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Good habits gone bad: Explaining negative consequences associated with the use of mobile phones from a dual-systems perspective

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Abstract. *Information technology use is typically assumed to have positive effects for users, yet information technology use may also lead to negative consequences with various degrees of gravity. In the current work, we build on dual-systems theories to investigate negative consequences associated with mobile phones use (MPU), defined as the extent to which the use of mobile phones is perceived to create problems in managing one's personal and social life. According to dual-system theories, human behaviour is guided by two systems: reflexive (automatic) and reflective (control), which most of the time work in harmony. But when the two systems come into conflict, they will both complete to exert their influences over behaviour. Thus, we view the negative consequences associated with MPU as an outcome of the tug-of-war between the two systems influencing our day-to-day behaviours, where reflexive system is represented in our study by MPU habits and reflective system is represented by self-regulation. We hypothesise that the influence of habit and self-regulation on these negative consequences will be mediated through MPU. A partial least square analysis of 266 responses was used to validate and test our model. The study results generally support our model. The theoretical and practical implications of our study are discussed.*

Keywords: problematic use, mobile phones, dual systems, habit, self-regulation, negative consequences

INTRODUCTION

Although the use of technology is typically assumed to have positive effects for users (DeLone & McLean, 2003; Burton-Jones & Grange, 2013), it appears that technology use may also lead to negative consequences with various degrees of gravity (Caplan, 2010; Turel *et al*., 2011a,b; Steelman *et al*., 2012; Kuss, 2013; Kuss *et al*., 2014; Spada, 2014). Mobile phone use (MPU) is a prevalent and ubiquitous example of user interactions with technology on a daily basis. A recent report found that on average, people check their mobile phones 150 times a day for various reasons such as texting, making calls, emailing, listening to music, playing games, browsing the web, taking pictures and checking the time (Meeker & Wu, 2013). While mobile phones facilitate social accessibility, enhance productivity and increase personal efficiency (Venkatesh *et al*., 2012), the ubiquitous and convenient nature of MPU has led to unfortunate changes in our social behaviour (Walsh *et al*., 2008), even consisting of risky (Pennay, 2006) and illegal actions (Nelson *et al*., 2009). For example, the National Safety Council (2010) estimates that roughly 28% of vehicle accidents (approximately 1.6 million) annually in the U.S. can be attributed to the use of mobile phones while driving. Furthermore, MPU has the potential to lead to users' reduced productivity, tardiness for appointments, a reduction in the number of hours slept, financial losses due to soaring mobile phone bills and complaints from family members (Bianchi & Phillips, 2005; Jenaro *et al*., 2007; Turel *et al*., 2011a,b; Billieux, 2012).

Recently, considerable efforts have been made to investigate these observations as a part of a spectrum of technology addictions, which encompass a wide range of dysfunctional behaviours and interactions with technology (e.g. video games, gambling, social networks and sex-related websites addiction) (Bianchi & Phillips, 2005; Jenaro *et al*., 2007; Turel & Serenko, 2010; Turel *et al*., 2011b; Billieux, 2012). Similar to other types of technology addictions, mobile phone addiction is expected to be manifested through a number of core symptoms: (1) conflict (i.e. the use of mobile phone interferes with other tasks); (2) withdrawal (i.e. the presence of negative emotions due to a lack of using the mobile phone); (3) relapse and reinstatement (i.e. the inability to reduce the usage of the mobile phone voluntarily); and (4) behavioural salience (i.e. the use of the mobile phone dominates other tasks) (Turel & Serenko, 2011; Turel *et al*., 2011a,b).

While prior studies have directed our attention towards the typical symptoms of technology addiction in the context of MPU, more effort is warranted to gain deeper understanding of its aetiology. There are a number of opportunities to pursue further understanding in this area of research. First, although theoretically sound investigations are required to provide recommendations for prevention policies and potential psychological interventions, unfortunately, most of the conducted research in the area of mobile phone addiction '*was realized in the absence of a theoretical rationale*' (Billieux, 2012, p. 303). Second, while the current literature has drawn our attention towards diagnosing the general symptoms of mobile phone addiction (Billieux *et al*., 2007; Billieux *et al*., 2008; Billieux, 2012), mobile phone addiction represents a complex phenomenon with multiple symptoms where different symptoms might be driven through different mechanisms (Billieux, 2012); hence, similar efforts are still needed to examine the underlying mechanisms through which these symptoms occur.

In this study, we utilise a dual-systems perspective in an attempt to explore and understand the mechanism underlying the negative consequences associated with MPU,[1] defined as the extent to which the use of mobile phones is *perceived* to create problems in managing one's personal and social life. These negative consequences represent or closely resemble the 'conflict' and perhaps 'salience' symptoms of technology addiction. Hence, it is reasonable to draw on the technology addiction literature (Turel *et al*., 2011a,b) and apply its core ideas to examine the negative consequences associated with MPU. Against the backdrop of the current literature, we build on the well-established dual-systems theories (Bargh & Chartrand, 1999; Metcalfe & Mischel, 1999; Evans, 2003) and investigate the negative consequences associated with MPU as an outcome of the tug-of-war between the two systems influencing our day-to-day behaviours: the reflexive system represented by habits and the reflective system represented by self-regulation (Bargh & Chartrand, 1999; Metcalfe & Mischel, 1999; Evans, 2003).

From brushing our teeth, tying our shoes, driving to work and all the way to using our mobile phones, '*our life*, *so far as it has definite form*, *is but a mass of habits*' (James, 1899, p. 65); however, the role of habitual behaviour in the occurrence of negative consequences associated with MPU is often overlooked. Moreover, aside from scant attention to the role of habit in the problematic use of technology literature (LaRose, 2010; Turel & Serenko, 2012), the phenomenon of habit has been under investigated.

We would like to stress that '*habits can be evaluated as neutral*, *or as* "*good*" (*desirable*), *or as* "*bad*" (*undesirable*)' (Graybiel, 2008, p. 360). Only when a habit conflicts with an already established goal, the habit is considered as a 'bad habit' (Ouellette & Wood, 1998; Turel & Serenko, 2012). Most of the time, the formed habits are exercised in the right time and place (i.e. appropriate contexts). Sometimes, however, habits sneak up on us and rear their heads when they are least wanted (i.e. inappropriate context), '*such situations are typically experienced as a conflict between two antagonistic forces that exert incompatible influences*' (Hofmann *et al*., 2009, p. 162). One force calls on us to do what we believe is appropriate in the situation (i.e. self-regulation), whereas the other urges us to do what we are accustomed to doing (i.e. habit; Hofmann *et al*., 2009). According to the dual-systems perspective, in inappropriate contexts, the reflective system will attempt to override automatic behaviour exerted by the reflexive system, and hence, the two systems will compete to influence the resulting behaviour. In addition to that, the habit of using technology has been shown to act as a double-edged sword where, through addiction formation, habit can increase negative feelings (e.g. guilt) and consequently, foster the development of discontinuance intentions towards the technology use (Turel, 2014). Generally speaking, some people are better than others at overriding their habits and avoiding the spillover of habits at the wrong place and time. Unfortunately, others do not possess the sufficient level of self-regulation to have the upper hand over their habits. As the interplay between self-regulation and habit related to technology use can, in some cases, lead to ultimately abandoning a technology, it is important to examine the

[1]The term 'negative consequences' is used throughout the paper to refer to broader general life negative consequences that could be associated with technology use.

mechanisms driving their influences, as well as the different relevant techniques for managing their impacts (Turel, 2014).

In the context of MPU, we examine self-regulation and habit of using mobile phones (MPU habit) as manifestations of the reflective and reflexive systems, respectively, where MPU habit and self-regulation both compete to exert their influences over negative consequences.[2] Moreover, we believe that MPU habit and self-regulation influences on negative consequences will be mediated through MPU. By focusing on the competing roles of habit and self-regulation, the current study extends the mobile phone addiction literature and provides a road map for developing future interventions. Furthermore, the current study recommends examining interventions that seek to improve users' self-regulation capacity (Muraven, 2010) to facilitate the disruption of bad MPU habits (Wood & Neal, 2009) or evade its formation altogether (Quinn *et al*., 2010).

THEORETICAL BACKGROUND

Dual systems

Dual-systems theories suggest that people process incoming information through two structurally different systems (Bargh & Chartrand, 1999; Metcalfe & Mischel, 1999; Evans, 2003; Strack & Deutsch, 2004; Lieberman, 2007).

The reflexive (i.e. automatic) system processes information using cognitive and affective associations to trigger rapid behavioural responses. In this case, working memory capacity is not required, and information processing may directly activate preexisting action tendencies. Habits, often understood as '*learned sequences of acts that become automatic responses to specific situations which may be functional in obtaining certain goals or end states*' (Verplanken *et al*., 1997, p. 540), represent a manifestation of the reflexive system's output. Once a habit is formed, behaviour will be performed automatically when triggered by environmental or internal cues (Triandis, 1980; Aarts & Dijksterhuis, 2000, Orbell *et al*., 2001). Habitual behaviour places minimal requirements on cognitive processing, conscious attention and deliberate control (Wood *et al*., 2002). As a result, habit exhibition is effortless, efficient and non-reflective in nature (Lindbladh & Lyttkens, 2002).

In contrast, the reflective system processes information based on rules to exert control over actions (Lieberman, 2007). This reflective system is responsible for setting higher-order goals, as well as establishing goal pursuit and the evaluation, monitoring and the regulation of ongoing behaviour based on a reference point (Strack & Deutsch, 2004; Baumeister *et al*., 2006;

[2]While habit and self-regulation were selected as manifestations of the dual systems because of their relevance for the context under investigation (Strack & Deutsch, 2004; Hofmann *et al*., 2009), they represent only one of the numerous ways through which dual systems could be illustrated (e.g. impulse vs. self-regulation in the context of interpersonal conflict, heuristic processing vs. systematic processing in the context of attitude formation, experiential vs. rational processing in the context of problem solving and stereotyping vs. suppression in the context of social judgement), i.e. there are no one-to-one associations between habit and self-regulation and the reflective–reflexive systems (for a review, see Smith & DeCoster, 2000).

Lieberman, 2007). Consequently, the reflective system acts as an impulse control, overriding automatic responses in the reflexive system.

Thus, self-regulation could be understood as '*overriding one's action tendency in order to attain another goal*' (Carver & Scheier, 2011, p. 3).[3] Reflexive responses, i.e. activated habitual responses, can be either good or bad depending on the situation (Ouellette & Wood, 1998; Graybiel, 2008; Turel & Serenko, 2012), but when they conflict with already established goals, the reflective system needs to be engaged (Muraven *et al*., 1998; Vohs, 2006; Hofmann *et al*., 2009). Table 1 summarises the characteristics of the two systems depicted in Figure 1.

Building on the dual-systems perspective (Bargh & Chartrand, 1999; Metcalfe & Mischel, 1999; Evans, 2003), MPU could be explained as an outcome of the interplay between the reflexive and reflective systems. In the context of MPU, we face the choice between responding to internal (e.g. feeling bored or anxious) and external (e.g. receiving a notification of an incoming email/call/ text message) triggers, stimulating MPU or deferring the MPU until a later point in time. Habit drives us to automatically exhibit learned responses towards the triggers (e.g. to answer the phone when we hear it ring or to check for text messages when we hear a 'ding'), without much deliberation about the setting in which we are exhibiting our behaviour (e.g. alone, with friends, in a meeting or while driving). Furthermore, the evaluation of the suitability or appropriateness of exhibiting the MPU habit behaviour in a specific setting is a function of the reflective system (Hofmann *et al*., 2009). Consequently, this leads to individuals evaluating the appropriateness of exhibiting the habitual behaviour and overriding it when necessary. For example, when the exhibition of MPU habit in specific settings (e.g. in a meeting or while driving) conflicts with already established goals (e.g. to appear professional or to drive safely), overriding the habitual response will hinge on the person's capacity to exercise self-regulation, as well as the strength of the habit (Carver & White, 1994; Carver & Scheier, 1998; DeShon & Gillespie, 2005). A recent study of information technology (IT) addiction from a neuroscience perspective provides further support for the use of dual-systems framework in the current context (Turel *et al*., 2014). The findings demonstrated the activation of distinct brain regions associated with habitual (reflexive) and inhibitory (reflective) tasks related to IT use. The findings further showed that some users have very strong drives from the reflexive system but can often exercise control over these drives by engaging the reflective system (Turel *et al*., 2014).

Mobile phone use habit

The habitual response to technology use has served as a fertile research venue that complements and expands the rational decision-making perspective dominating the information systems (IS) literature (Limayem *et al*., 2007; Ortiz de Guinea & Markus, 2009; Polites & Karahanna, 2012) by focusing more on the reflexive system, rather than the more traditional reflective system introduced in the Technology Acceptance Model (TAM) (Davis *et al*., 1989). The strength of habit can manifest directly in technology use (Limayem *et al*., 2007; Venkatesh

[3]Inhibition of prepotent responses is only one of the several distinct executive and cognitive processes underlying self-regulation (for a review, see Vohs & Baumeister, 2011).

Table 1. Features associated with reflexive and reflective systems (adapted from Lieberman (2007))

Reflexive system	Reflective system
Parallel processing	Serial processing
Fast operating	Slow operating
Slow learning	Fast learning
Non-reflective consciousness	Reflective consciousness
Sensitive to subliminal presentations	Insensitive to subliminal presentations
Spontaneous processes	Intentional processes
Prepotent responses	Regulation of prepotent responses
Typically sensory	Typically linguistic
Outputs experienced as reality	Outputs experienced as self-generated
Relation to behaviour unaffected by cognitive load	Relation to behaviour altered by cognitive load
Facilitated by high arousal	Impaired by high arousal
Phylogenetically older	Phylogenetically newer
Representation of symmetric relations	Representation of asymmetric relations
Representation of common cases	Representation of special cases (e.g. exceptions)
	Representation of abstract concepts (e.g. negation and time)

et al., 2012) or indirectly through attenuating the influence of behavioural intention on technology use behaviour (Bhattacherjee, 2001; Limayem *et al*., 2007). Researchers studying automatic use of technology have focused on the development of IS-use habits, the maintenance of those habits and their consequences (Kim & Malhotra, 2005; Kim *et al*., 2005; Limayem *et al*., 2007; Kim, 2009; Ortiz de Guinea & Markus, 2009; Venkatesh *et al*., 2012).

People constantly carry their mobile phones, using them to accomplish various tasks limited to not only making phone calls but also including text messaging, social networking, emailing and other functionalities (Venkatesh *et al*., 2012). In the process of serving the users' goals, mobile phones provide a variety of cues that may trigger the automatic recurrence of behaviour. As a result, mobile phones may be viewed as a very fertile context for the formation of habitual behaviours (Verplanken & Wood, 2006; Ortiz de Guinea & Markus, 2009). Thus, we focus on MPU habit in general and not the use of mobile phones to perform to a specific task (Limayem *et al*., 2007), where MPU habit is defined as *the extent to which people tend to use mobile phones automatically*.

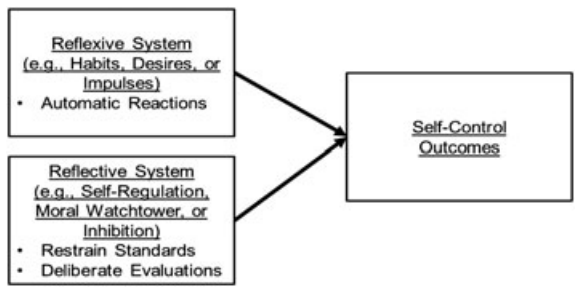


Figure 1. Dual systems and the prediction of self-control outcome.

We regard habits as cognitive structures that are similar to 'if-then' rules (Verplanken *et al*., 2007; LaRose, 2010), which means that the repetition of behaviour would lead to the development of a mental representation of relationships between goals and the actions needed to perform them (Aarts & Dijksterhuis, 2000). For example, a novel activity carried out using a mobile phone may start with a clear goal in mind, such as checking incoming emails to increase one's efficiency; however, when repeated enough times, this goal-directed behaviour may turn into a habit.

Furthermore, habits can be activated outside of the original context in which they were intentionally formed. This activation can occur because of the mental association with secondary stimuli. For example, the habit of using a mobile phone may have been initiated by the intention to make a call or check for messages. However, as the use becomes habitual, secondary stimuli, such as hearing the notification sound of an incoming text message, phone call and email or even observing others use their own phones, trigger the same behavioural response without having the underlying motivation that originally drove the development of the habit.

Finally, although the relationship between habit strength and technology addiction has been investigated in the problematic use literature in contexts such as social networking websites (Turel & Serenko, 2012) and internet browsing (LaRose, 2010) from a behavioural perspective and has recently been examined as a tug-of-war between habitual impulsive responses and self-regulation from a neural perspective (Turel *et al*., 2014), to our knowledge the tug-of-war between habit and self-regulation invoked by the spillover of technology use habit to an inappropriate context and the engagement of self-regulation to override that habit have yet to be examined behaviourally and in the MPU context.

Self-regulation

In our day-to-day lives, most people engage in self-regulation where they attempt to overcome emotions, urges or temptations and alter their responses to align with higher-order goals, values and ideals they have (Muraven & Baumeister, 2000). Self-regulation, in a broader sense, entails three processes: self-monitoring, self-judgement and self-reaction (in that order). In self-monitoring, people are aware of their own performance as well as the various effects caused by their conduct. In self-judgement, people evaluate their performance either by using personal standards or by comparing their performances with the performance of others. In self-reaction, people alter their responses (affective, cognitive or behavioural) to match their standards and goals. Based on the outcome of self-judgement, people either reinforce the behaviours that are positively evaluated or abstain from pursuing actions that yield negative results.

Self-regulation or, more specifically, poor self-regulation is evident at the heart of the mobile phone addiction phenomenon in young adults and adolescents (for a review, see Billieux, 2012), where mobile phone users experience an inability to regulate their MPU, which eventually results in negative consequences. This 'regulation-failure', which generally refers to one's failure to adequately monitor, judge and adjust his or her behaviour, could be inferred from the preoccupation with the thought of MPU, as well as the compulsive pattern of MPU accompanied with the occurrence of negative consequences. These maladaptive cognitions and behaviours mirror typical technology addiction symptoms and provide

increased confidence in utilising the dual-systems perspective to provide additional insights into this area. In this study, we focus on self-regulation as a personality trait, rather than focusing on self-regulation over the use of *a specific* function of mobile phones. Prior research investigated the users' inability to override their urge to use mobile phone for a specific function [e.g. emailing (Turel & Serenko, 2010), social networking (Salehan & Negahban, 2013), texting (Sultan, 2014) and gaming (Young, 2009)]. It is reasonable to assume that in the absence of mobile phones, these dependencies would continue to exist through other IT devices. Even more, we can assume that the dependence on specific content might exist independently of other multiple functions available on mobile phones (in other words, the dependence is towards the content, not the platform). Yet, with tremendous advancements in mobile phone capabilities and functionalities, it is possible to develop a dependence towards MPU itself. Mobile phones could be viewed as a bundle or a collection of functionalities. Each function may serve one or more of the users' needs or goals, as a result, providing the users with a rewarding experience. As the range of functionalities provided by a mobile phone expands, users acknowledge that their mobile phone will be the gateway for delivering rewarding experiences (although users might not be able to predict their next rewarding interaction with their mobile phone, e.g. a funny video shared on YouTube, good news in an email, confirmation about dinner reservation in a text message and exciting status about a friend on Facebook). Therefore, mobile phones may serve as a delivery mechanism for rewards based on a variable schedule (Ferster & Skinner, 1957). Consequently, while some users are expected to exhibit an obsessive compulsive pattern of their MPU (Steelman *et al*., 2012), as they search for the next rewarding interaction with their mobile phones, which are highly accessible anywhere and at any time, other users are expected to exhibit a regulated pattern of MPU.

Negative consequences associated with MPU

Technology adoption and use as a field of research have received great attention over the last two decades, especially in the field of IS (Bagozzi, 2007; Benbasat & Barki, 2007; Goodhue, 2007; Schwarz & Chin, 2007; Silva, 2007) with the advent of the technology adoption model (Davis, 1989; Davis *et al*., 1989; Davis *et al*., 1992), the study of task-technology fit (Goodhue & Thompson, 1995), continued IS usage (Kim & Malhotra, 2005; Kim *et al*., 2005; Kim, 2009; Ortiz de Guinea & Markus, 2009) and hedonic IS (Agarwal & Karahanna, 2000; Venkatesh *et al*., 2012).

Being 'always connected' has been depicted in the literature to increase the likelihood of encountering negative consequences in different contexts, especially in relation to MPU. A number of negative consequences have the potential to occur with MPU both within an individual's personal life and in organisational performance (Turel & Serenko, 2012). For example, an individual may experience psychological distress (Beranuy *et al*., 2009), financial problems due to soaring phone bills (Bianchi & Phillips, 2005; Billieux *et al*., 2008), life-threatening situations (e.g. MPU while driving; Billieux *et al*., 2008; Steelman *et al*., 2012) or anxiety and insomnia (Jenaro *et al*., 2007). In relation to the organisation, a variety of negative consequences such as work overload and increased technology–family conflicts have the potential to increase

negative emotions of an individual and reduce organisational commitment (Turel & Serenko, 2010; 2011; Turel *et al*., 2011a,b). Because of the variety of negative consequences that can result from MPU, we focus in the current study on an individual's *perceived* general level of personal and social problems associated with MPU (Caplan, 2010).

MODEL DEVELOPMENT

The model presented in this study posits that dual systems, composing of self-regulation (i.e. reflective) and MPU habit (i.e. reflexive), influence MPU. In turn, MPU will impact negative consequences. Figure 2 presents the theoretical model and hypotheses developed in this section.

MPU habit and negative consequences

While it is possible in many cases, such as those of high level of user's engagement with mobile phones, that high level of MPU will not result in negative consequences (Charlton & Danforth, 2007; 2010; Turel & Serenko, 2011), the prior literature generally suggests that high level of reported MPU is a mandatory and necessary condition for negative consequences to occur, said differently, the higher the level of the reported MPU, the greater the possibility of negative consequences (Charlton, 2002; Bianchi & Phillips, 2005; Charlton & Danforth, 2007; 2010; Billieux *et al*., 2008; Barley *et al*., 2011; Billieux, 2012). Lengthier and larger number of interactions with the mobile phone are expected to result in higher *chances* of MPU in an

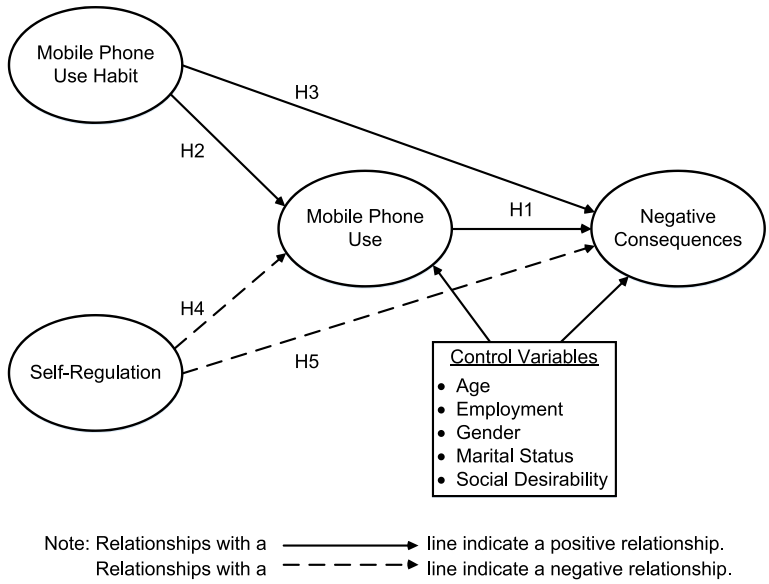


Figure 2. Theoretical model.

inappropriate context, and hence, an increase in negative consequences, which could be attributed to the distractions and interference with users' ongoing tasks.

H1: Mobile phone use will increase negative consequences.

Habits play a significant role in automatically driving a wide array of behavioural responses such as technology use (Davis & Venkatesh, 2004; Kim & Malhotra, 2005; Kim *et al*., 2005; Limayem *et al*., 2007; Venkatesh *et al*., 2012). As the strength of MPU habit increases, MPU can be activated directly by stimulus cues (Venkatesh *et al*., 2012). We would expect, in general, that the stronger the MPU habit, the greater the use or the interaction with the mobile phones would be.

However, interactions with mobile phones could also occur in an appropriate context as well as in an inappropriate context. When a habitual behaviour is activated in a context that differs from the one it is formed in, there is a possibility that the activation context is inappropriate for the executed behaviour. The spillover of habits from one context (i.e. appropriate) to another context (i.e. inappropriate) will render the habit dysfunctional. Said differently, when the habitual behaviour is activated in a setting placing the executed behaviour in conflict with already established goals, the activated habit is coined as a 'bad' habit. For instance, when the habit of checking emails interferes with other important activities such as engaging with colleagues in a meeting, eating dinner with family or focusing on the road while driving, then the habit of checking the mobile phone becomes a 'bad' habit. As a result, habits are not inherently bad, by themselves they cannot result in negative consequences, but habits can result in negative consequences by triggering behaviours that are undesired in the context of their enactment. From the prior discussion, we expect that the impact of MPU habit on negative consequences will be mediated through MPU.

H2: Mobile phone use habit will increase mobile phone use.

H3: Mobile phone use habit influence on negative consequences will be fully mediated through mobile phone use.

Self-regulation and negative consequences

People with good self-control are '*more adept than their impulsive counterparts at regulating their behavioral*, *emotional*, *and attentional impulses to achieve long-term goals*' (Duckworth, 2011, p. 2639). We believe that people with high levels of self-regulation might be less susceptible to potential negative consequences associated with MPU. Suppressing and overriding thoughts related to maladaptive cognitions that trigger MPU might increase attention to other important elements in the context of MPU. For example, paying more attention to an ongoing conversation between colleagues rather than being preoccupied with the thought of checking one's mobile phone might be beneficial in capturing important

details in the conversation. Additionally, as the reflective system oversees the reflexive system, MPU that is deemed incongruent with the user's goals will be reduced. Social cognitive theory lends support to that argument, where people are usually expected to regulate their behaviours when deemed problematic (Bandura, 1986). As a result, the influence of self-regulation is expected to be exhibited through a reduced level of MPU behaviour (Bandura, 1998; Turel, 2014) but not directly on negative consequences. Therefore, when a person's ability to exercise self-regulation is high, MPU in an 'inappropriate situation' is less likely to occur; hence, negative consequences could be avoided or at least minimised. When a person's ability to exercise self-regulation is low, MPU is more likely to occur, regardless of the individual's knowledge of the possible negative consequences of MPU (e.g. checking a received email while driving on the highway might increase the chance of getting into an accident). As a result, we argue that the impact of self-regulation on negative consequences will be fully mediated through MPU.

H4: Self-regulation will reduce mobile phone use.

H5: Self-regulation's influence on negative consequences will be fully mediated through mobile phone use.

METHOD

Study context and sample

The data investigated in this study were collected from an online crowdsourcing market, Amazon's Mechanical Turk, utilising an online survey. An online crowdsourcing market is an internet-based participant recruitment resource, which facilitates the distribution, completion and retrieval of survey responses (Steelman *et al*., 2014). The only restriction for individual participation in the study was the ownership of a mobile phone. Participants received a monetary incentive of 20 cents for participating in the study and responding to all of the survey questions, a level of compensation that has been found in prior research to be adequate in this environment while still encouraging valid responses (Buhrmester *et al*., 2011; Mason & Suri, 2012; Steelman *et al*., 2014). After completing the consent form, the participants indicated whether or not they owned a mobile phone; if not, they went directly to the end of the survey, where we collected demographic information. We separated submissions from people without a mobile phone in order to reduce missing or false data entries. Participants were requested to reflect on their MPU experience pertaining to basic services (e.g. talk, text and email[4]) and

[4]While many additional abilities are available in today's mobile devices, especially smartphones, many individuals across the globe still utilise simpler devices. As the mobile phone addiction literature has found that even these basic abilities can cause series problems in people life (Leung, 2008; Turel & Serenko, 2010), we did not want to potentially bias our results by only capturing responses from individuals with smartphones. Therefore, the abilities captured are general in nature and apply to both smartphones and traditional mobile phones (e.g. flip phones).

answer the questions accordingly through a web link that provided access to the survey. The average time needed to complete the survey was approximately 15 min. The collected sample consisted of 300 responses. All surveys were completed online and were examined for multiple attempts and fictitious answers as recommended by Steelman *et al*. (2014).

After removing incomplete or duplicate answers, we continued our data cleaning process with an examination of outliers by examining a combination of Cook's distance, Mahalanobis distance and residual analyses to identify and remove potential outliers (Hair *et al*., 2006). No outliers were found in this dataset. Our final dataset, utilised for all analyses, consisted of 266 responses. Respondents' ages ranged from 18 to 68 years with a mean age of 29.30 (standard deviation = 8.57). The sample included approximately 51% men and 49% women respondents. Out of the collected sample, 83% of respondents had a Bachelor's degree or higher, 53% were single and 65% were employed.

Operationalisation of variables

To measure the constructs used in our model, we used well-established and reliable measures. A complete list of items is provided in the Appendix. The measures for MPU habit, MPU (duration and frequency) and negative consequences were based on measures developed by Limayem *et al*. (2007), Venkatesh *et al*. (2008) and Caplan (2010), respectively and adapted to the context of MPU. To capture self-regulation, we used the impulsiveness subscale developed by Eysenck and Eysenck (1978). Because of the potential for individuals to underreport negative behaviours such as those pertaining to excessive MPU as well as overreport positive behaviours such as their self-regulation abilities, we statistically control for the presence of social desirability bias using the short form of the Marlowe–Crowne social desirability scale (Reynolds, 1982). Additionally, we included a series of control variables that have been found to potentially influence the hypothesised relationships within the model (e.g. age, gender and marital and employment status).

DATA ANALYSIS

To test both the measurement and structural models in this study, we conducted a partial least squares (PLS) estimation, a component-based structural equation technique using SmartPLS 2.0.M3 (Institute of Operations Management and Organizations, University of Hamburg, Germany), (Ringle *et al*., 2005). PLS allows for the estimation of both the measurement and structural models (Chin, 1998); however, compared with covariance-based SEM, it does not explicitly model measurement error (Esposito *et al*., 2010). Thus, PLS is recommended for research focusing on newer, untested relationships (Gefen *et al*., 2011), as is the case with the model presented in this research. Furthermore, to be consistent with previous research, we adopt a similar analytical approach (Turel *et al*., 2011b). All constructs were modelled using reflective indicators. Gender, employment status and marital status were coded using a dichotomous dummy variable, while age was coded as a continuous variable.

Table 2. Summary statistics

Variable	Mean	SD	AVE	CR	CAR	1	2	3	4	5	6	7	8	9	10
1 Age	29.30	8.57	—	—	—	—									
2 Employment	0.35	—	—	—	—	−0.24***	—								
3 Gender	0.49	—	—	—	—	0.13*	−0.05	—							
4 Marital status	0.43	—	—	—	—	0.47***	−0.19**	0.10	—						
5 Social desirability	6.74	2.39	—	—	—	0.10	0.01	−0.03	0.03	—					
6 Self-regulation	4.00	1.27	0.68	0.90	0.84	0.16**	0.08	0.15*	0.02	0.17**	0.83				
7 MPU habit	4.83	1.46	0.78	0.93	0.91	−0.11	−0.07	−0.09	−0.02	−0.03	−0.40***	0.88			
8 MPU duration	1.09	0.51	0.64	0.84	0.72	−0.08	−0.15*	−0.14*	0.14*	0.10	−0.30***	0.40***	0.80		
9 MPU frequency	0.87	0.39	0.60	0.82	0.67	−0.07	−0.15*	−0.30***	0.16**	0.08	−0.34***	0.34***	0.73***	0.78	
10 Negative consequences	2.96	1.71	0.90	0.96	0.94	−0.11	−0.04	−0.32***	0.03	−0.01	−0.54***	0.33***	0.43***	0.42***	0.95

*$p < 0.05$, **$p < 0.01$ ***$p < 0.001$.

SD, standard deviation; AVE, average variance explained; CR, composite reliability; CAR, Cronbach's alpha reliability.

Square root of the AVE on the diagonal; Respondents were on average 29.30 years old (age), 65% were employed (employment), 49% were female (gender) and 43% were single (marital status). Additionally, the SD of 8.57 for age provides indication of a wide range of respondents within this study. For detailed indication of the scale ranges for each construct, please refer to the Appendix.

Testing measurement model

To test the measurement model, we began by examining the reliability, convergent and divergent validities of the constructs (Hair *et al*., 2006; Chin, 2010). First, to assess the consistency of our measurement scales, we examined the reliability estimates of each construct. The reliability estimates of our multi-item measurement scales were evaluated by examining the Cronbach's alpha reliability (CAR) and composite reliability coefficient for each construct, as shown in Table 2. Except for MPU frequency with CAR of 0.67, the CAR for each measurement scale ranged from 0.72 to 0.94. The composite reliability ranged from 0.82 to 0.96 for each measurement scale exceeding the recommended threshold of 0.70 (Nunnally & Bernstein, 1994; Hair *et al*., 2006), indicating adequate levels of reliability for each of the constructs.

Next, the convergent validity was assessed by examining (1) the factor loadings and cross loadings and (2) the average variance explained (AVE) for each construct (Gefen & Straub, 2005; Hair *et al*., 2006). Support for convergent validity is present when indicator items load primarily on their focal construct and less on the alternative constructs within the model, and the AVE for each construct exceeds 0.50 (Chin, 1998). Additionally, the discriminant validity can be assessed by (1) items loading highly on their focal construct with minimal cross loadings on other constructs and (2) the square root of the AVE exceeding the interconstruct correlation in the study (Fornell & Larcker, 1981). Table 2 reflects that the AVE of all constructs exceeds the 0.50 threshold with a minimum of 0.60 and the square root of the AVE of each construct exceeds all off-diagonal correlations between the focal construct and all other constructs in the model. Moreover, as seen in Table 3, each of the measurement items loaded higher on their focal construct (minimum of 0.70) than they did on all other constructs, with a minimum of 0.19 difference between the loadings and cross loadings. With (1) the constructs loading primarily

Table 3. Loadings and cross loadings

Construct		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Self-regulation	SRG1	**0.82**	−0.32	−0.21	−0.21	−0.39
	SRG2	**0.88**	−0.41	−0.28	−0.30	−0.51
	SRG3	**0.85**	−0.32	−0.29	−0.30	−0.46
	SRG4	**0.76**	−0.27	−0.22	−0.24	−0.41
Mobile phone use habit	HAB1	−0.31	**0.85**	0.33	0.31	0.17
	HAB2	−0.38	**0.87**	0.36	0.29	0.35
	HAB3	−0.34	**0.91**	0.36	0.33	0.24
	HAB4	−0.38	**0.90**	0.38	0.35	0.36
Mobile phone use duration	DUR1	−0.24	0.26	**0.76**	0.51	0.31
	DUR2	−0.24	0.41	**0.83**	0.60	0.31
	DUR3	−0.26	0.30	**0.82**	0.66	0.40
Mobile phone use frequency	FRQ1	−0.32	0.20	0.57	**0.75**	0.43
	FRQ2	−0.17	0.24	0.51	**0.70**	0.19
	FRQ3	−0.28	0.36	0.63	**0.86**	0.31
Negative consequences	NEG1	−0.51	0.34	0.42	0.38	**0.93**
	NEG2	−0.53	0.31	0.40	0.37	**0.96**
	NEG3	−0.50	0.27	0.39	0.35	**0.95**

on their focal constructs, (2) less so on all other constructs, (3) all AVEs exceeding 0.50 and (4) the square root of the AVE exceeding off-diagonal correlations, we find significant support for the convergent and divergent validities (Gefen & Straub, 2005; Hair *et al*., 2006).

Based upon the examination of the reliabilities, both convergent and divergent validities of our measurement model and the results presented in Tables 2 and 3, we find significant evidence supporting the validity and reliability of our measurement model.

Assessment of method biases

To assess the potential for common method bias within our model, we conducted a Harmon's one-factor test via exploratory factor analysis (Podsakoff & Organ, 1986) and examined the correlations between constructs within the model (Pavlou *et al*., 2007) and a structural equation model (Liang *et al*., 2007). The rationale for the Harmon's one-factor test is that if common method bias poses a serious threat to the analysis and interpretation of the data, a single latent factor would emerge, accounting for the majority of the manifest variables (Podsakoff & Organ, 1986). Results from this procedure yielded five factors, which accounted for 66% of the variation, with the first factor only accounting for 40%, indicating that common method bias does not pose a serious threat in the current study (Sanchez *et al*., 1995). Next, we examined the correlation between first-order constructs in the correlation matrix (Table 1), whereas evidence of common method bias should have resulted in extremely high correlations ($r^2 > 0.90$) (Pavlou *et al*., 2007). In our analysis, the correlations did not indicate significant excessive correlations providing further support for a lack of significant common method bias in our analysis.

Finally, we utilised the Liang *et al*. (2007) common method bias approach for a single-method factor within PLS. This test models a common method factor within the analysis to examine its impact on each indicator item. When estimating the model including the common method factor, (1) none of the original results change in their direction or significance, (2) the loadings of the common method factor on each indicator item are low and nonsignificant aside from three paths and (3) the loadings of the substantive items on their respective constructs are all significant with greater magnitudes than the method factor loadings. Additionally, we examined the squared factor loadings of both the common method factor and the substantive construct indicators to determine the AVE for each construct. For the composite sample, the AVE of the substantive indicators is 0.76 with the average method-based variance explaining less than 0.01. Also, the AVE for each focal construct at least exceeds 0.64, while the variance explained by the method factor is below 0.5. Together, the multiple tests used indicate that common method bias is not a significant concern within our study.

In addition to the tests for common method bias, we attempted to capture participants' social desirability bias, which has been known to potentially inflate positive behaviour responses and constrain negative behaviour response (Reynolds, 1982). In Table 2, we find that the social desirability scale's highest correlation is with self-regulation ($r = 0.17$), which captures an individual's perception of their ability to control their behaviours throughout the day. This positive correlation is to be expected based on the prior theoretical discussion and usage of the social desirability scales (e.g. Nederhof, 1985), and we believe that the level of correlation provided,

and the relatively low correlations with other focal constructs in the model, provides confidence that social desirability biases do not pose a large concern in this study.

Structural model

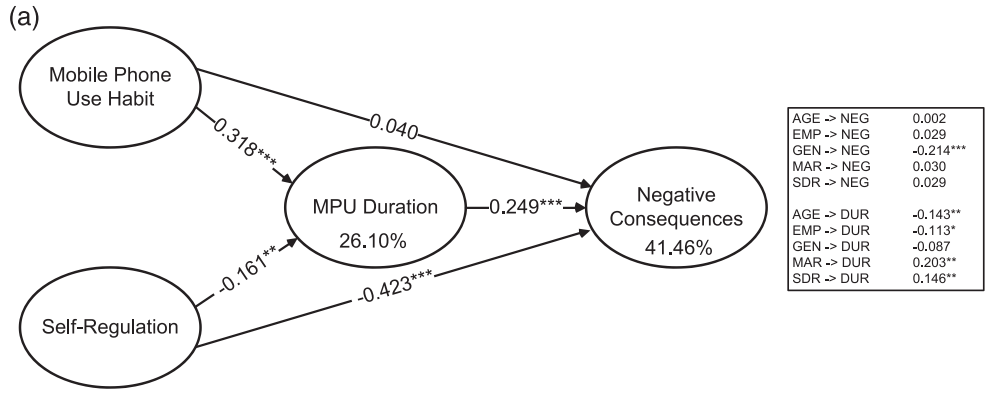
We ran two structural models where MPU was represented in Model 1 by the duration of MPU and in Model 2 by the frequency of MPU. Different facets of MPU were examined separately to help gain more insights regarding which facet represents the primary driver of negative outcomes. The structural models were estimated with Smart PLS based on the 266 responses and the recommended 1000 bootstrapping resamples to generate robust parameter estimates (Chin, 2010). Because PLS analysis does not provide an overall goodness-of-fit, measure models should be evaluated on the basis of their R^2 values and the direction and significance of the path coefficients (Götz *et al.*, 2010). The results of the structural models pertaining to the estimated path coefficients and their significance within our structural model are shown in Figure 3-a and 3-b. Model 1 explains 41.46% of the variance related to negative consequences and 26.10% of the variance in the duration of MPU. Model 2 explains 39.33% of the variance related to negative consequences and 29.64% of the variance in the frequency of MPU.

The significant positive effect of MPU (duration ($\beta = 0.249$, $p < 0.001$) and frequency ($\beta = 0.184$, $p < 0.01$)) on negative consequences provides support for H1. The significant positive effect of MPU habit on MPU (duration ($\beta = 0.318$, $p < 0.001$) and frequency ($\beta = 0.216$, $p < 0.001$)) provides support for H2. Additionally, the direct path from MPU habit to negative consequences was not significant. Therefore, the influence of MPU habit on negative consequences appears to be fully mediated through MPU, providing full support for H3.[5]

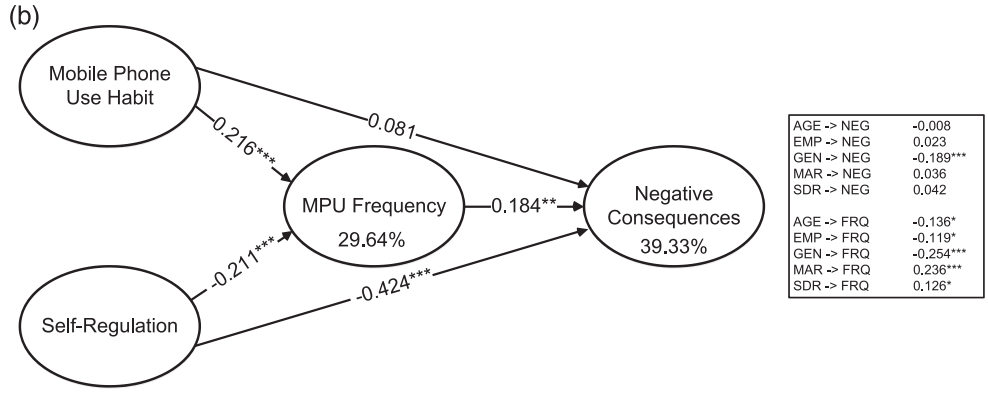
The significant negative effect of self-regulation on MPU (duration ($\beta = -0.161$, $p < 0.001$) and frequency ($\beta = -0.211$, $p < 0.001$)) provides support for H4. Additionally, self-regulation had a significant negative effect on negative consequences ($\beta = -0.424$, $p < 0.001$). Because the direct path from self-regulation to negative consequences was significant in the presence of MPU (duration and frequency), the influence of self-regulation on negative consequences appears to be only partially mediated through MPU, failing to support H5.

In addition to the significance and direction of the structural paths, we conducted a Chow's test (Chow, 1960) utilising the PLS estimations to compare the coefficients across the models, which indicated no significant differences between the impact of MPU habit and self-regulation on different facets of MPU (duration and frequency). Also, there was no significant difference between the impacts of MPU on negative consequences across both models.[6]

[5]We also conducted a series of Sobel tests for all mediation analyses in this paper and found consistent results with our main analysis.
[6]Unreported results of all analyses are available from the authors upon request.



Note: EMP = Employment; GEN = Gender; MAR = Marital Status; SDR = Social Desirability; NEG = Negative Consequences; DUR = MPU Duration.



Note: EMP = Employment; GEN = Gender; MAR = Marital Status; SDR = Social Desirability; NEG = Negative Consequences; FRQ = MPU Frequency.

Figure 3. (a) Model results capturing duration of MPU and (b) model results capturing frequency of MPU.

DISCUSSION

The results provide support for the dual-systems theories for the investigation of negative consequences associated with MPU, highlighting the roles of self-regulation and MPU habit in driving MPU and associated perceptions of negative consequences.

As Figure 3-a and 3-b demonstrates, MPU duration and frequency increase the negative consequences associated with MPU. First, the link between the duration of MPU and negative consequences is intuitively clear and has been examined heavily in the literature (Billieux, 2012) and emphasised enough to be the hallmark of problematic technology-use literature (Charlton, 2002; Charlton & Danforth, 2007; 2010). Second, the positive relationship between frequency of MPU and negative consequences could be explained by the distractions and interruptions of ongoing tasks associated with frequent MPU, which could lead to reduced performance on the ongoing tasks (Barley *et al*., 2011).

Self-regulation, as predicted, was negatively associated with MPU. Users who monitor and continuously evaluate their mobile phone behaviour, and use the discrepancy between their goals and their current level of behaviour to adjust their future behaviour, tend to have lower reported instances of negative consequences. By using their MPU within the boundary of their needs and available resources, users with high level of self-regulation, in general, face less negative consequences relative to users who are low on self-regulation. Also, it appears that high levels of self-regulation allow people to directly minimise the negative consequences associated with their MPU where people with high self-regulation cope better with the negative consequences, anticipate and prevent them and recover faster from their impact.[7]

An alternative line of reasoning may indicate that the level of a person's capacity to exercise self-regulation may allow that person to overcome the impacts of habitual responses by increasing their control over such behaviours. To test for this possibility, we test for a potential moderating effect of self-regulation on the habitual influences leading to MPU. When testing for this moderation effect, we find no significant evidence supporting this line of reasoning.[8] Our findings support the findings reported by other studies, examining the interaction between the reflexive and reflective systems (Li *et al*., 2013). Therefore, we believe that the mediating results and influences as developed in our study provide the leading theoretical insights into a dual-systems model of mobile phone addiction. However, the idea of an interaction between the reflexive and reflective systems merits further research beyond the context we examined and the sample used in this study.

CONTRIBUTIONS, IMPLICATIONS, LIMITATIONS AND FUTURE RESEARCH

The current study adopted a dual-systems perspective and focused on the role of MPU habit and self-regulation in explaining negative consequences derived from MPU. We believe that this work makes several contributions to the field of research on technology dependence in general and mobile phone addiction in particular, yet the contributions of the study need to be viewed in the light of its limitations. First, this study relied on self-reported MPU data. As MPU becomes habitual with reduced levels of conscious attention, actual levels of mobile usage may be underestimated. Second, we acknowledge a lack of correspondence between reported facets of MPU activities. For example, while the measures of MPU duration capture both incoming and outgoing focal MPU activities, the measures of MPU frequency only capture the frequency of incoming focal MPU activities. Third, we focused on self-regulation and habit to present one of the many possible manifestations of the reflective and reflexive systems. Moreover, self-regulation is a multifaceted multidimensional construct, and the conceptualisation and measure used in the current study might have only captured a subset of the processes underlying self-regulation. In addition to that, we measured general self-regulation, but habit was MPU specific. Hence, the comparison of their effects may be 'unfair' or biased. Fourth, the current study is a cross-sectional survey and thus works within limitations on the inferences we can make on causality.

[7]We would like to thank the Associate Editor for offering this possible explanation.
[8]The complete interaction analysis is available upon request.

Notwithstanding its limitations, the current study generates multiple contributions. First, although a limited number of empirical studies have examined the role of habit (e.g. Turel & Serenko, 2012), as well as the role of self-regulation (e.g. LaRose *et al*., 2003; Caplan, 2010; Li *et al*., 2013) in explaining the problematic use of technology, the current study brings the two perspectives together and grounds them in a well-established theoretical framework to provide a more nuanced understanding of the mechanisms driving mobile phone addiction.

Second, we focused on investigating negative consequences associated with MPU, which represents a subset of the core symptoms of mobile phone addiction, to provide a deeper and a richer examination of the phenomenon. This approach paves the way for the creation of an integrative framework that accounts for the various pathways between different psychological, sociological and technology-related factors and the heterogeneous symptoms of mobile phone addiction (Billieux, 2012). Moreover, while other symptoms of mobile phone addiction (e.g. withdrawal and relapse and reinstatement) warrant their own investigations, we focused in the current study on negative consequences, which is believed to have the potential for smoothing the integration of mobile phone addiction concept with organisational behaviour and work–family conflict models (e.g. Turel *et al*., 2011b).

Third, using the dual-systems perspective as a theoretical framework facilitated the portrayal of a more balanced view of 'system use' relative to the one adopted in the majority of IS research, emphasising the benefits of IS deployment and encouraging its use. The current work extends recent efforts that have been made to advance that notion and to fill the void in the literature pertaining to the 'dark side' of technology use (LaRose *et al*., 2003; Block, 2008; Turel *et al*., 2011a,2011b; Turel & Serenko, 2012). Moreover, there have been recent calls in the IS field for studies focusing on the roles of self-regulation (Bagozzi, 2007) and habit (Ortiz de Guinea & Markus, 2009) in guiding 'system use' behaviour. In the current study, we supplemented prior efforts, addressed recent calls and empirically examined a model that not only draws researchers' attention to the problematic aspects of technology use but also investigates one of the plausible mechanisms through which they take place. We shed light on the role of MPU in mediating the influence of habit and self-regulation on negative consequences. While the influence of MPU habit on negative consequences was fully mediated by MPU, self-regulation had both direct and indirect influence on negative consequences. In our study, we found that both habit and self-regulation influence MPU. While self-regulation had a stronger influence on the frequency of MPU compared with that of habit, habit had a stronger influence on the duration of MPU compared with that of self-regulation. However, a Chow's test found no significant differences in our sample and should be explored in future research.

Fourth, our work expands the potential interventions for reducing the negative consequences associated with MPU. The study results would recommend examining the influence of interventions that seek to enhance self-regulation and break bad habits. Based on the model of self-control strength (Muraven & Baumeister, 2000), it is possible to improve people's self-control through regular practice of self-control tasks (Muraven, 2010). The model of self-control strength argues that regardless of the self-control task, practising small acts of controlling urges, temptations, thoughts or feelings is predicted to enhance self-control

abilities (Muraven, 2010). For example, physical exercises, using non-dominant hand exercises, money management and posture adjustment exercises are recommended in prior literature to increase resources needed to exercise self-regulation activities, and these resources are transferable across different contexts (Baumeister *et al*., 2006). Moreover, to increase the chances of breaking a bad habit and facilitating a behavioural change, an individual needs to form implementation intentions. An example of implementation intentions might include thoroughly preparing a detailed plan that highlights what should be done to alter a specific habit and when, where and how it should be done (Webb *et al*., 2009; Wood & Neal, 2009).

Furthermore, it is easier to avoid developing a bad habit than it is to break an already existing one (Quinn *et al*., 2010). As a result, we need to enhance self-regulatory performance, which could be done by directing more attention to the self and monitoring its behaviour (Carver & Scheier, 1998), thus aiding in the avoidance of bad habit formation. Moreover, self-awareness can circumvent ego depletion (a depletion of cognitive resources resulting in poorer performance on later self-control task; *Alberts et al*., 2011). Additionally, there are actions that we can consider to forge self-awareness. For instance, a possible government intervention could consist of public awareness campaigns illustrating the dangerous consequences of developing bad MPU habits and recommending that people proactively monitor their own MPU. We believe that IT-based interventions are promising for this venue. For example, recent mobile applications have been developed to track the number of times an individual checks their mobile phone throughout the day (e.g. Checky by Calm.com, Inc). If people notice an increase in their MPU in an inappropriate situation, they should remind themselves that this behaviour has negative consequences and encourage themselves to refrain from repeating the inappropriate use (Webb *et al*., 2009).

The current study provides a number of opportunities for future research. Future studies should collect longitudinal data utilising objective measures. Moreover, assessment of respondents' activities should take place in natural settings through techniques that allow for surveying respondents *in situ*. Also, future research should capture the frequency of both active and passive MPU activities. In addition to that, future research should go beyond the basic activities captured in the current study (talk, text and email) towards a broader set of activities available nowadays via mobile phones (e.g. playing games, watching TV shows and browsing social media). Moreover, while we feel that our conceptualisation and measure of self-regulation provide important insights into self-regulation's ability to influence negative consequences associated with MPU, in order to explore and validate our findings future researchers should use multidimensional measures to capture additional facets of self-regulation (e.g. Carey *et al*., 2004) and should also attempt to capture both general and specific measures of habits and self-regulation to explore any differential effects that may arise.

Moreover, we investigated the problematic aspect of MPU behaviour despite the motivations driving that use. Different drivers may have varying roles, if any, in establishing mobile phone dependence. We believe that future research should examine the roles of hedonic in addition to utilitarian motivations underlying mobile phone addiction as well as its related consequences. Future studies should examine the influence of different intervention

strategies related to mobile phone addiction, premised on the idea of enhancing mobile phone users' ability to exercise self-regulation and/or breaking MPU habits. We believe that attention should be directed towards exploring questions such as what self-regulation building exercises would be more effective and when, how long and how frequently the exercises should be practised. To add, we call upon future research to study more manifestations of the reflective and reflexive systems as well as their interplay as they relate to MPU and the associated negative consequences as well as other types of technologies and symptoms of technology addiction.

Finally, the present study hints at the tug-of-war between the reflexive and reflective systems as a potential antecedent of the 'dark side' of IT. By extending the adopted theoretical framework, to examine different technologies and their use in different sectors, we believe that future research can gain more insights into the paradox of positive and negative impacts associated with IT use. For example, our theoretical model can be used to explain how IT-use habits developed in personal use context might have carryover effects of negative impacts in organisational use context and vice versa. Moreover, from a tug-of-war perspective, the current model can be used to aid future research in identifying the inflexion point where IT use turns from 'beneficial' to 'problematic'.

CONCLUSION

The purpose of this article is not to question the fruitful insights provided by the prior technology addiction literature but rather to dig deeper in the technology addiction phenomenon and provide nuanced understanding of the possible mechanisms driving its occurrence. In this study, we were able to build and validate a model that examines negative consequences associated with MPU from a dual-systems perspective. The findings of the study would suggest enhancing the ability of mobile phone users to exercise self-regulation as well as identifying mechanisms to break bad habits. We believe that moving towards a granular examination of technology addiction symptoms across multiple technologies, contexts and mechanisms will provide the field with the building blocks needed to build a grand theory of the complex multidimensional technology addiction phenomenon.

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