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Modeling habitual and addictive smartphone behavior
The role of smartphone usage types, emotional intelligence, social stress, self-regulation, age, and gender

Alexander J.A.M. van Deursen *, Colin L. Bolle, Sabrina M. Hegner, Piet A.M. Kommers

University of Twente, Department of Communication Science, PO Box 217, 7500AE Enschede, The Netherlands

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ABSTRACT

The present study investigates the role of process and social oriented smartphone usage, emotional intelligence, social stress, self-regulation, gender, and age in relation to habitual and addictive smartphone behavior. We conducted an online survey among 386 respondents. The results revealed that habitual smartphone use is an important contributor to addictive smartphone behavior. Process related smartphone use is a strong determinant for both developing habitual and addictive smartphone behavior. People who extensively use their smartphones for social purposes develop smartphone habits faster, which in turn might lead to addictive smartphone behavior. We did not find an influence of emotional intelligence on habitual or addictive smartphone behavior, while social stress positively influences addictive smartphone behavior, and a failure of self-regulation seems to cause a higher risk of addictive smartphone behavior. Finally, men experience less social stress than women, and use their smartphones less for social purposes. The result is that women have a higher chance in developing habitual or addictive smartphone behavior. Age negatively affects process and social usage, and social stress. There is a positive effect on self-regulation. Older people are therefore less likely to develop habitual or addictive smartphone behaviors.

1. Introduction

The use of mobile Internet has reached figures over 50% in most Western countries (Donovan, 2013). In the Netherlands, 70% of the general population and over 90% of the adolescents own a smartphone (CBS Statistics, 2013). Often expressed concerns related to the increasing dependency on smartphones centers around the notion of addiction (Haverlag, 2013). While the need for research on Internet and smartphone addiction is acknowledged (Haverlag, 2013; LaRose & Eastin, 2004; LaRose, Lin, & Eastin, 2003), most of the investigations focus on describing behaviors and consequences (Yu, Kim & Hay, 2013). Factors that support smartphone addiction are to a large extent unknown (Haverlag, 2013). In the current contribution, first we focus on the type of smartphone use, or the gratifications that might play a role in habitual or addictive smartphone behavior. Second, we focus on personal traits that have been proposed as effective on addictive Internet and gaming behaviors: social stress, emotional intelligence, and self-regulation (Kwon et al., 2013). Third, we investigate the role of gender and age. Men and women are known to use smartphones in different ways, and younger people are the most profound users of mobile technologies.

1.1. Addictive smartphone behavior

Internet and smartphone addiction are different from addictions such as alcohol or drugs; the former are behavioral and not substance dependent. Behavioral addiction can be defined as a disorder characterized by (1) behavior that functions to produce pleasure and to relieve feelings of pain and stress, and (2) failure to control or limit the behavior despite significant harmful consequences (Shaffer, 1996). In behavioral addictions, the behavior itself – think of using smartphones, social media, or gambling – act as a reward. Whang, Lee, and Chang (2003) consider Internet addiction as "an impulse-control disorder with no involvement of an intoxicant; therefore, it is akin to pathological gambling" (p. 144). Internet and other digital addictions are often the result of habitual behavior used to relieve pain or escape from reality (Huisman, Garretsen, & Van Den Eijnden, 2000). When the use of the Internet or smartphones becomes addictive, this might result in negative effects on financial, physical, psychological, and social

* Corresponding author. Tel.: +31 534891021 (3299 secr.); fax: +31 534894259.
E-mail address: a.j.a.m.vandeursen@utwente.nl (A.J.A.M. van Deursen).

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aspects of life (Young, 1999). Although the Internet in general, and the mobile Internet on smartphones in particular have similar features making the type of addiction similar (Kwon et al., 2013), smartphones have unique factors, such as (screen) size, applications, ubiquity, and flexibility in both time and space (Nielsen & Fjuk, 2010). The large variety of available applications promotes the intensive use of smartphones and the need of being online (Okazaki & Hirose, 2009).

1.2. Habitual smartphone behavior

Excessive and impulsive smartphone behavior can be explained by problematic habitual evolvement (Oulasvirta, Rattenbury, Ma, & Raita, 2011). Habits are formed through repeated acts in certain circumstances (Oulasvirta et al., 2011). In cognitive research, habits are defined as "an automatic behavior triggered by situational cues, such as places, people, and preceding actions" (Oulasvirta et al., 2011, p. 2). Habits are behavioral acts without self-instruction or conscious thinking (LaRose & Eastin, 2004), and can have both positive and negative effects (Wood & Neal, 2007). Habits enable multitasking and accomplishing complex tasks, and provide control over behavior in novel situations (Wood & Neal, 2007). Habits furthermore have a positive social feature, because habits characterize a person and predict that person's actions (Oulasvirta et al., 2011; Wood & Neal, 2007). On the other hand, maladaptive habits can cause unintended behavior activated by internal or external cues interfering with other acts, for example when people experience excessive urges such as unintended smartphone checking. This could interfere with daily life if it is not limited by regulations or social norms (Rush, 2011). Smartphones have the potential to produce new habits related to Internet use, for example, automatic actions in which the smartphone is unlocked to check the start screen for notifications (Oulasvirta et al., 2011). Such automatic actions can be triggered by external (ringtone) and internal cues (emotional state, urge). When previous actions resulted in desirable outcomes, those actions are likely to reoccur. The frequency of these actions and the salience of the reward determine the strength of the habit (Rush, 2011). Strong habits are repeated more often and are easier provoked by cues compared to habit that are less automatic (LaRose & Eastin, 2004). This can reach the level where they become annoying, such as inappropriate use of a smartphone at restaurants, concerts, and/or family gatherings. When the smartphone is removed, panic attacks or feelings of discomfort might emerge (Young, 1999; Shaffer, 1996). We hypothesize that:

H1: Habitual smartphone use positively influences addictive smartphone behavior.

1.3. Type of smartphone usage

Testing the relationship between types of smartphone use and addictive behavior requires a classification of usage types. Song, Larose, Eastin, and Lin (2004) proposed a twofold classification based on process and content gratifications. Process-related gratifications are acquired during consuming or prosuming media (Song et al., 2004) and are most interesting in relation to addictive smartphone behavior. Pleasurable experiences function as rewards and increase the chance to develop habitual or addictive behaviors (Yang & Tung, 2007). Besides process related use, previous studies showed that social usage affects addictive Internet behavior (Chou & Hsiao, 2000; Yang & Tung, 2007). Li and Chung (2006) concluded that if people depend on the Internet for social reasons, the risk to get addicted is the highest. People who are highly dependent on the Internet for interaction act impulsively, avoid emotions, and fail to keep up a proper planning or time management (Li & Chung, 2006). Lopez-Fernandez, Honrubia-Serrano, Freixa-Blanxart, and Gibson (2014) concluded that smartphone addicts spend most of their time on their smartphone for social purposes. Bandura (1991) explains with operant conditioning that actions are reinforced by rewards and punishments. Using the smartphone for pleasurable or social experiences is rewarding. The result is that we are more likely to repeat those actions as an escape from real life (Chou & Hsiao, 2000). We hypothesize that:

H2a: Process usage positively influences habitual smartphone use.
H2b: Process usage positively influences addictive smartphone behavior.
H3a: Social usage positively influences habitual smartphone use.
H3b: Social usage positively influences addictive smartphone behavior.

1.4. Personal traits

In the current study, we consider three traits that have shown to affect Internet and gaming addictions: emotional intelligence, social stress, and self-regulation (Kwon et al., 2013). Emotional intelligence is especially popular in its relation to physical and mental well-being (Engelberg & Sjoberg, 2004; Grisham, Steketee, & Frost, 2007; Kun & Demetrovics, 2010; Parker, Taylor, Eastabrook, Schell, & Wood, 2008; Rozin, Taylor, Ross, Bennett, & Hejmadi, 2003). It involves the ability to monitor and discriminate one's own and others' emotions, and subsequently use this information to guide one's thinking and actions (Kun & Demetrovics, 2010). Poor emotional regulation by adolescents is associated with problem behaviors (Wills, Pokhrel, Morehouse, & Fenster, 2011). In addictive behavior, decoding and differentiation of emotions as well as the regulation of emotions play an important role (Kun & Demetrovics, 2010). Internet addicts are more likely to have problems with decoding facial expressions and emotions (Engelberg & Sjoberg, 2004). Furthermore, individuals that have difficulties in coping with negative emotions easily turn to the Internet (Kun & Demetrovics, 2010). Overall, individuals with lower levels of emotional intelligence show less physical and mental well-being and possess a higher risk of developing Internet addictions (Beranuy, Oberst, Carbonell, & Chamarro, 2009; Engelberg & Sjoberg, 2004; Parker et al., 2008). This also applies to smartphone addictions (Beranuy et al., 2009; Kun & Demetrovics, 2010). We hypothesize that:

H4a: Emotional Intelligence negatively influences habitual smartphone use.
H4b: Emotional intelligence negatively influences addictive smartphone behavior.

The second personal trait we focus on is social stress. In general, stress is a nonspecific response of the body to a demand placed upon it to adapt, whether that demand produces pleasure or pain (Goeders, 2003). Smartphones are designed to be carried 24/7 and support their owners in different ways. The result is that many people are strongly attached to their smartphone (Rush, 2011) and increasingly also expect others to be available at any time. This can cause stress or anxiety when the device is not at immediate reach (Carbonell, Oberst, & Beranuy, 2013): one cannot be reached by others, cannot contact friends, or fails in being up-to-date (Lee, Chang, Lin, & Cheng, 2014; Sayrs, 2013). Because the smartphone has become so visible in daily life, it is becoming a critical tool in impression management. Not being able to be reached, for example, might cause symptoms of stress because this unavailability

might result in bad impressions when someone expects you to communicate instantly. We propose the following hypotheses:

H5a: Social stress positively influences habitual smartphone use.
H5b: Social stress positively influences addictive smartphone behavior.

Most human behavior is regulated by forethought: people motivate and control their behavior to achieve desired outcomes, also named self-regulation (Bandura, 1991). Failure of self-regulation is controlled by emotions, automatic behavior, and steered by impulses (Metcalfe & Mischel, 1999). It can lower a person's self-efficacy, self-esteem, and can lead to stress (LaRose & Eastin, 2004; Wills et al., 2011). To alter such negative effects, one might use media to escape, feel better, or find a feeling of belonging (LaRose & Eastin, 2004). Self-regulation has been shown to play a critical role in disorders such as Internet addiction (Dawe & Loxton, 2004; LaRose et al., 2003). A failure of self-regulation might begin with consciously using the smartphone to relieve negative feelings. This allows habits to form when the undertaken actions do not result in the desired outcomes and the behavior is not adapted. Behavior then can become addictive, as it is no longer consciously observed. We propose the following hypotheses:

H6a: Self-regulation negatively influences coping with social stress.
H6b: Self-regulation negatively influences habitual smartphone use.
H6c: Self-regulation negatively influences addictive smartphone behavior.

1.5. Gender and age

Research into the risk factors for problematic Internet use has emphasized that its occurrence may be influenced by demographics (Billieux & Van Der linden, 2012). Compared to men, women are more socially oriented (Lee et al., 2014), making social media relatively more appealing to them (Duggan & Brenner, 2013). Males on the other hand are more attracted by process oriented usage types such as gambling, playing games, or watching porn (Frangos, Frangos, & Kiohos, 2010). Gender differences might also surface concerning emotional intelligence and social stress. Women are more likely to display greater emotional awareness, to use more emotion-related language, and to use a more extensive range of emotional regulation strategies than do men (Barrett, Lane, Sechrest, & Schwartz, 2000; Nolen-Hoeksema, 2012). Furthermore, women are more likely to feel the stressful effects of negative interpersonal events and therefore experience higher levels of social stress (Troisi, 2001). Finally, from the majority of studies on online addiction, one might expect that males are more likely to engage in habitual or addictive smartphone behaviors than females (e.g., Choi et al., 2009; Morahan-Martin & Schumacher, 2000). We hypothesize that:

H7a: Men are more likely to use the smartphone for process use than women.
H7b: Women are more likely to use the smartphone for social use than men.
H7c: Women have higher levels of emotional intelligence than men.
H7d: Women are more likely to experience social stress than men.
H7e: Men are more likely to show habitual smartphone use than men.
H7f: Women are more likely to show addictive smartphone behavior than men.

Older people are less likely than younger people to embrace new technologies (Charness & Bosman, 1992). Furthermore, on the Internet, adolescents are less focused on money and earnings, but more on pleasurable experiences. Additionally, they strongly depend on the use of social media for communication purposes (Howe & Strauss, 2004; Lenhart, Purcell, Smith, & Zickuhr, 2010). Because of their reliance on digital communication, we expect that adolescents show more unregulated, habitual, and addictive smartphone behavior than older people. Furthermore, Mayer, Caruso, and Salovey (1999) asserted that in order for emotional intelligence to be considered a standard intelligence, it should increase with age. Indeed, several scholars concluded that adults function at a higher level of emotional intelligence than adolescents (Mayer et al., 1999; Van Rooy, Alonso, & Viswesvaran, 2005). Finally, social stress is particularly salient among youngsters; they are more likely to experience conflicts or difficulties in social relationships (Clarke, 2006). We hypothesize that:

H8a: Age negatively influences process use of smartphones.
H8b: Age negatively influences social use of smartphones.
H8c: Age positively influences emotional intelligence.
H8d: Age negatively influences social stress.
H8e: Age positively influences self-regulation.
H8f: Age negatively influences habitual smartphone use.
H8 g: Age negatively influences addictive smartphone behavior.

1.6. Research model

According to the theoretical considerations, we propose the conceptual model in Fig. 1.

2. Materials and methods

2.1. Sample and procedure

The present study was designed as a cross-sectional study. We relied on a data set collected in May 2014. Respondents were recruited from a Dutch Internet survey panel (Thesistools) based on voluntary participation. The panel matches the Dutch population in terms of region, education, age and gender. The company performed a random selection, ensuring the sample remained representative of the Netherlands. Members were invited to participate via an e-mail explaining the general topic of the survey, the time it would take to complete, and a link to the online-survey system of Thesistools. Before completing the questionnaire, participants received an information text, including a rough overview of the aim and structure of the upcoming questionnaire. The Behavioral Science Ethics Committee of the University of Twente approved this study and participants were informed that the data was treated in strict confidence. The time needed to answer survey questions was limited to approximately 15 min, and participants were allowed to stop and come back and finish the survey at a later time. Furthermore, we pilot-tested the survey with three participants (aged 18, 37, and 58) to examine the clarity of the questionnaire. The three participants were asked to read the questions after which the understanding and clarity were discussed. While reading the questions, the participants had to mark those that they did not fully understand or that were not clear enough.

In total, 1,200 people were randomly selected with a goal of obtaining a sample of approximately 300 individuals. We made sure to include enough men and women, and participants of

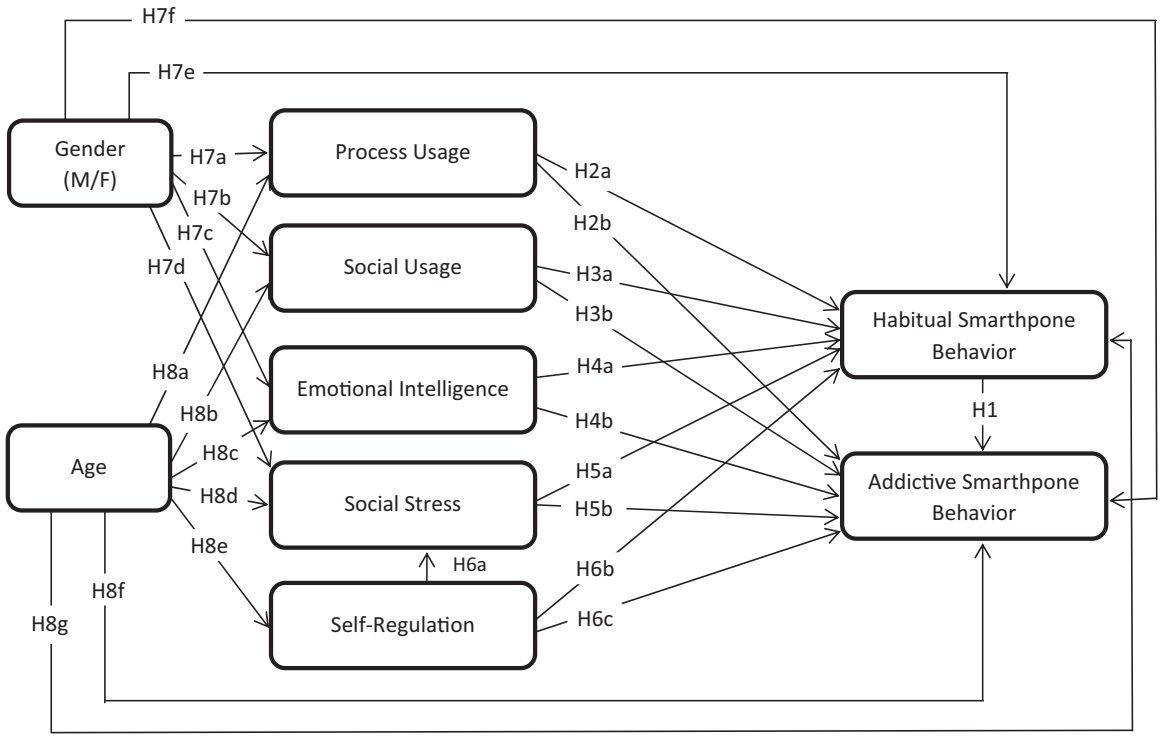

Fig. 1. Conceptual Model and proposed hypotheses.

different age, required to test the conceptual model. Incomplete questionnaires (4) were deleted and participants without a smartphone were excluded from participation. This resulted in a total of 386 complete responses that could be used for data analysis. Table 1 summarizes the demographic profile. The mean age of the respondents was 35.2 years (SD = 14.7), ranging from 15 to 88. Although the sample is not representative for the Dutch populations, it suits the purpose of the current study. Respondents on average used the smartphone for 16.9 (SD = 17.2) hours a week, and owned one for 4.7 (SD = 4.6) years.

2.2. Measures

To measure addictive smartphone behavior, we used the Mobile Phone Problem Use Scale developed by Bianchi and Phillips (2005). This 26-item scale covers tolerance, escape from problems, withdrawal, craving, negative consequences, and social motivations. The scale uses ten-point Likert responses, ranging from very true of me, to very untrue of me. Example of an item is: "*I feel lost without my mobile phone.*" All measures were pretested with 26 respondents recruited using Facebook. They were asked to complete the questionnaire which enabled us to investigate the reliability of the items. If the reliability, measured with Cronbach's alpha, was low, we adjusted or replaced items. Results of the pretest showed high internal reliability for the addictive behavior scale. The appendix overviews the final measures used with the reliability scores that resulted from the main test.

Table 1
Demographic profile (N = 386).

	N	%
Gender		
Male	124	33
Female	262	67
Age		
15–25	139	36
26–35	92	24
35–45	49	13
46–55	60	14
>55	46	12

Habitual smartphone behavior was measured with an instrument adapted from Limayem, Hirt, and Cheung (2003). They consider habitual behavior as an automatic response to certain (internal and external) cues. The original scale was developed for habitual Internet use which we adapted to the use of smartphones. An example item is: *"I use my smartphone automatically,"* scored on a 5-point agreement scale. Results of the pretest showed high internal reliability of the scale.

To determine the process- and socially-oriented uses of the smartphone, we adapted items proposed by Chua, Goh, and Lee (2012). Additionally, we created two items for both usage types. Based on the results of the pretest, we deleted one item for social usage to improve internal reliability. An example of a process usage item: "*Because it helps me to pass time.*" An example of a social usage item: "*Because it helps me to maintain relationships.*" Items are scored on a 5-point agreement scale.

To assess emotional intelligence, we used the Schutte Self-Report Emotional Intelligence Test (Schutte et al., 1998). This instrument consists of 33 items rated on a five-point agreement scale. The items on the test relate to three emotional intelligence components: appraisal and expression of emotion, regulation of emotion, and utilization of emotion. An example question is: "*I seek out activities that make me happy.*" Items are scored on a 5-point agreement scale. Based on the pretest, we decided to remove five items to improve Cronbach's alpha.

To assess if the respondents felt stressed in social contexts, we used a revised version of the Brief Fear of Negative Evaluation Scale (Schlenker & Leary, 1982) proposed by Carleton, Mccreary, Norton, and Asmundson (2006). The main objective of this scale is to examine social anxiety when people must or are willing to make a preferred impression on a real or imagined audience. The scale consists of 11 items rated on a five-point agreement scale. An

example item is: *"I worry about what other people will think of me even when I know it doesn't make any difference."* Based on the pretest results we deleted one item to improve internal reliability.

To assess the degree of self-regulation, we used the Self-Regulation Scale (Diehl, Semegon, & Schwarzer, 2006). This scale uses a four-point Likert scale, from 1 (not at all true) to 4 (exactly true). An example item is: "*If I am distracted from an activity, I don't have any problem coming back to the topic quickly.*" Based on the pretest, we deleted one item to improve internal reliability.

After the main study, Cronbach's alpha's exceeded the required threshold of 0.7 for all items that implied high internal consistency of the scales. See the Appendix A.

2.3. Data analysis

To test our hypotheses and the relations presented in the conceptual model, we applied structural equation modeling using Amos 20.0. Since we used validated scales together consisting of a large number of items, we submitted composite scales rather than the individual items themselves to analysis with applied structural equation modeling. Parceling of items has become quite common (Bandalos & Finney, 2001). To obtain a comprehensive model fit, we included the suggested indices by Hair (2006): the χ^2 statistic, the ratio of χ^2 to its degree of freedom (χ^2/df), the standardized root mean residual (SRMR), the Tucker-Lewis index (TLI), and the root mean square error of approximation (RMSEA).

3. Results

3.1. Structural and path model

All basic assumptions for structural equation modeling were met. Hoelter's critical N is issued to judge if the sample size is adequate for applying structural equation modeling. The model as presented in Fig. 2 resulted in a Hoelter's N of 432 (at the .05 levels of significance) and 588 (at the .01 levels of significance), sufficient since sample size is adequate if Hoelter's $N > 200$. The fit results obtained from testing the validity of a causal structure of the conceptual model (see Fig. 1) are as follows: $\chi^2(6) = 9.93$; $\chi^2/df = 1.66$; SRMR = .03; TLI = .97; RMSEA = .04 (90% confidence interval [CI] = .00, .09). The model explains 37% of the variance in addictive smartphone behavior, and 45% in habitual smartphone use. Table 2 provides the correlations between the variables. Fig. 2 provides the path models with coefficients and variances explained.

3.2. Overview of the hypotheses

The standardized path coefficients in Fig. 2 reveal several significant direct and indirect effects between usage types, personal traits, smartphone habits, smartphone addiction, and gender and age. Tables 3 and 4 summarize the validation of the hypotheses. According to the results, 18 out of 26 hypotheses were supported. In order to show the insignificance of the rejected linkages, these were removed and the model was re-estimated. This did not result in alternation of the conclusions on other hypotheses. Despite the rejection of eight hypotheses, the suggested model provides an adequate explanation for habitual and addictive smartphone behaviors.

The first hypothesis is supported: habitual smartphone behavior has a positive influence on addictive smartphone behavior. The influence of process usage on habitual and addictive smartphone behavior are positive, confirming hypotheses H2a and H2b. Additionally, there is an indirect influence of process usage on addictive smartphone behavior following the path through habitual smartphone use. Social use of the smartphone directly influences habitual smartphone use, hereby supporting hypothesis H3a. The influence on addictive smartphone behavior is indirect, thus hypothesis H3b is partially supported. We did not find any influence of emotional intelligence, thus hypotheses H4a and H4b are rejected. Social stress did not influence habitual smartphone use rejecting hypothesis H5a. However, we did find a direct influence of social stress on addictive smartphone behavior; hypothesis H5b is therefore supported. Self-regulation

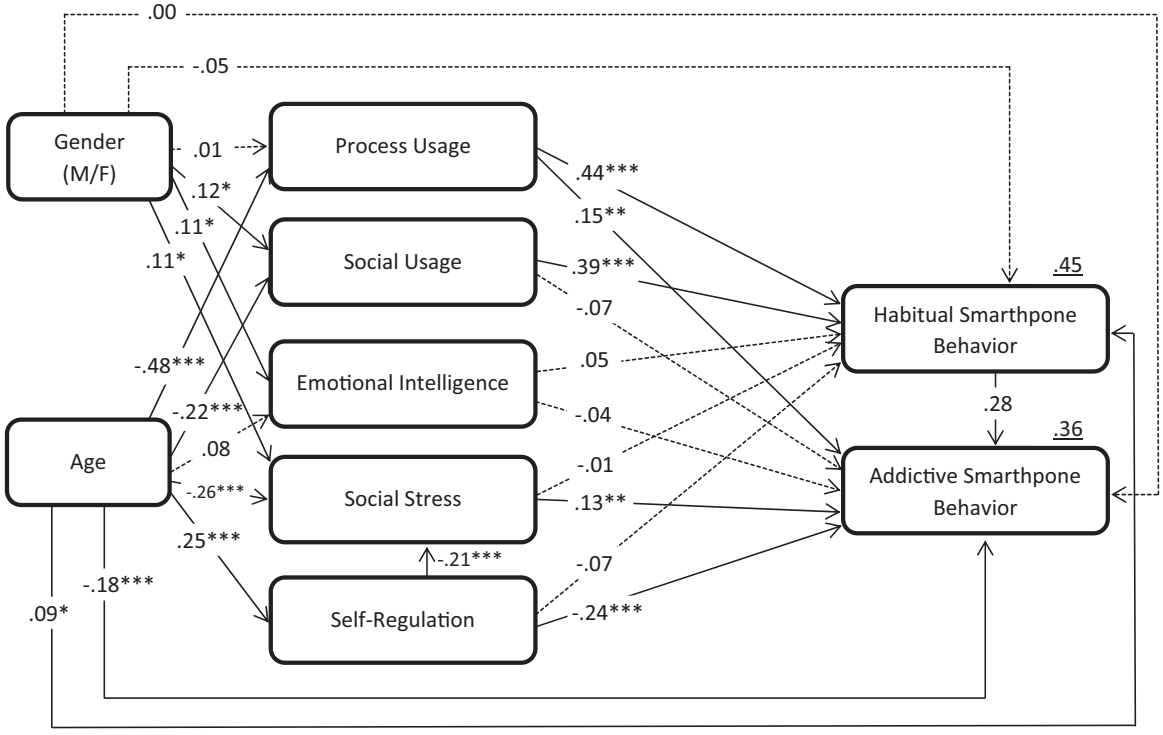

Fig. 2. Results for the research model with path coefficients. Note: $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$ level. The dotted lines are non-significant paths. Squared multiple correlations are underlined.

Table 2
Correlation matrix.

	1	2	3	4	5	6	7	8	9
1. Gender (M/F)	–	−.12	*.07*	.15	.14	*.10*	*−.02*	*.03*	*.06*
2. Age		–	−.48	−.23	−.32	*.06*	.25	−.22	−.40
3. Process Usage			–	.43	.31	*.04*	−.11	.57	.43
4. Social Usage				–	*.09*	.32	*.09*	.56	.18
5. Social Stress					–	−.11	−.28	.14	.33
6. Emotional Intelligence						–	.37	.16	−.12
7. Self-regulation							–	*−.05*	−.37
8. Habitual Smartphone Use								–	.39
9. Addictive Smartphone Behavior									–

Note: numbers displayed are significant at p-value <.05, numbers in italics are not significant.

Table 3
Significant direct, indirect, and total effects of usage type and personal traits on habitual and addictive smartphone behavior.

Link	Direct effects β	Indirect effects β	Total effects β	Validation
H1. Habitual smartphone use – Addictive Smartphone Behavior	.28	–	.28	Supported
H2a. Process Usage – Habitual Smartphone Use	.44	-	.44	Supported
H2b. Process Usage – Addictive Smartphone Behavior	.15	.13	.28	Supported
H3a. Social Usage – Habitual Smartphone Use	.39	–	.39	Supported
H3b. Social Usage – Addictive Smartphone Behavior	–	.11	.11	Partly supported
H4a. Emotional Intelligence – Habitual Smartphone Use	–	–	–	Rejected
H4b. Emotional Intelligence – Addictive Smartphone Behavior	–	–	–	Rejected
H5a. Social Stress – Habitual Smartphone Use	–	–	–	Rejected
H5b. Social Stress – Addictive Smartphone Behavior	.13	–	.13	Supported
H6a. Self-Regulation – Social Stress	−.21	–	−.21	Supported
H6b. Self-Regulation – Habitual Smartphone Use	–	–	–	Rejected
H6c .Self-Regulation – Addictive Smartphone Behavior	−.24	−.03	−.27	Supported

Note: effects are significant at $p < 0.05$ level.

Table 4
Significant direct, indirect, and total effects of age and gender.

Link	Direct effects β	Indirect effects β	Total effects β	Validation
H7a. Gender – Process Usage	–	–	–	Rejected
H7b. Gender – Social Usage	.12	–	.12	Supported
H7c. Gender – Emotional Intelligence	.11	–	.11	Supported
H7d. Gender – Social Stress	.11	–	.11	Supported
H7e. Gender – Habitual Smartphone Use	–	.05	.05	Rejected
H7f. Gender – Addictive Smartphone Behavior	–	.03	.03	Rejected
H8a. Age – Process Usage	−.48	–	−.48	Supported
H8b. Age – Social Usage	−.22	–	−.22	Supported
H8c. Age – Emotional Intelligence	–	–	–	Rejected
H8d. Age – Social Stress	−.26	−.05	−.31	Supported
H8e. Age – Self-regulation	.25	–	.25	Supported
H8f. Age – Habitual Smartphone Use	.09	−.31	−.22	Supported
H8 g. Age – Addictive Smartphone Behavior	−.18	−.36	−.54	Supported

Note: effects are significant at $p < 0.05$ level.

negatively influences social stress levels and addictive smartphone behavior. There is no influence on habitual smartphone use. The indirect effect of self-regulation results from the influence on social stress. Hypotheses H6a and H6c are supported, H6b is rejected.

Table 4 shows the results of the hypothesized relationships of age and gender on the usage types, personal traits, and habitual and addictive behavior. Women are more likely to use the smartphone for social purposes than men, hereby supporting hypothesis H7b. However, we did not find that men use the smartphone more for process usage than women do. Hypothesis H7a is rejected. For both emotional intelligence and social stress, we found positive effects, suggesting that both are higher among women than men. Hypotheses H7c and H7d are supported. Via indirect paths, women are more likely to develop habitual and addictive smartphone behavior. We did, however, expect that males would be more likely to show habitual and addictive smartphone behavior. Therefore, hypotheses H7e and H7f are rejected.

Age negatively influences both process and social use of the smartphone, hereby supporting hypotheses H8a and H8b. We did not find a significant influence of age on emotional intelligence, rejecting hypothesis H8c. The effect of age on self-regulation is positive so also hypothesis H8e is supported. Age shows both a direct and indirect (via self-regulation) effect on social stress. Hypothesis H8d is supported. Direct and indirect effects of age together result in a negative total effect on habitual and addictive smartphone behavior. This confirms hypothesis H8f and H8g. Note that the direct influence of age on habitual smartphone use is positive.

4. Discussion

4.1. Main findings

The present study investigates the role of process and social smartphone usage, emotional intelligence, social stress, self-regu-

lation, gender, and age in relation to habitual and addictive smartphone behavior. The results first show that habitual smartphone use is an important contributor to addictive smartphone behavior. Smartphone habits cause unintended behavior activated by internal or external cues. Automatic urges in which the smartphone is unlocked to check for notifications increase the chance to develop addictive behaviors. This is further strengthened by process and social types of usage. Process related smartphone use appears to be a strong determinant for both developing habitual and addictive smartphone behaviors. The smartphone offers several pleasurable experiences that potentially function as rewards and increase the chance that process oriented use develops into habitual use. Furthermore, pleasurable experiences might directly result in losing behavioral control (Song et al., 2004). Besides process oriented smartphone use, social purposes influence habitual smartphone use. This indirectly might lead to addictive behaviors. Both Internet and smartphone addicts are known to extensively focus on social applications (Li & Chung, 2006; Lopez-Fernandez et al., 2014), while tending to isolate themselves offline (Lopez-Fernandez et al., 2014). Behaviors of both process and social oriented smartphone usage types function as a reward: winning games, unlocking new features, or receiving new notifications (Whang et al., 2003). Such rewards cause people to feel better and increase the likelihood of the behavior to reoccur (Bandura, 1991). For example, when checking a Facebook account, new notifications or newsfeeds act as a reward and therefore ensure that checking will reoccur. This might develop in habitual and addictive behaviors which become increasingly difficult to control.

Research concerning emotional intelligence in relation to digital addiction is novel (Kun & Demetrovics, 2010). Some scholars revealed a negative effect of emotional intelligence on Internet addiction (Engelberg & Sjoberg, 2004; Kun & Demetrovics, 2010). In the current study, we did not find an influence on habitual or addictive smartphone behavior. We used an elaborate measure for emotional intelligence, accounting for appraisal and expression of emotion, regulation of emotion, and utilization of emotion. Future studies might address these specific subsets separately. For example, problems in regulating emotions might have a different effect on habitual or addictive smartphone behaviors as compared with having difficulties in expressing emotions. Our results do suggest that social stress positively influences addictive smartphone behavior. A high level of social stress creates anxiety to be in the spotlight or interact with people in real life (Whang et al., 2003). The result is that social interactions in real life are ignored, while more anonymous interactions online increase (Whang et al., 2003). Smartphones offer a relatively safe environment where people do not have to communicate, socialize, or present themselves in real (Jin & Park, 2009).

LaRose and Eastin (2004) stated that failure of self-regulation could lead to more media habits and can develop into media addiction. We found that lower levels of self-regulation cause a higher risk to show addictive smartphone behavior. Metcalfe and Mischel (1999) argue that deficient self-regulation is controlled by emotions and automatic process steered by impulses. The effect of self-regulation on habitual smartphone use was not significant. Habits are to some extent regulated by personal and social norms (Metcalfe & Mischel, 1999). This might make habits less dependent on failures of self-regulation. Addictive behavior is characterized by losing self-control, which is different than habitual behavior. Habits should be considered automatic behavioral rituals, but without a total loss of self-regulation (Metcalfe & Mischel, 1999).

Concerning gender, we found that men experience less social stress than women, and use their smartphones less for social purposes. Women use their smartphones more to maintain their social relationships, have more conversations than men and gossip more on the phone than men do (Jenaro, Flores, Gamez-Vela, Gonzailez-Gil, & Caballo, 2007). Women furthermore experience more social anxiety related to speaking in public, speaking to strangers, speaking in groups, and presenting themselves (Jenaro et al., 2007). Contrary to our expectations, the result is that women are more likely to develop habitual and addictive smartphone behaviors than men, though indirectly through the type of use and social stress. The appeal of the smartphone itself is known to be gender neutral (Bianchi & Phillips, 2005).

Most research on Internet addiction is conducted among young (adolescents) samples (Weinstein & Lejoyeux, 2010). Our results suggest that when getting older, people spend less time on the smartphone for process and social usage, experience less social stress and are better in self-regulation. They are therefore less likely to develop habitual or addictive smartphone behaviors. Younger people are used to immediate rewards and feedback (Howe & Strauss, 2004), and are less likely to react on impulses (Metcalfe & Mischel, 1999). Furthermore, self-regulation can be learned; with growing age people feel more settled and have different interests and motivational goals (Diehl et al., 2006). However, we do not know yet whether such differences will prevent addictive smartphone behavior among older adults when the technology becomes more widespread in this population. Growing old might result in increased loneliness or a stronger need for belongingness, which might turn them to computers and smartphones (Pearson, Carmon, Tobola, & Fowler, 2010).

4.2. Limitations

This study has several limitations that need to be addressed. The study focused on addictive smartphone behavior, however, the mean scores on the items of this construct reveal that only a small part of the sample can be characterized as being an actual smartphone addict. Habitual smartphone behavior showed more variance. The occurrence of severe, negative life consequences is necessary to distinguish addiction from behavior that is merely impulsive although this has not been observed in most media addiction literature; many of the media 'addicts' described in prior studies were not addicted (LaRose et al., 2003). The result is that in our contribution, observed significant effects on self-perceptions of addiction generally describe a relationship between usage types, personal traits, gender, age, and excessive smartphone consumption, instead of clinically defined (smartphone) addiction. In future studies, we recommend focusing on actual smartphone addicts to see whether (1) the relations between the observed variables change, and (2) effect sizes become stronger. Furthermore, additional qualitative methods might help in getting insights on additional factors influencing habitual and addictive smartphone behaviors.

The present study used self-reports which could have resulted in socially-desirable answers, i.e. the answers that seem favorable for others. This might especially be important in relation to maladaptive or addictive behaviors. A note for further research is to investigate smartphone addiction with other methods, starting with more qualitative approaches to gain further insights in the factors that need to be accounted for when explaining habitual or addictive smartphone behaviors. Furthermore, limitations of using self-reports might have affected the studies personal traits. For example, recognizing emotions of self and others is difficult to assess because of inappropriate self-perception or providing socially-desirable answers (Matthews, Roberts, & Zeidner, 2004). Finally, the sample used in the study was collected among the Dutch population. Generalizing the results to populations with different levels of technology usage and cultural differences must be undertaken with care. Furthermore, respondents in the current study voluntarily participated in the survey. Volunteers can differ

from other groups within the same population due to their higher social status and/or a higher need for approval (Heiman, 2002).

Appendix A. Means, standard deviations, and reliability of the measures

Addictive smartphone behavior (10-point scale; α = .93)	*2.67*	*1.33*
1. I can never spend enough time on my mobile phone	2.65	2.00
2. I have used my mobile phone to make myself feel better when I was feeling down	3.21	2.41
3. I experience problems when I find myself using my mobile phone when I should be doing other things	3.37	2.51
4. I have tried to hide from others how much time I spend on my mobile phone	2.59	2.28
5. I lose sleep due to the time I spend on my mobile phone	2.78	2.61
6. I have spent with the mobile phone more than I should have	3.68	2.92
7. When out of range for some time, I become worried about the thought of missing a call	3.05	2.55
8. Sometimes, when I am on my mobile phone and I am doing other things, I get carried away with the conversation and I don't pay attention to what I am doing	3.03	2.54
9. The time I spend on my mobile phone has increased over the last 12 months	5.57	3.06
10. I have used my mobile phone to talk to others when I was feeling isolated	3.68	2.85
11. I have attempted to spend less time on my mobile phone but am unable to	2.84	2.14
12. I find it difficult to switch off/switch to silent my mobile phone	3.33	2.70
13. I feel anxious if I have not checked for messages or switched on my mobile phone for some time	2.77	2.31
14. I have frequent dreams about my mobile phone	1.41	1.19
15. My friends and family complain about my use of the mobile phone	3.37	2.73
16. If I don't have a mobile phone, my friends would find it hard to get in touch with me	2.09	1.77
17. My academic performance has decreased as a direct result of the time I spend on my mobile phone	2.12	2.00
18. I have aches and pains that are associated with my mobile phone use	1.60	1.50
19. I find myself using on my mobile phone for longer periods of time than intended	4.46	3.06
20. There are times when I would rather use my mobile phone than deal with other more urgent matters	3.41	2.83
21. I am often late for appointments because I'm talking on my mobile phone when I shouldn't be	1.34	0.75
22. I become irritable if I have to switch off/to silent my mobile phone for classes, meals, or at the cinema	1.30	0.69
23. I have been told that I spend too much time on my mobile phone	1.50	0.97
24. More than once I have been in trouble because my mobile phone has gone off during a class, at the cinema, or in a restaurant	1.44	0.82
25. My friends don't like it when my mobile phone is switched off/to silent	1.28	0.68
26. I feel lost without my mobile phone	1.67	0.99
Habitual smartphone behavior (5-point scale; α = .92)	*3.73*	*1.02*
1. Smartphone usage is part of my daily routines	4.10	1.08
2. Checking my smartphone is becoming a habit	3.83	1.23
3. I use my smartphone automatically	3.78	1.22
4. It's a habit to use my smartphone	3.85	1.19
5. My smartphone is a part of my life	3.61	1.28
6. When I need to complete a certain task than the use of my smartphone is an obvious choice	3.25	1.28
Process usage (5-point scale; α = .89)	*3.35*	*0.99*
1. I use my smartphone in order to escape from real-life	3.49	1.27
2. I use my smartphone in order to relax	3.63	1.28
3. I use my smartphone because it is entertaining	3.91	1.09
4. I use my smartphone because it informs me for things that happen in everyday life	3.75	1.24
5. I use my smartphone in order to stay up to date of the latest news	2.94	1.36
6. I use my smartphone because it helps me passing time	2.75	1.38
7. I use my smartphone because it's a pleasant break from my routines	3.01	1.37
Social usage (5-point scale; α = .73)	*4.06*	*0.76*
1. I use my smartphone to interact with people	4.32	0.94
2. I use my smartphone to maintain relationships	4.42	0.83
3. I use my smartphone to call other people	3.73	1.45
4. I use my smartphone to text message others	4.11	1.07
5. I use my smartphone to contact people through social media	4.43	0.97
Emotional Intelligence (5-point scale; α = .87)	*3.75*	*0.47*
1. I know when to speak about my personal problems to others	4.16	0.91
2. When I am faced with obstacles, I remember times I faced similar obstacles and overcame them	4.16	0.83
3. I expect that I will do well on most things I try	3.89	0.81
4. Other people find it easy to confide in me	4.02	0.86
5. I find it hard to understand the non-verbal messages of other people[a]	2.30	1.05
6. Some of the major events of my life have led me to re-evaluate what is important and not important	3.71	1.09
7. Emotions are one of the things that make my life worth living	3.83	0.87
8. I am aware of my emotions as I experience them	3.92	0.93
9. I expect good things to happen	3.71	0.89
10. I like to share my emotions with others	2.97	1.14
11. When I experience a positive emotion, I know how to make it last	3.61	0.91
12. I arrange events others enjoy	3.55	0.97
13. I seek out activities that make me happy	3.89	0.86
14. I am aware of the non-verbal messages I send to others	3.43	0.99
15. I present myself in a way that makes a good impression on others	3.57	0.84

16. By looking at their facial expressions, I recognize the emotions people are experiencing	3.82	0.88
17. I know why my emotions change	3.68	0.89
18. I have control over my emotions	3.48	0.91
19. I easily recognize my emotions as I experience them	3.84	0.88
20. I motivate myself by imagining a good outcome to tasks I take on	3.74	0.83
21. I compliment others when they have done something well	4.09	0.82
22. I am aware of the non-verbal messages other people send	3.80	0.79
23. When I am faced with a challenge, I give up because I believe I will fail[a]	2.28	1.04
24. I know what other people are feeling just by looking at them	3.44	0.88
25. I help other people feel better when they are down	3.88	0.81
26. I use good moods to help myself keep trying in the face of obstacles	3.80	0.84
27. I can tell how people are feeling by listening to the tone of their voice	3.69	0.85
Social stress (5-point scale; α = .94)	*2.91*	*0.96*
1. I worry about what other people will think of me even when I know it doesn't make any difference	3.09	1.25
2. I am unconcerned even if I know people are forming an unfavorable impression of me	3.46	1.21
3. It bothers me when people form an unfavorable impression of me. I am frequently afraid of other people noticing my shortcomings	3.23	1.14
4. I rarely worry about what kind of impression I am making on someone	3.11	1.12
5. I worry about what kind of impression I make on people	2.64	1.21
6. When I am talking to someone, I worry about what they may be thinking about me	2.69	1.21
7. I am usually worried about what kind of impression	2.75	1.16
8. If I know someone is judging me, it tends to bother me	3.12	1.18
9. Sometimes I think I am too concerned with what other people think of me	2.37	1.15
10. I often worry that I will say or do wrong things	2.63	1.23
Self-regulation (4-point scale; α = .78)	*2.90*	*0.55*
1. I can concentrate on one activity for a long time, if necessary	3.26	0.86
2. If I am distracted from an activity, I don't have any problem coming back to the topic quickly	2.78	0.92
3. If an activity arouses my feelings too much, I can calm myself down so that I can continue with the activity soon	2.93	0.77
4. If an activity requires a problem-oriented attitude, I can control my feelings	3.04	0.76
5. It is difficult for me to suppress thoughts that interfere with what I need to do[a]	2.06	0.89
6. I can control my thoughts from distracting me from the task at hand	2.44	0.83
7. After an interruption, I don't have any problem resuming my concentrated style of working	2.96	0.89
8. I have a whole bunch of thoughts and feelings that interfere with my ability to work in a focused way[a]	2.05	0.94
9. I stay focused on my goal and don't allow anything to distract me from my plan of action	2.80	0.78

[a] Recoded.

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