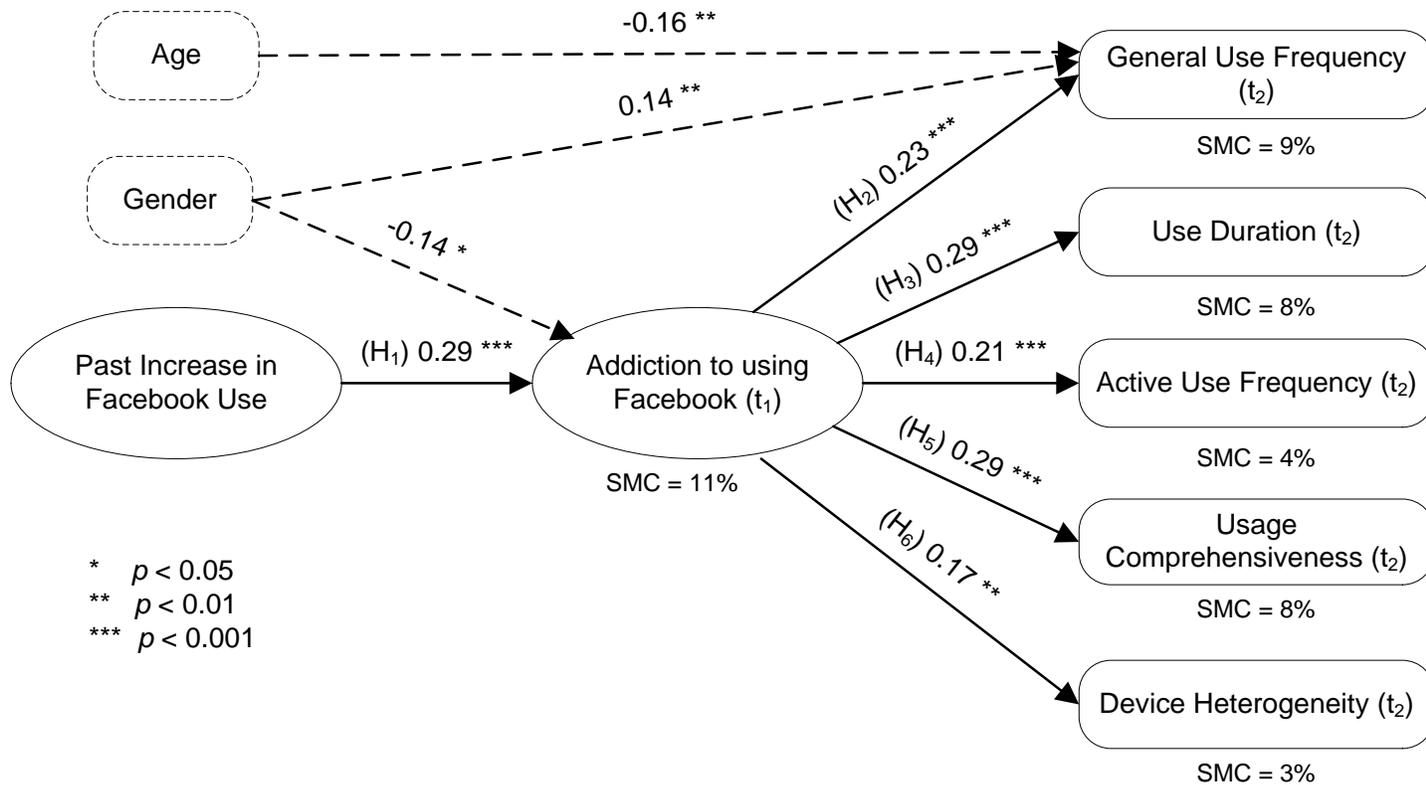


Figure 2: Structural Model

Post-hoc Mediation Estimation

The proposed model implies full mediation; i.e., that past increase in Facebook use influences future use through the addiction levels it builds (and the implied cognition modification and neural sensitization processes). To further substantiate the validity of this proposition, the current mediation model was contrasted with a partial-mediation model that allowed past increases to affect the five facets of use not only through addiction, but also directly (i.e., indicating a form of inertia, or natural growth). This model was estimated with AMOS 19 which revealed that the significance and magnitude of the hypothesized paths did not change after the inclusion of direct effects. But, the five added direct effects of past increase on system use facets were non-significant (p -values ranging from 0.18 to 0.44). A chi-square test contrasting this model [$\chi^2(148) = 220.68$] with the hypothesized full-mediation model [$\chi^2(153) = 224.65$] produced a non-significant test statistic [$\chi^2_{\text{difference}}(5) = 3.97, p = 0.55$]. This implies that estimating the additional five parameters of the direct effects of past increase fails to significantly improve the model's fit. Thus, the hypothesized full mediation conceptualization is superior to the potential partial-mediation conceptualization. It means that past increase in use by itself does not imply future use. It translates, in part, into future use through facilitating the development of addiction.

DISCUSSION

This study supports the existence of a potential “vicious cycle” in the case of hedonic IS, as implied by rational addiction and incentive sensitization theories. According to this cycle past increase in hedonic system use is one factor that can facilitate the development of addiction to using the IS. It explains about 11% of the variation in it. Thus, past increase in IS use is an important, yet mostly overlooked predictor of technology-related addiction-like symptoms and possibly addictions. The level of explained variance suggests that increase in use by itself is not enough for developing addiction. Rather, as argued in the Conceptual Background section, many other elements, such as personality, mental states, family, demographic and social factors can possibly explain the remaining variance in levels of addiction to using a hedonic IS [11, 12, 13, 20]. Thus, in many cases increase in IS use can be healthy. However, it is an essential ingredient in the mix of factors that can explain addiction-like symptoms formation, because it is instrumental in the incentive sensitization and use rationalization processes. This also lends support to the idea that an ongoing reinforcement of hedonic rewards can be dangerous, because it is needed for developing a technology-related addiction in the case of Facebook [37] as well as in the case of videogames [42].

The findings further suggest that once some level of addiction develops, it puts individuals in what may be termed as a “vicious cycle” of system use growth. Thus, the relationship between one’s level of addiction to using a hedonic IS and the use of that IS can be temporal, complex, and multifaceted. As the findings suggest, IS use (at least the five facets as supported by H2-6) in at least some hedonic contexts can be induced, in part, by the level of addiction to this act. One of the important contributions of this study is in showing that this addiction-induced use, at least in the context of Facebook, has no fewer than five facets (as supported by H2-6). These include general use frequency, active use frequency, use duration, usage comprehensiveness, and access device heterogeneity. One’s level of addiction explains between 3 to 9% of the variations in the IS use dimensions. This fine-grained treatment of IS use can advance research on system use (technology adoption and continuance). Moreover, it can improve theorizing on, and detecting symptoms of technology-related addictions.

In addition to the main findings, the results suggest that age and gender exert some influence on addiction to using Facebook and on one’s general use frequency. Older users employ Facebook fewer times per day compared with younger ones. Men (coded as 1) use Facebook more frequently than women (coded as 0). However, women present higher levels of Facebook addiction compared to men.

Theoretical Implications

Several implications emerge from this study. First and foremost, this study demonstrates that some people may engage in a “vicious cycle” of hedonic IS use, and that possibly this cycle is associated with the processes described in rational addiction and incentive sensitization theories. Thus, it adds to the body of works on system use which mostly focuses on desirable use, and suggests that some system use processes can be maladaptive and harmful. As per the abovementioned theories, this happens when strong intrinsic rewards are present, which can be the case with Facebook. Thus, IS research that focuses on systems that provide such rewards (e.g., gambling websites, social networking websites, video games, and pornography websites) can include maladaptive perception change processes, addiction states, and past use patterns as predictors of current levels of system use. These can enrich existing system use models which

typically focus on positive planned behaviors [e.g., 6, 23] and expand it to such contexts in which there is a risk for maladaptive processes.

Second, this study expands the typical simplistic view of technology use, which often includes a single dimension [13], or up to three dimensions of use (frequency, duration, and comprehensiveness) [26]. This study adds two additional dimensions that can also be relevant in other IS use contexts, and may be incorporated into IS use models. Relying on ideas from the substance use literature, this study first distinguished between general use frequency and active use frequency and showed that active use frequency is also a viable IS use dimension. In fact, in many cases it may be a more appropriate use measure than general use frequency because revenues are typically influenced more by activity (e.g., posting bids, purchasing) than by browsing. Next, this study conceptualized the construct of access device heterogeneity, and showed that it is also a possible system use dimension. Arguably, this may be an important use outcome to include in future research given the multitude of devices individuals can use to access information systems. Ultimately, the nuanced conceptualization of system use is a key feature of the study, because system use is a central phenomenon in IS studies [40], and improving its granularity can advance our understanding of user – system interactions.

Lastly, the findings regarding the control variables are also informative. They indicate that addiction phenomena may be associated with demographic variables. It thus supports past research in this domain [20] and suggests that future research on technology-related addictions should include at least age and gender controls. It is interesting to see that men use Facebook more often, yet develop lower addiction levels compared to women. This implies that perhaps men emphasize the use thrill or emphasize socialization differently from women, and consequently are less prone to Facebook, and possibly other technology-related addictions. This proposition should be tested in future research.

Practical Implications

First, the results can inform the development of better addiction prevention techniques, through more specific research in this direction is needed. Based on the findings, prevention can be achieved by enforcing use increase constraints, or helping users develop self-awareness regarding their potentially problematic behavior. When abnormal levels of use or use increase are detected, companies and service providers that are concerned for their users can for example, constrain further increase in daily use time, frequency, and breadth of use features. While easy to implement, further research on the effectiveness and efficiency of such measures is warranted, because users may find ways to bypass them. Furthermore, more research is needed with regards to the specific definition of “abnormal use” or “abnormal use increase”, which are likely to differ by the IS and the specific situation in which it is used.

Second, the findings imply that several aspects of IS use can be indicative of high levels of a technology addiction. They can therefore be used for screening and prevention purposes. In essence, by focusing on a wide array of system use facets, organizations and service providers can better detect potential cases of addiction, and possibly take measures to reduce or prevent this problem. Moreover, because many of the symptomatic system use aspects can be obtained from system use logs, screening for potential cases of addiction can be automated (e.g., detecting abnormal and persistent increase in use, use frequency, duration, and intensity). This screening, though preliminary only (i.e., it may produce a list of candidates who may need to go through further screening), may be potentially less biased than self-reported scales. Companies and IS

service providers that provide access to addiction-prone IS may have the incentive to follow this path because they may have liability issues when their users develop technology addictions [38]. However, one should consider the ethical and legal privacy implications of applying this monitoring mechanism to all users or employees. It may irritate users and possibly violate their rights. Thus, it may be wise to apply such tests only if users opt-in, and when there is a reasonable reason to believe that the benefits of such tests outweigh the drawbacks of these privacy violations. Finding the optimal balance of activity monitoring has been a challenge for organization, e.g., in the case of Internet misuse [1], and it requires further research. Lastly, the findings indicate that IS use has several potentially overlooked facets. Organizations and online service providers that are interested in examining the success of their IS can therefore include active use frequency and device heterogeneity as potential additional success criteria. This is important, because IS success assessment is imperative for organizational learning as well as future IS design and funding decisions.

Limitations and Future Research

Despite the contributions of this study, some limitations should be acknowledged. First, this study was based on a single possibly addictive application, namely Facebook, and employed a limited sample of North American users. Thus, caution should be exercised when generalizing from these findings to other hedonic and non-hedonic applications as well as to different user populations. Future studies should examine other types of applications (e.g., gambling or online gaming websites) and focus also on non-North American populations. Moreover, this study used language which is borrowed from the addiction literature, with terms such as “addiction careers” and “vicious cycle”. This was done in order to be consistent with the vast body of works on typical substance addictions. However, because the viability, severity, and prevalence of Facebook addiction are yet to be determined, it should be noted that this language may seem to some as somewhat dramatic, and perhaps more appropriate terms will be suggested in the future. Furthermore, the cycle this study focuses on is rather simplistic, and includes a straightforward use increase-addiction-use pattern. Future research can examine more elaborated and multi-staged cycles.

Second, this study used the term “addiction” in order to be consistent with the vast literature on problematic overuse behavior with regards to certain technologies. The appropriateness of this term is yet to be determined (e.g., while acknowledged in the recent version of the DSM, this manual still refers to the problem as a disorder and not addiction). Obviously most of the participants in this study would not meet any criteria for classification as true “addicts” or as having any pathological disorder. But, consistent with the technology-related addiction literature, it was assumed that all users have some levels of addiction as manifested through the level of addiction-like symptoms they present. Thus, caution should be exercised when interpreting the term addiction in this context, and perhaps more appropriate terms will emerge in future research.

Third, while system use as demonstrated in this study can be associated with addiction, these effects are unlikely to be direct. There are many maladaptive cognition modification processes that translate addictions into increased use [39]; and there are many such processes that translate past increase in use into addiction [4]. Such factors and processes were not captured in this study for parsimony reasons. Consequently, the obtained R-square scores were relatively small. Note that low R-squares in behavior variables are common across many behavior domains, especially

when a behavior is predicted by a single individual-difference factor [35]. This is because there are many variables that can potentially influence behavior. Thus, future research may examine a broader nomological network of system use predictors which will explain more variation in system use facets; as well as a broader set of predictors of technology-related addiction.

Fourth, the design of this study was imperfect. It included two surveys which were administered one week apart. The first survey may have primed user behaviors in the following week, and consequently their responses to the second survey. This risk was mitigated by not letting participants know what the first and the second surveys were about, but could not be fully eliminated. Measurement at additional points in time and using different time intervals can help to further alleviate this concern. Moreover, the study relied on self-reported data for capturing use increase and use patterns. Ideally, objective measures of such concepts should be obtained from system use logs. This was not feasible in the current study due to privacy settings, but future studies are encouraged to try to use such objective measures.

CONCLUSION

Information system use has often been treated as a positive desirable behavior. This study shows that it is not always the case; and that some users of hedonic IS can get trapped in a “vicious cycle” which can propel the development of addiction to using the system that can drive further use of the system. The resultant IS use is not a simple construct. Rather, it can be a multifaceted concept which includes at least five dimensions. Thus the relationships between technology-related addiction and system use are temporal and complex. Ultimately, this study adds to the growing IS body of knowledge regarding system use and addiction, and shows that in many respects the associations between technology-related addictions and system use are similar to those between other addictions and the enactment of problematic behaviors. Using these findings it is hoped that researchers can better theorize and examine drivers and outcomes of system use and technology-related addictions.

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