"Who is a smartphone addict?"

The impact of personal factors and type of usage on smartphone addiction in a Dutch population

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Abstract

More than 80% of the Dutch are online via their smartphones. While these devices have a lot positive features, they also can create problematic behaviors, such as a smartphone addiction. In this research, the process of developing smartphone habits and smartphone addiction are investigated. Furthermore, the effect of social usage, process usage, emotional intelligence, social stress, and self-regulation on smartphone addiction and habits are examined. Finally, the role of age and gender on all determinants is further explored. While prior research on online addiction is a well-developed research domain, studies focusing on this phenomenon in the smartphone context are relatively new. It is assumed that (smartphone) addiction can be developed through repeated actions (habits): when an action is rewarding, it will likely reoccur, this is also called operant conditioning. Process usage is typically a sort of usage that is pleasurable and rewarding; likewise, social usage of a smartphone is rewarding and can function as a substitute for other communication channels (e.g., face-to-face interaction). Therefore, personal factors are of importance. Emotional intelligence (EI) influences our well-being and, in addition, determines our capability to communicate. Other personal factors, such as social stress, influence the way we communicate. Specifically, people with high levels of social stress have more anxiety to meet people face-to-face and present themselves. Finally, self-regulation — i.e. how good people are in controlling and regulating their behavior — is an important factor. Without self-regulation, there is no control over one's behavior such in addiction. All those factors can differ between men and women and across age (groups). To examine the determinants, an empirical study was conducted among a Dutch population. A survey was conducted with 386 volunteer participants. To test the hypotheses, a structural equation modeling using Amos 20.0 was applied. The results suggest that smartphone addiction exists and it can develop through habits. Younger persons are more vulnerable with regard to developing an addiction, especially when they have higher levels of social stress, are weak at self-regulation, and extensively use their smartphones for social and process purposes. Furthermore, females are somewhat more sensitive to develop addiction because of higher rates in social stress and social usage typical of this gender group. The findings can be explained by differences in the generations. The younger generation, the Millenials, are grown up with digital innovations and rely (heavily) on digital sources. Social anxiety is thereby of importance, as it is a determinant of smartphone addiction, because persons use their smartphones as substitutes of other communication tools.

Keywords: smartphone addiction, personality, social stress, type of usage, habit(ual) behavior.

Content

1. Introduction

In the past decades, the growth of digital devices and applications has been indisputable. It affects the way how people act, work, communicate, consume media, interact, and gather information (Park & Lee, 2011). According to Comscore (2013), in 2012 there were 1.5 trillion digital interactions. This proves that digital communication is everywhere and that digital devices are part of our daily lives.

94% of the Dutch population have access to the internet through a computer, smartphone, or a tablet (Van Deursen & Van Dijk, 2012). New technologies, including smartphones, make it possible that online digital activities are everywhere for business, relaxation, communication, at home, at work, or in public. Dutch people use the online world between 4 and 5 hours every day (CBS, 2013).

Furthermore, a trend in the digital environment is the increase of mobile online activities. Online mobile use has increased from 31% in 2011 to 42% in 2012 in Western countries (Comscore, 2013). Especially, Dutch adolescents (more than 80%) are online on their smartphones (CBS, 2013). Smartphones are a part of people's life. This could result in habitual or even addictive behaviors, including panic attacks when being out of reach (Haverlag, 2013). Therefore, research must continue to investigate the influence of online innovations on human behavior, including the phenomenon of smartphone addiction.

Research reports on online behavior detected differences in the usage of online activities between people (Van Deursen & Van Dijk, 2012). Differences in time spent online in spare time are detected, suggesting that low-educated people tend to spend more time online as compared to higher-educated people (Van Deursen & Van Dijk, 2012). Those differences go hand in hand with the type of usage of online activities. Specifically, while higher-educated people spend more time looking for information relevant for their career, low-educated people use the internet more for entertainment and socializing (Van Deursen & Van Dijk, 2012). Will the sort gratification of internet usage play a role in addictive smartphone behavior?

RQ 1: Does the type of usage gratification affect addictive smartphone usage?

Research on digital addictions suggests that online addicts share the same personal factors (Young, 1999). Some personal factors, such as stress, are common among addicts. Addicts often want to relieve stress and escape from the reality (Young, 1999). Other personal factors, such as (emotional) intelligence, self-control, and self-esteem, have also been investigated; however, the results are inconsistent. Therefore, it is not entirely clear which personal factors affects online addictions (Khan, Kim & Kim, 2013). In this study, social stress, emotional intelligence, and self-regulation will be further investigated.

RQ 2: Which personal factors affect addictive smartphone usage?

The digital generation of now, the Millennial Generation, is born between 1980 and 2000. This generation is grown up with an overload of digital developments and digital media. They are every day connected to the (wireless) internet, TV, and smartphones. They tend to solve problems online. They rely on online and digital learning systems, acquire direct feedback, and depend on digital

information sources. Their focus is more globally with digital networks. Most importantly, they have more problems with casual communication (Howe & Strauss, 2004; Kubiatko, 2013; Lenhart, Purcell, Smith, & Zickuhr, 2010). Therefore, the expectation is that younger people may be more likely to be smartphones addicts. However, former research reports conflicting results on the effects of age on addiction (Davis, 2001).

What about gender? Do women have longer conversation on the phone? Yes, women spend a longer time on the phone than men do (Friebel & Seabright, 2010). Males and females use smartpones in a different way (Pawłowska & Potembska, 2012). Compared to men, women use telephones more to 'gossip' or maintain social relationships and have a stronger relationship with their mobile phones. Therefore, social media are more appealing to women (Duggan & Brenner, 2012). Men use their phones more for game applications and are more into (mobile) gambling. However, there is some controversy in previous research on digital addiction and gender differences and they are not in line with each other (Frangos, Frangos & Kiohos, 2010; Jenaro, Gomez-Vela, Gonzalez-Gil, &Caballo, 2007; Ko, Yen, Chen, Chen, & Yen, 2005; Rush, 2011).

RQ 3: What is the role of demographic characteristics of age and gender in smartphone addiction?

While prior research on internet and smartphone addiction behavior is widespread and acknowledged by many researchers (Haverlag, 2013; La Rose, Lin, Eastin, 2003; La Rose & Eastin, 2004), most of this research focused on the effects of problematic (mobile) internet and smartphone behavior. Thus, little is known on *how* and *who* gets addicted to the use of online activities on smartphones. It is interesting to investigate whether past research on internet and smartphone addiction holds true in the context of new technological developments.

2. Theoretical Background

2.1 Online mobile usage anno 2014

The use of mobile devices is a normal task nowadays; over 80% of adolescents are using online mobile applications (CBS, 2012). Anno 2014 the smartphone is used for different applications, most operate online. But what do we mean when we refer to online mobile usage? This is important to define which activities will fall into the category of online mobile usage.

2.1.1 Online mobile usage: mobile internet and applications

In academic research, there is not an agreed definition of online mobile usage (Nielsen & Fjuk, 2010). However, another angle to define (mobile) internet in 2014 is using (mobile) Web 1.0 and 2.0 approaches. Internet activities can be divided into two stages. Web 1.0 is the first stage of the internet. Internet can be seen as static web pages that provide information in one direction, top-down (Chard, 2008).

In 2005, O'Reilley proposed a new definition of the internet, Web 2.0. Web 2.0 is suitable to describe the internet anno 2014. The internet is a two-way directed interactive medium. Three words to describe Web 2.0 are: share, collaborate, and exploit (Chard, 2008). In Web 2.0 approach, internet activities can have a consuming essence, for example, searching for information, playing games, watching media, or shopping for goods. Further online usage can have a 'prosuming' essence which entails creating and sharing media content. For example, post social media messages or upload videos, or sharing info pages. Finally, the use of internet (applications) can have a social or interactive essence as in, for example, participating on the social media platforms, playing games, or communicating in chatrooms (O'Reilley, 2005). *In this study, we consider online mobile usage as described in Web 2.0 that can be divided into different usage types based on information, entertainment, or social interaction (see Section 2.4 for further detail).*

2.1.2 Mobile devices: the smartphone

Mobile devices are available in a wide variety of types, including laptops, tablets, PDAs and smartphones. These devices differ in screen sizes, usage, and other characteristics, which leads to differences in use and usage experience (Ghose, Goldfarb & Han, 2010). In this research, only the use of a smartphone will be considered under the definition mobile device. Because the smartphone is a most popular mobile device, most people own a smartphone, it is commonly used, there is a large number of applications available and it is more affordable than a tablet. In addition, due to its small size and functions, this device is carried around most. Smartphones are carried everywhere: in bed, at the restroom, at work, at restaurants, etc. Therefore, smartphone devices are different from other mobile or technical devices, as they are extensions of the human being (Mcluhan, 1964).

As usage per device is different, it is important to choose one device. Smartphones have unique factors, such as size, screen size, applications, ubiquity, and flexibility in both time and space (Nielsen & Fjuk, 2010). Therefore, users can access to online activities for consumption, sharing or exploiting media content any time any place (Okazaki & Hirose, 2009). The smartphone is an extension of many people lives; due to its size and features it is carried around 24/7by its owner . Different applications promote the 24/7 usage of smartphones and the need of being online (Okazaki & Hirose, 2009). Applications are suitable in different contexts, like mobile internet, camera, telephone connection,

agenda, among many more downloadable applications. Life without a smartphone is for many people unthinkable; thus, people are getting in some way dependent on their smartphone (Haverlag, 2013). Thus, the use of smartphones is intense because it is always accessible. This intense usage could lead to addictive behavior (Young, 1999).

In what follows, the usage of a smartphone will be categorized with validated classification theory and will be linked to problematic online mobile behavior.

2.2 From a habit to smartphone addiction

The smartphone is 24/7 accessible with applications that stimulate its continuous usage. These devices could lead to excessive and impulsive behavior because of problematic habitual evolvement (Oulasvirta, Rattenbury, Ma, & Raita, 2011). In the next section, problematic habitual evolvement will be explained.

2.2.1 Habit forming and smartphones

Online mobile applications on smartphones can cause habits *(*Oulasvirta, Rattenbury, Ma & Raita, 2011). How do habits develop and become addictive? 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"(pg.2)* (Oulasvirta et al., 2011). Habits are behavioral acts without self-instruction or conscious thinking (La Rose & Eastin, 2004).

Habits can have both positive and negative effects (Wood & Neal, 2007). Positive effects of habits line in that, due to the fast automatic behavior aspect, they enable multitasking and accomplishment of complex tasks. Habits give control over behavior in novel situations, where fast anticipation is needed (Wood & Neal, 2007). Habits have also a positive social feature, because they identify a person, Because habit characterizes a person and predicts that person's actions (Oulasvirta, et al., 2011; Wood & Neal, 2007). On the other hand, habits can have a negative influence on someone's behavior. They can cause unintended behavior activated by internal or external cues interfering other acts. This is also called maladaptive habits, as people create excessive urges, for example, unintended smartphone checking. It could interfere with daily life; however, due to regulations or social norms, people are able to limit these negative influences (Rush, 2011).

Oulasvirta et al. (2011) concluded that smartphones causes negative checking habits. Checking habits are automatic actions whereby the smartphone is unlocked to check the start screen for new messages, notifications, alerts, and application icons; these habits can be triggered by external (ringtone) and internal cues (emotional state, urge). Those habits can be maladaptive and interfere with people's life. Checking for information can be rewarding, if someone has a new message or notification, the so-called new information reward. Rewards can enforce repeated actions (Everitt & Robbins, 2005).

How persistent a habit is depends on the habit strength (La Rose, Lin, Eastin, 2003). Habit strength is the degree of automaticity of a habit. The strength of the habit is formed through operant conditioning (Rush, 2011). Operant conditioning is the development of habits and addictions. When

previous actions had desirable outcomes, those actions will likely reoccur. The frequency of these actions and the salience of the reward determine the strength of the habit (and can form the basis of an addiction) (Rush, 2011). A habit that is often repeated has a stronger degree than the one that is less automatic and repeated.

Strong habits are repeated more often and are easier provoked by cues (La Rose, Lin, Eastin, 2003). This can reach the level where they become annoying, such as inappropriate use of a smartphone at restaurants, concerts, and/or family gatherings.

Companies are aware of the value that habitual behavior creates for them. Social media, application, and game publishers create compulsion loops so that users spend more time and repeat their actions on their mobile applications or social platforms. To summarize, smartphone usage could form habits through different cues, repetitions, and stimulation of application publishers.

2.2.2 Addiction

Addiction is a term with a long history of reference to alcohol or drugs abuse arising from the addictive effect that those substances have on the human body and brain. However, taking large amounts of drugs or alcohol for a long period are not the only types of addiction (APA, 2001). People can develop addictions not only towards substances, but also to specific behavioral patterns (APA, 2001). The positive reinforcement of a substance or action, the time between consumption or action, and physiological response determines how addiction originates (Carbonell, Oberst, & Beranuy, 2013). Thus, when the positive reinforcement is strong, there is a short time between an action and a corresponding physiological response; as a result, that action becomes more addictive.

2.2.3 Behavioral addiction

Internet and smartphone addictions are different from other addictions such as alcohol or drugs. Drugs addictions are not behavioral addictions; rather, these but are termed substance dependence (APA, 2001). Behavioral addiction can be defined as "*a disorder where behavior (only) functions to produce pleasure and to relieve feelings of pain and stress in which a person:*

1. *Fails to control the behavior;*
2. *Continues to execute (addictive) behavior despite significant harmful consequences"*.

With most addictive behaviors, dopamine release is responsible for the reward and pleasurable feeling of behavior. In behavioral addiction, it is the process that gives the pleasant feeling. In the process of the addictive behavior, dopamine and endorfine are being released (Everitt & Robbin, 2005). When the reward is not present, dopamine is still released because of the anticipation of the reward; therefore, gambling and social media are so addictive (Everitt & Robbin, 2005).

The symptoms of behavioral addiction are similar to other types of addictions (APA, 2001). The following symptoms cited in APA Diagnostic Classification DSM-IV-TR (2001) are common to all addictions:

- Tolerance building: more and more is needed to fulfill a person's needs.
- Withdrawal: when a substance or action cannot be performed, anxiety or unpleasant feelings arise.
- Loss of control: behavior is not in control anymore.

- Preoccupied by the addiction: other activities, such as recreation, social activities, and work are planned around the addiction.
- The time planning, doing, and recovering from the addiction is controlling life.

It should be noted that not every addict will have all symptoms or signs, as these could differ per person (Isaac, 2008).

2.2.4 Smartphone addiction

Whang, Lee, and Chang (2003) defined internet addiction as "*an impulse-control disorder with no involvement of an intoxicant; therefore, it is akin to pathological gambling*" (pg. 144).

Online mobile- or smartphone addiction is closely related to internet addictions because the features are similar (Kwon, Kim, Choi, Gu, Hahn & Min, 2013). Internet addiction mostly begins with habits such as the checking habit; digital addictions are often the result of using habits to relieve pain or escape from the reality (Huisman, Garretsen, & van den Eijnden, 2000). Therefore, there is frequently an undesirable situation with certain habits that become problematic, such as playing games, visiting social media or forums (Young, 1999). Some characteristics, such as stress, loneliness, or isolation, could play a role as well (Young, 1999).

People often do not turn of their smartphones, do not go out without them, and use them for business, relaxation, and socializing. Smartphone usage can lead to addicted behavior (Wood & Neal, 2007; La Rose & Eastin, 2004). The relationship between people and their smartphone is much more developed than expected compared to the fixed telephone and even with their desktop or laptop computer (Carbonell, Oberst & Beranuy, 2013). This is particularly true of adolescents, as they spend much time with and on their smartphones; in addition, adolescents are more sensitive to rewards and cues than older people (Haverlag, 2013).

The difference between internet and smartphone addiction is in the usage gratifications and usage context of the two (Carbonell, Oberst, & Beranuy, 2013; Ghose, Goldfarb, & Han, 2010). Gratifications of a substance or behavior create the addiction (Carbonell, Oberst, & Beranuy, 2013) Smartphones have different gratifications or features that can make a strong positive reinforcement (pleasurable experience) for it users. Carbonell, Oberst, and Beranuy (2013) collected the (unique) gratifications of smartphones that (can) cause positive reinforcement by its users, namely:

Euphoria: Getting text messages, calls, or social media response creates a feeling of being valued or loved.

Instrumental functions: Smartphone function as a clock, camera, recorder, diary, agenda, radio, music player, navigation. These and others functions can all be used to the users' requirements.

Identity and status symbol: Smartphones do not only have functional properties, but also function as an identity symbol of its user. This is caused not only by the device, but also by the number of messages, notifications, and calls a person receives. It can cause usage in public places to showcase a user's identity and creates an emotional bondage with the owner.

(Online) Social network: Smartphones functions can create and maintain social networks. Social networks that are different from those created by physical (face-to-face) social network are evolving through smartphones and are rapidly changing. Teenagers are particularly prone to creating and maintaining social networks with their smartphones.

Dependency: Due to the identity and social network implications of smartphones, users get dependent of their smartphones. Staying in 24/7 contact with their social networks creates a feeling of belongingness ("they have one, so I need one, too").

Connection worldwide: Smartphones make it easy to connect to the online world; therefore, it is possible for users to connect with people/peers worldwide. There are no boundaries any more. When face-to-face communication is not possible, communication through smartphones is then most applicable.

Feeling of control: In recent years, people stopped going outside without their smartphones. Due to the accessibility of other contacts afforded by smartphones, people feel more secure and in control. Without a smartphone, a feeling of fear can emerge due to disconnection.

Permanent Mobility: Because smartphones are on and always at hand for many individuals, it is expected that others are also permanently connected and accessible. This leads to a feeling of concern when people do not react in time. Hereby, the use and bonding with the smartphone is being reinforced.

Entertainment: Many applications are available on smartphones; thus, the device can function as an online mobile game console. Apart from games, the online functions of a smartphone can offer shopping, browsing, and watching multimedia gratifications.

Expression of feelings: Smartphone features like calling, text messaging, communication applications, and social media make it possible to express or share feelings, experiences, and situations in text, videos, and pictures.

In sum, it can be concluded that addiction not necessary exists immediately, but also can develop through habits; those habits can become maladaptive (i.e. function as an escape) and lead to the development of an addiction. Smartphone addiction is a behavioral addiction that negatively interferes with a person's life. Smartphone addiction behavior can include an intense focus on the smartphone or a specific application, for example, checking, posting, or interacting on social media platforms. If the smartphone or application will be removed from the addicted person, panic attacks or feelings of discomfort emerge (Young, 1999; Huisman et al., 2000; Shaffer, 1996).

Based on the properties of the smartphone it can be assumed that smartphone habits (usage rituals) can form a smartphone addiction.

H1: Smartphone habits are positively related to addictive smartphone behavior.

2.3 Type of usage and gratifications

Previous research on addiction agreed in that that internet and mobile phones can be addictive (Haverlag 2013; Song, La Rose, Eastin, & Lin 2004) and can have a negative influence on financial, physical, psychological, and social aspects of life (Young, 1999). However, what risk factors create a smartphone addiction still remains unknown (Goeman, 2011; Haverlag, 2013). There is some controversy in research on the relation between type of usage, gratification, and addiction. Some researchers found no relation between the type of gratification and addiction (Song et al., 2004). However, others claim that pleasurable gratification seeking leads to habits and, eventually, to addiction through operant circumstances. This contention is also called the learning theory (Bandura, 1991). The inconsistency could also be caused through multiple gratifications, usage segmentations, and classifications (Song et al., 2004). The problem lies in the fact that all activities could be classified in different gratifications (Song, et al., 2004). Therefore, in the present study, validated usage classifications of smartphone and internet related to addiction will be explored.

2.3.1 Usage types and addiction

The goal of this research is to test the relation between usage gratifications of the smartphone and addiction. Previous research on the classification of internet and smartphone usage gratifications provides different theoretical points of view. These include the media literacy theory (La Rose & Eastin, 2004), uses and gratification theory (van Deursen & van Dijk, 2010; van Deursen & van Dijk, 2013), or other validated segmentation usage schemes focused on usage and personality or usage experience (Chittaranjan, Blom, & Gatica-Perez, 2011). Therefore, there are various classifications of mobile internet and applications.

Looked into the usage types of internet and internet addiction, Song, La Rose, Eastin, and Lin (2004) found several usage classification of the internet and divided them in two main gratifications, namely, process and content gratifications. The downside of the study by Song et al. (2004) is that different activities per person can fall under a different gratification. This is so because some users are searching on Ebay for an entertainment or process gratification, while others are seeking for more business or content gratification. Therefore, some hypotheses in the referred to study were not confirmed. In this context, the usage motivation of a person must be made clear.

The first usage dimension — process gratification — is the dimension that concludes all pleasurable experiences, such as using, sharing, creating media channels or content. The gratification is realized during consuming or prosuming of media (Song et al., 2004). The opposite of process gratification is content gratification. Content gratification is the dimension that includes the need to gather and acquire information, perspectives, or skills from media content. Bandura (1991) explains with operant conditioning that our actions are reinforced by rewards and punishments: when an action is rewarding, we are more likely to repeat those actions. There can be expected that process gratification — a pleasurable experience — will lead earlier to excessive smartphone usage, because of the pleasurable experience with a rewarding characteristic that can relieve pain. This is in line with the research on gaming and gambling addictions: these addictions are so addictive because of the process-oriented gratification: the pleasurable feeling of taking part in a game (Chen, Chen, & Ross, 2010). This pleasurable feeling can function as an escape from the real life (Chou & Hsiao, 2000)

In the study of Yang and Tung (2007), significant differences in usage were detected between non-internet addicts and internet addicts. Internet addicts spend twice as much time than non-addicts on the internet; Internet addicts use the internet mostly for entertainment and social gratifications. These results could also apply to smartphone addiction.

From the above literature overview, the following hypotheses can be formulated:

H2A: Process usage is positively related to smartphone habits.
H2B: Process usage is positively related to smartphone addiction.

To demonstrate what will fall under process gratification, an investigation of usage schemes/factors is needed. In the study by Van Deursen and van Dijk (2013), a usage scheme derived from the U&G was used to identify the difference in usage between different socio-economic groups. The authors found differences between spending time online and in activities. They validated 7 usage factors, namely: internet activities for information, career, personal development, shopping, entertainment, relaxation, relationship maintenance, and social interaction. Due to the overlap in other smartphone usage classification research (Chua, Goh, & Lee, 2012), those usage factors could also be used in the present study. However, to fully account for the unique factors of smartphone usage, other factors also need to be added. Leung and Wei (2000) found the following uses and gratifications of mobile phone: affection/sociability, entertainment, instrumentality, psychological reassurance, fashion/status, mobility, and immediate access. The mobility and immediate access aspects are associated with the usage on transport, such as buses or cars. Yang and Tung (2007) derived process-oriented uses of smartphones, namely, shopping, entertainment, fashion, status, and relaxation. Classic examples of addiction in process dimension are online gaming and watching porn (Goeman, 2011). The unique factor entertainment of smartphones is applicable to the process dimension (see 2.3.2).

The second usage dimension: Social gratification is the dimension that concludes all social and interaction purposes of using, sharing, creating media channels or/and content. As already noted above, internet addicts use it mostly for social and/or entertainment purposes (Yang & Tung, 2007). In the study by Li and Chung (2004), an examination of internet functions and addiction was performed. The authors conclude that internet addicts spend more time on the internet, are dependent on it, and abuse it for social reasons. They conclude that, if people spend much time or depend on the internet for social reasons, the risk to get addicted is the biggest. People highly dependent on the internet for interaction act in a more impulsive way, avoid emotions, and fail to keep up a proper planning and manage time (Li & Chung, 2004). In the research of Lopez-Fernandez, Honrubia-Serrano, Freixa-Blancart, and Wilson (2013,) smartphone addicts were found to spend most of their time for social purposes and and, to a lesser extent, for content gratifications. These findings are also supported by Chou and Hsiao (2000) who found that internet addicts spend three times more time on the internet than non-addicts. Internet addicts spend their time online mostly for interaction purposes and pleasure. They report the internet negatively influences their daily life and career (Chou & Hsiao, 2000).

To specify the social gratification dimension, the same classification research on uses and gratification can be used as the process gratification dimension of Van Deursen and van Dijk (2013) and other classification of Yang and Tung (2007). In the present study, the following factors or activities are categorized as social gratification: affection/sociability, psychological reassurance, relationship maintenance, social interaction, social media use, content sharing, and interaction purposes. (Classic) examples of addiction in the social gratification dimension are social media addiction, chatting, as well as gaming as interaction tool. The unique factors include feeling in control, permanent mobility, connections worldwide, and expression of feelings. Therefore, smartphones could create dependency translated in the urge to be 24/7 up to date (see 2.3.2).

Therefore, the following hypotheses can be formulated:

H3a: Social usage is positively related to smartphone habits.
H3b: Social usage is positively related to smartphone addiction.

For the exact usage factors and items, see also Section 3.2.

2.4 Personal situation and addictive smartphone usage

Smartphone addiction is a new phenomenon. Several non-academic reports state that 46% of smartphone owners are addicted to their phones (Intermarketresearch, 2013). However, scientific research is relatively new in the area of smartphone addiction and the impact of personal factors (Haverlag, 2013). Some personal factors could be risk factors for development of addiction (Beranuy, Oberst, Carbonell, & Chamarro, 2009). In the present study, a selection of personal factors of addicted internet and game users are considered because of the similarities with smartphone addiction (Kwon et al., 2013).

2.4.1 Emotional intelligence

One of the popular concepts in personality trait research is emotional intelligence (EI), especially in its relation to physical and mental well-being of a person (Kun & Demetrovics, 2010). Notwithstanding, only seven studies have been conducted on EI and behavioral addiction (; Engelberg & Sjoberg, 2004; Grisham, Steketee, & Frost, 2007; Kaur, Schutte, & Thorsteinsson, 2006; Kun & Demetrovics, 2010; Lin & Chuang, 2005; Parker, Taylor, Eastabrook, Schell, & Wood, 2008; Rozin, Taylor, Ross, Bennett & Hejmadi, 2005; Markey, & Van der Wal, 2007). Among these, the studies by Engelberg & Sjoberg (2004) and Parker et al. (2008) are directly related to internet addiction.

Emotional intelligence can be defined as follows: *"Emotional intelligence [. . .] involves the ability to monitor one's own and others' feelings and emotions, to discriminate among them and to use this information to guide one's thinking and actions."(pg. 1)* (Kun & Demetrovics, 2010). In other words, emotional intelligence is "*the ability to perceive, process, and understand own emotions of from others"(pg.2)* (Beranuy et al., 2009).

Mayer and Salovey (1997) operationalized EI in following four branches:

1. Perceiving Emotions: the capability to perceive emotions in others, oneself, objects, art, stories, music, and other incentives.
2. Facilitating Thought: the capability to manage emotions, to communicate feelings or other cognitive processes.
3. Understanding Emotions: the capability to understand emotions; information, meanings, relationships and how emotions are involved in relationships and emotional meanings.
4. Managing Emotions: the capability to be open to feelings, to verbalize feelings for personal understanding and growth.

In addiction, two main branches of EI play a key role namely, decoding and differentiation of emotions and regulations of emotions (Kun & Demetrovics, 2010). A study on Swedish population showed that people with a higher score on the internet addiction scale scored worse on decoding facial expressions and emotions (Engelberg & Sjoberg, 2004). Kun and Demotrovics (2010) also noted that people who cannot cope with stress and negative emotions can choose the internet or other online strategies to cope with it and other negative emotions.
Therefore, the two most important branches are being investigated in the present study.

Former research suggests that people with higher EI scores have an edge on people with a lower score. According to Kun & Demetrovics (2010), people with higher score:

- Have more positive traits
- Are happier
- Are more successful (than people with a low EI score)
- Are more adaptive
- Can better cope with disappointments/downfalls
- Have better interpersonal relationships

Therefore, while people with high EI (could) have a better physical and mentally well-being, people with low EI (could) have lower physical and mentally well-being and have a higher risk of developing addiction (Beranuy et al., 2009).

Studies of Engelberg & Sjoberg (2004), Parker et al. (2008) on internet addiction and EI exposed linkage between EI and internet addiction. Parker et al. (2008) showed that low EI is positively related to internet addiction. In the study of Engelberg & Sjoberg (2004) students had to identify their internet activities, 12 facial expressions and in with a task they must identify themselves in two personal situations. People with high score on internet addiction scored low on the identifying task and facial expression task. Emotional decoding was for 20 percent responsible of the variance explained in addiction. This illustrates that people with low EI are at more risk to get addicted to a behavioral addiction.

Similar results were obtained in two recent studies on internet and mobile phone addiction and EI (Beranuy et al., 2009; Kun & Demetrovics, 2010). The relation between addiction and EI was tested with an the internet addiction scale and the EI scale(Beranuy et al., 2009) The other study contained

a meta analysis (Kun & Demetrovics, 2010). Both studies showed a negative correlation between addiction and EI. If a person is weak in coping with his/her emotions, emotional signs, and maintaining real relationships, his/her strategy can be to communicate through online mobile applications (Kun & Demetrovics, 2010).

In the overview by Kun and Demetrovics (2010), the conclusion is that lower EI is related to smoking, alcohol use, drugs use, and problematic internet use.

Based on these findings in previous research, the following predictions can be made:

H4a: Emotional Intelligence is negatively related to smartphone habits.
H4b: Emotional intelligence is negatively related to smartphone addiction.

2.4.2 Stress caused by social anxiety

"Stress can be defined as the nonspecific response of the body to any demand placed upon it to adapt, whether that demand produces pleasure or pain"(pg.1) (Goeders, 2003). Stress causes different actions why which a human being attempts to adapt in a situation. These include danger reactions or anxiety. The heart rate increases; stress also releases cortisol, which could lead to unpleasant feelings (Goeders, 2003). While this does not explain how stress acts as a determinant of addiction, stress increases rewards because stressed persons become over-sensitive to rewards (Goeders, 2003). When a person is stressed, the demand for pleasure increases more than when a person is not stressed (Goeders, 2003). Immediate reward, comfort, or pleasure could then be searched by a person, including drugs, alcohol, or browsing through social media. Compared to non-addicts, internet addicts more frequently try to escape from the reality when they are stressed out (Whang, Lee & Chang, 2003)

Past research on addiction claims that stress is a general determinant of addiction (Young, 1999). Stress causes a decline in dopamine receptors that are responsible for producing positive feelings in human brain (Everitt & Robbins, 2005). Stress acts as a trigger to drink, take drugs, or use the internet. This mechanism is captured by the so-called self-medication hypothesis, which suggests that a person uses or abuses a substance (drugs or the internet) to cope with tension or to relieve pain or anxiety (Goeders, 2003; Young, 1999). Addiction can only exist when there is stress (Young, 1999). Smartphone applications can cause direct rewards, such as playing games, watching pornography, or communicating with others.

Stress also causes people to want to act in a safe environment, and the smartphone could be such a a save environment to communicate with and be in (Haverlag, 2013). So, computer-mediated communication can alleviate stress. For example, face to face interaction can be avoided in a social context when one has a smartphone. Therefore, stressed individuals feel less awkward or intimidated and, therefore, are more comfortable (Young & Rodgers, 1998).

Jin and Park (2009) confirm that digital communication can act as a safe environment for (introvert) people who feel stressed in face-to-face communicative interaction. Introvert individuals engage more in social situations with digital communication, such as text messaging, chatting, and e-mailing. A study on stress and social situations by Sayrs (2013) showed that the more people use digital communication, the less fulfilling personal relations become. Eventually, people can get isolated. This

digital communication includes text messaging, e-mailing, and chatting. Making phone-calls is different from text messaging; here, a greater desire for face-to-face communication predicts a greater desire to make phone-calls.

Alongside with the higher stress levels that some individuals have when engaged in face-to-face communication, stress level can get even higher because of the desire to be online 24/7. The smartphone is than a substitute for other communication channels. Smartphones are designed to be carried 24/7 and support us with multiple tasks. People are always connected so that they never get bored and efficiently accomplish their tasks. Due to this convenience, many people are strongly attached to their smartphones (Rush, 2011). This feeling of connection with the smartphone can cause stress or anxiety when a smartphone is not at reach (Carbonell, Oberst, & Beranuy, 2013). People can feel guilty when they are not reachable, cannot contact their friends, or are not up to date (Sayrs, 2013). Lee, Chang, and Cheng (2014) confirm that people have anxiety when they do not have their smartphones at hand. The anxiety when people are not with their smartphone arises because they think the smartphone is necessary to accomplish some actions, goals, or desires; therefore, when the smartphone is not in reach, they panic because they think they cannot function normally any more.

Therefore, the following hypotheses can be formulated:

H5a: Social stress is positively related to smartphone habits.
H5b: Social stress is positively related to smartphone addiction.

2.4.3 Failure of self-regulation: deficient self-regulation

Human behavior is motivated and controlled by the ongoing exercise of self-influence (Bandura, 1991). Most human behavior, that is purposive, is regulated by forethought. People's forethought of is formed by their beliefs of themselves, their goals, external influences, and desired outcomes of actions. Through forethought, people motivate and (try to) control their behavior to achieve goals or desired outcomes, which is also called self-regulation (Bandura, 1991). Thus, self-regulated behavior is proactive and guides actions towards certain desired outcomes.

The process of self-regulation is described by Bandura (1991) it can be summarized as*: "How individuals monitor their own behavior (self-monitoring), judge it in relation to personal and social standards (judgmental process), and apply self-reactive incentives to moderate their behavior (self-reaction)".* Self-regulation works through psychological sub-functions that must be developed; otherwise, self-directed change is uncertain. An intention, goal, or desire are not very functional or give little direction if people cannot self-direct their behavior. Actions are then controlled by impulses (Bandura, 1991; La Rose & Eastin, 2004). Following Bandura (1991), psychological sub-functions of self-regulation include the following characteristics:

- *Self-Monitoring*: Attention and observation of your own performances. Without self-monitoring, influencing motivation or actions is not adequate. Successful self-regulation partly lies in self-monitoring, if it is precise. Self-monitoring is influenced by self-belief and the cognitive structure of a person (i.e. how actions are perceived). Thereby mood affects how performances are perceived. Self-monitoring provides information on the impact of actions not only to people themselves, but also to others and the environment. So attention

to the action is important; however, attention to the situation, condition, and context are of equal importance.

- *Judgmental process*: Is the self-observation of performance of behavior *before* actions is conducted. Judgment is made on the basis of self-observations with personal standards, standardized group norms, social comparisons (others), personal comparison (prior behavior) or/and collective comparison (contribution to group accomplishments). When a wrong judgment is made or the action does not meet the standards, then it has a negative impact on self-regulation.
- *Self-Reaction*: Self-reaction is the process whereby a person provides him/herself with psychological or behavioral rewards or punishment. Rewards could be in the form of self-administered rewards for good behavior (behavioral) or in the form of self-evaluation (psychological), such as self-satisfaction or self-esteem. Rewards are often derived from accomplishment that meets the standards of the forethought, norms, desires, or goals that a person has. Actions can depend on people's rewards (self-reaction). In a media addiction context, this could translate in over-consumption of media, based on their direct pleasurable effect .

There are different levels of self-regulation (La Rose, Lin, & Eastin, 2003). The more addicted one is, the more failure of self-regulation is formed in that person's behavioral pattern. Failure of self-regulation or deficient self-regulation is the loss of conscious self-control (La Rose, Lin, & Eastin, 2003). This could have different reasons, such as failure of the sub-functions of self-regulation. Other factors can play a role as well (Bandura, 1991). Specifically, depression can cause that a person feels that his/her actions do not meet their personal standards (a failure of judging and monitoring). When deficient self-regulation occurs, then behavior becomes impulse-controlled and habits could lead to addiction. To recall, loss of control is an attribute of addiction.

Failure of self-regulation can lower a person's self-efficacy, self-esteem, and can lead to stress (La Rose & Eastin, 2004). To alter these negative influences, more problematic usage can occur to escape, to feel better, to give a feeling of belonging (La Rose & Eastin, 2004). Self-regulation failure could also lead to more media usage than desired. La Rose and Eastin (2004) refer to research on TV addiction. TV addicts turn on the TV when feeling negative, which is an automatic response. In the research by La Rose, Lin, and Eastin (2003), deficient self-regulation and low self-efficacy were found to be positively related to internet addiction among Western students.

Metcalfe and Mischel (1999) looked at self-regulation in a different way. They differentiated between two states of mind: hot or cold state. The situation of deficient self-regulation is referred to as a hot state of mind, controlled by emotions, automatic behavior (habits), and steered by impulses (Metcalfe & Mischel, 1999). In a cold state of mind, cognitive state of mind is consciously steered by strategic emotionally-neutral actions to successfully self-regulate one's behavior.

To sum up, failure of self-regulation begins by consciously using the smartphone to relieve the feelings of boredom or stress; furthermore, habits can then form also due to a decrease of self-monitoring so that actions are not compared with the desired outcomes and behavior will not be adapted. Behavior then can become maladaptive or addictive, as it is no longer consciously observed.

So the following hypotheses can be formulated:

H6a: Self-regulation is negatively related to smartphone habits.
H6b: Self-regulation is negatively related to smartphone addiction.

2.5 Demographics: age.

Age is a factor that influences how ICT is used (Kubiatko, 2013). According to the report of the CBS (2013), adolescents are heavy users of smartphones in comparison compared to older users. The difference in digital behavior between the age groups can be explained by discussing the usage of ICT by different generations.

The Millennial Generation

Born between 1980 and 2000, this generation is grown up with an overload of digital developments and digital media. This generation is also called the net generation and is described to embrace people who are internet savvy, phone-addicted, and digitally conscious (Akande, 2008). Previous generations are called digital immigrants and are less positive and integrative with digital devices, media, and developments (Kubiatko, 2013). Compared to older generations, the millennial generation has several other common characteristics and traits. Millennials are smart, impatient, they expect results, developments, and direct answers. This also results in their expectation of immediate rewards.

This generation created a digital lifestyle. They are every day connected to the internet, TV, and smartphones. They tend to solve problems online. They relate on online and digital learning systems and acquire direct feedback; they depend on digital information sources. Their focus is more globally with digital networks; however, they are less focused on money and earnings, but more on pleasurable experiences. Most importantly, they have more problems with casual communication and use social media for communication purposes (Howe & Strauss, 2004; Lenhart, Purcell, Smith, & Zickuhr, 2010).

Given the fact that younger people are living a digital life, rely on digital information and digital communication, and have more problems with face-to-face (casual) communication, an expectation is that younger people use smartphones more, tend to develop smartphone habits and addiction earlier than older people do. However, the role played by other personal factors remains unclear. Therefore, a clear hypothesis will not be made and age will be tested as a research question in relation with all variables.

To be more specific regarding age, in what follows, the age group of the millennial generation (born after 1980, i.e. below 35 years old) will be referred to as younger people.

Considering former research on age and smartphone addiction the following research question is stated:

RQ 3a: What is the role of age in smartphone addiction?

2.6 Demographics: gender

It is an established fact that, compared to men, women are more socially oriented (Lee, Chang, Lin & Cheng, 2014). For example, women call for a longer time than men do. This includes phone calls to friends, customer services, and sales calls (Friebel & Seabright 2010). There are also differences between males and females in internet and smartphone usage (Pawłowska & Potembska, 2012). While males tend to use the smartphone for more process-oriented gratifications, women use the device more for socially-oriented gratifications. Women use telephones more than men to 'gossip' or maintain social relationships and have a stronger relationship with their mobile phones. Therefore, social media are most appealing to women (Duggan & Brenner, 2012). Men use their phones more for game applications and are generally more into (mobile) gambling.

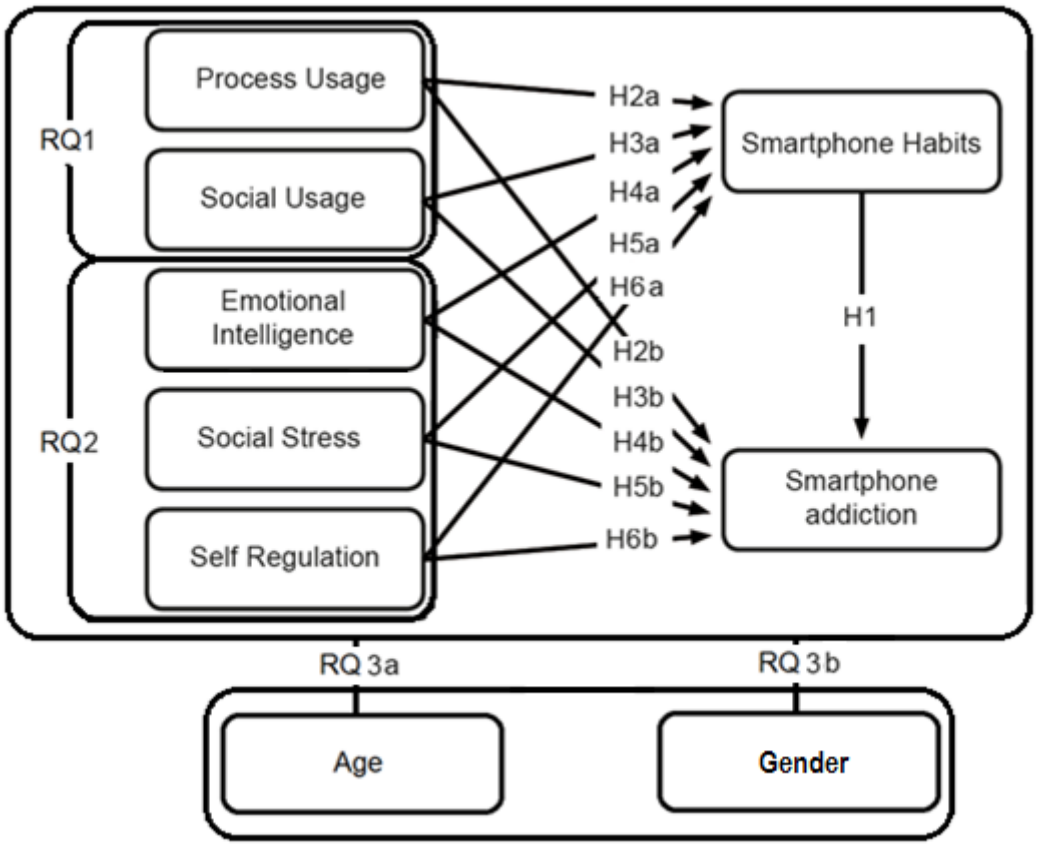
However, there is some controversy in digital addiction and the role of gender. In a Spanish study of Jenaro, Gomez-Vela, Gonzalez-Gil, and Caballo (2007), female smartphone addicts showed a stronger association with social anxiety. Some other studies did not find significant gender differences in smartphone and internet addiction (Rush, 2011). By contrast, Frangos, Frangos, and Kiohos (2010) detected that males are more likely to become internet addicts due to gambling, playing games, and watching porn. Ko et al. (2005) established that males are more likely to be game addicts and that their motivations for substance abuse are different from those that have. Lower self-esteem and lower daily life satisfaction were associated with game abuse in men but not in women. Taken together, these contradictory findings provide poor support to the contention about prominent gender differences in addiction. However, it can be expected that women and men develop an addiction in different ways due to different usages, different motivations, and different interests in usage gratifications. Therefore, the role of gender will be addressed as the research question in the present study and its relation with all other factors will be investigated.

RQ3b: What is the role of gender in smartphone addiction?

2.7 Research model

According to the theoretical considerations, the hypotheses and research question the following model is formed presented in figure 1.

Figure 1. Smartphone addiction



3. Method

3.1 Participants

In June 2014, 386 voluntary participants (121 men, 262 women, M age = 35.2 years, age range: 15-88 years) were recruited with the thesistools.com panel through an e-mail with a direct link to the questionnaire. Participants took part in the study voluntarily and anonymously. Incomplete questionnaires were deleted and participants without a smartphone were excluded from the sample.

Another 26 anonymous participants (M age = 28.0 years) were recruited via social media for a pretest. The purpose for conducting a pretest was to verify the clarity and check the validity and reliability of the questionnaire items. An interview took place with 3 participants to examine the clarity of the questionnaire and 26 anonymous participants filled in the questionnaire for the validity and reliability of the items.

Table 1. Demographic profile of the sample

		N	%
Gender			
	male	124	33
	female	262	67
Age			
	15-25	139	36
	25-35	92	24
	35-45	60	16
	45-55	60	16
	55<		12

3.2 Measurements

In this study, the survey measured the constructs with different items and different versions of Likert scale. The survey can be divided in four sections, namely: demographic section, personal situation section, usage section, and, finally, the smartphone addiction section. In the following sections, measures of the constructs will be discussed including the results of the pretest. To apply the survey in the Netherlands, the items were translated in to Dutch.

Demographics and general information

The basic demographics of the participants are listed in the survey. Alongside with the basic demographics costs for the smartphone usage, smartphone ownership and hours spent on a smartphone on a weekly basis were listed as items. The means are presented in table 2.

Table 2. General information: means and standard deviations

	M	SD
Smartphone usage per week (in hours)	16.9	17.2
Smartphone ownership (in years)	4.7	4.6
Smartphone monthly costs (in euro)	28.6	21.9

Emotional intelligence

To assess Emotional Intelligence of the respondents, the Schutte Self-Report Emotional Intelligence Test (SSEIT) was applied. This survey consists of 33 items to be rated on a five-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). This set of items is based on the EI model designed by Salovey and Mayer (1990). The items on the test relate to three EI components: (1) appraisal and expression of emotion; (2) regulation of emotion; and (3) utilization of emotion. The EI model of Salovey and Mayer (1990) and the SSEIT are widely used in different cultures (e.g., Austin, Saklofske, Huang, & McKenney, 2004). An example question of SSEIT is: "*I seek out activities that make me happy.*" [Translated into Dutch as: "*Ik zoek bezigheden uit die mij gelukkig maken.*"]

The results of the pretest verified a total of 28 items (α= 0.85); five items were deleted to improve Cronbach's alpha (lower than 0.8) or/and due to the factor loading of the performed factor analyses.

Social stress

To assess if the respondents felt stressed in social contexts, the scale of Carleton, McCreary, Nortonand, and Asmundson (2006) was used. This is a revised version of the scale by Schlenker and Leary (1982) called Brief Fear of Negative Evaluation scale (BFNE). The main purpose of the scale is to examine people's social anxiety on a self-presentation approach. The authors of the scale propose that social anxiety arises when people must or are willing to make a preferred impression on a real or imagined audience, and, when people are unsure that they will make the preferred impression, this could lead to social anxiety that can be measured with the developed scale. The scale consists of 11 items to be rated on a five-point Likert scale, from 1 (Not at all characteristic of me) to 5 (Extremely characteristic of me). An example item is: *"I worry about what other people will think of me even when I know it doesn't make any difference."* [Translated into Dutch as: *"Ik maak me druk om wat anderen van mij vinden zelfs als ik weet dat het geen verschil maakt."*]

The results of the pretest verified a total of 10 items (α=.93), 1 item was deleted to improve Cronbach's alpha or/and due to the factor loading of the performed factor analyses.

Self-regulation

To asses people's degree of self-regulation, the Self-Regulation Scale (SRS) developed by Diehl, Semegon, and Schwarzer (2006) was used. Self-regulation includes dispositional and situational components (Diehl et. al., 2006). The SRS is based on the dispositional components, a form of dispositional self-regulation focused on the attention control to goal directed behavior. The scale is developed with 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.* [Translated into Dutch as: "*Als ik ben afgeleid dan kan ik mij makkelijk weer concentreren."*]

The results of the pretest verified a total of 9 items (α=.92), 1 item was deleted to improve Cronbach's alpha or/and due to the factor loading of the performed factor analyses.

Smartphone usage types

To determine to what process- and socially-oriented degree the respondents use their smartphones, the items used in the research by Chua, Goh, and Lee (2012) were applied. This study was based on

the Uses and Gratification Theory (UGT) and investigated the usage of mobile content contribution and retrieval; therefore, it was very applicable to use for the items in the present study. In our study, only process and social usage gratification items were used. An example of a process usage item: "*Because it helps me to pass time".* Translated in to Dutch: "*Ik gebruik mijn smartphone omdat het mij helpt om de tijd door te komen*." An example of a social usage item is: "*To keep in touch with people".* [Translated into Dutch: *"Ik gebruik mijn smartphone om in contact te blijven met anderen."*

The results of the pretest verified a total of 7 process usage items (α=.82) and, in total, 6 social usage items (α=0 ,743), 1 process item and 1 social usage item were deleted to improve Cronbach's alpha or/and due to the factor loading of the performed factor analyses .

Smartphone habits

Habitual smartphone behavior is measured through selected items from the study by Limayem, Hirt, and Cheung (2003). The authors developed a habit scale in the context of the IS Continuance Theory. IS continuance usage is simply the context of usage after the adoption stage of a particular device. The basis assumption in their research is that habitual behavior is an automatic response to certain (internal and external) impulses and explains (besides intentions) people's performed behavior. In the referred to study, habit was a moderator between performed behavior and behavioral intentions. The scale is highly applicable in our study as smartphone has already been in wide use for certain years and the original scale was developed in the context of the internet, which has a lot in common in functionality as the smartphone. An example of a habit item is: *"I use my smartphone automatically."* [Translated into Dutch as: *"Ik gebruik mijn smartphone automatisch."*]

The results of the pretest verified to use all items (α=.86). Three items were revised to meet the correct factor analysis standards.

Smartphone addiction

To measure smartphone addiction, the survey included the MPPUSA scale developed by Lopez-fernandez, Honrubia-Serrano, Freixa-Blanxart, and Gibson (2014). This is a 26-item list that measures six factors of addiction and smartphone usage, namely, (1) tolerance, (2) escape from problems, (3) withdrawal, (4) craving, (5) negative consequences, and (6) social motivations (Lopez-Fernandez et al., 2013). The items are measured with a ten-point Likert scale. Participants with a score of 156 or higher were rated as smartphone addicts. Example of an item is: "*I feel lost without my mobile phone*". [Translated into Dutch as: *"Ik voel mij verloren zonder mijn smartphone."*]

The results of the pretest verified to use all items (α=.95). The total items are present in appendix 1.

In the following table the means and standard deviations of the item scores per variable are presented. In appendix 2 the complete survey with means, standard deviations and alpha's are included.

Table 3. Means and standard deviations of average measurements scores

	M	SD
Emotional intelligence score	3.75	.47
Social Stress score	2.91	.96
Self-Regulation score	2.90	.55
Process Usage score	3.35	.99
Social Usage score	4.06	.76
Smartphone habit score	3.73	1.02
Smartphone addiction score	2.67	1.33

3.3 Procedure

Pretest interview

Three participants had to read the questionnaire items. After the reading, an interview took place to discuss the understanding and (un)clarity of the items. While reading the items, the participants had to mark the items that they did not fully understand or that were not clear enough. These three interviews proved that the items were understood properly and the items were clear to the participants.

Validity and Reliability pretest

26 anonymous participants took part in the pretest for validity and reliability pretests. The questionnaire was designed online (hosted by thesistools.com). Respondents were recruited via social media platforms and the pretests were performed with SPSS (version 22).

The questionnaire counted 104 items distributed over 7 constructs: (1) the construct EI with 33 items; (2) the construct social stress with 11 items; (3) the construct self-regulation with 10 items; (4) the construct process usage with eight items; (5) the construct social usage with 6 items; (6) the construct smartphone habit with 6 items, and (7) the construct smartphone addiction with 26 items. The validity of the items was tested with a factor analysis. The results showed a reasonable grouping of items on the constructs. Only with the construct smartphone habit, three items were reformulated.

For the reliability test, a Cronbach's Alpha test was applied. In total, nine items were deleted because due to low alpha and weak grouping: 5 EI items, 1 social stress item, 1 self-regulation item, and 1 process item. Therefore, a total of 95 items was created for the main study.

Main study

A questionnaire was built to test the research questions and the hypotheses. First, items were collected through theoretical research. Second, items were translated into Dutch to apply the survey in the Netherlands. The 95-item questionnaire was constructed with the online server thesistools.com; therefore, participants completed the survey online. A post in Facebook groups of UT students was generated to recruit the pretest participants; the participants for the main study

were recruited via the thesistools.com panel. In an introduction email (see appendix 3), the participants of the main study were provided a direct link to the questionnaire. In this email, an introduction to the study was given that specified the purpose of the study and the time needed to complete the survey. The questionnaire was designed with an intro page with instructions; second, the questionnaire was divided in four parts: (1) demographics; (2) personal situation; (3) smartphone usage; and (4) smartphone addiction, with 10 pages with ca. 10 items each. The survey took around 10 to 15 minutes to complete.

3.4 Data analysis

To test all hypotheses and the relations presented in the model (see 2.7), a structural equation modeling using Amos 20.0 was applied. The basis of the structural equation model is the analysis of a structural theory conducted on a certain phenomenon with a confirmatory (hypothesis-testing) approach. With this analysis and theory, causal processes of the observations are presented.

According to van Deursen and van Dijk (2013), *"The term structural equation modeling conveys the following two important aspects of the procedure: (1) the causal processes under study are represented by a series of structural (i.e., regression) equations; and (2) the structural relations can be modeled pictorially to enable a clearer conceptualization of the theory under study. The hypothesized model can then be tested statistically in a simultaneous analysis of the entire system of variables to determine the extent to which it is consistent with the data."(pg.9).* With an adequate goodness of fit, the relations among the variables in the model, it can be assumed that relations are plausible. With an inadequate goodness of fit, the plausibility of the relations has to be rejected.

To obtain a comprehensive model fit, we included the suggested indices by Hair (2006). With an $\chi 2$ statistic and ratio of $\chi 2$ degree of freedom as $\chi 2/df$. The standard root mean residual must be higher than 0.8. The Tucker-Lewis indix must be higher than 0.9 and the root means square of error of approximation must be higher than 0.6. Those indices are often used to represent a model fit in three categories: absolute, parsimonious, and incremental.".

4. Results

4.1 Structural and path model

As mentioned in the preceding chapter, statistical analyses were performed to examine the basic assumptions of the structural equation modeling. There were no significant differences in normality, kurtosis, and skewness found with acceptable criteria. Besides, there were no outliers or multicollinearity measured.

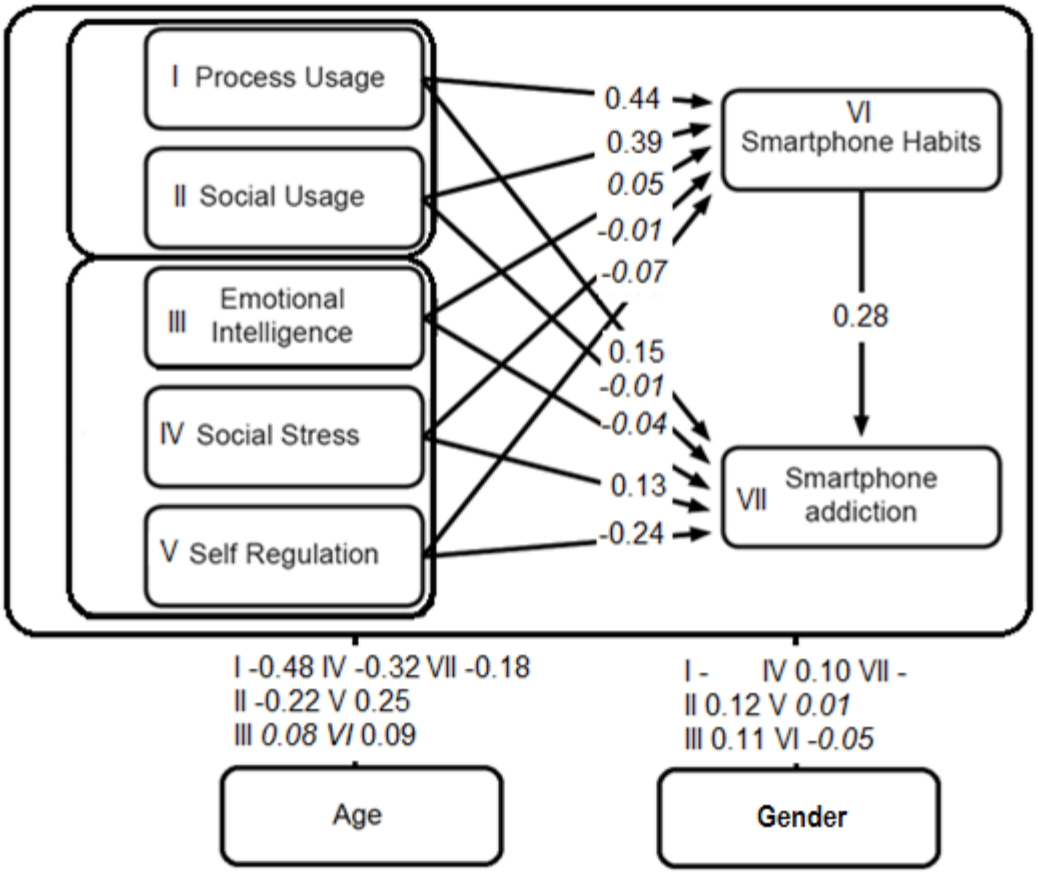
The fit results obtained from testing the validity of a causal structure of the conceptual model (see Figure 1) are as follows: $\chi2(4)=10.42$; $\chi2/df=2.60$; SRMR=.02; TLI=.99; RMSEA=.04 (90% confidence interval [CI] = .01, .07). A significant chi-squared value indicates a lack of satisfactory model fit. For improvement, we deleted twee non-significant paths: from gender to Process Usage, and from gender to smartphone addiction (see Table 4 for the low correlations). This resulted in a model with good fit and a non-significant chi-squared value: $\chi2(2)=4.71$; $\chi2/df=2.35$; SRMR=.01; TLI=.98; RMSEA=.03 (90% confidence interval [CI]=.00, .07). The model explained 37% of the variance in smartphone addiction and 45% in smartphone habits. Table 4 provides the correlations between the variables.

Table 4. Correlation Matrix

	1	2	3	4	5	6	7	8	9
1. Emotional intelligence		.11	.38	*.04*	.32	.16	-.12	*.07*	*.10*
2. Social Stress			-.29	.31	*.09*	.14	.33	-.33	.14
3. Self-Regulation				.10	*.09*	*-.05*	-.37	.26	*-.02*
4. Process Usage					.43	.57	.43	-.48	*.07*
5. Social Usage						.56	.18	-.23	.15
6. Smartphone Habit							.39	-.22	*.03*
7. Smartphone Addiction								-.40	*.06*
8. Age									-.12
9. Gender									

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

Figure 2. Results for the research model with path coefficients.



Note: numbers displayed are significant at $p < .05$ level, path coefficients in *italics* are not significant, symbol '–' means 'not fitted'.

4.2 Overview of the hypotheses and the effects of age and gender

The standardized path coefficients in Figure 2 reveal several significant direct and indirect effects between usage types, age, gender, personal factors, smartphone habits, and smartphone addiction. A coefficient linking one construct to another in the model represents the direct effect of a determinant on an endogenous variable. An indirect effect in the model is two coefficient links multiplied with each other. The total effects are a sum of all effects together. In Table 5, the effects (type of usage, personal factors) are summarized. Table 6 summarizes the effects of gender and age. Hypotheses 1, 2a, 2b, 3a, 5b, 6b are confirmed.

Table 5. Significant (in)direct effects of type usage and personality

	Direct effects β	Indirect effects β	Total effects β
H1. Smartphone Habit > Smartphone Addiction	.28		.28
H2a. Process Usage > Smartphone Habit	.44		.44
H2b. Process Usage > Smartphone Addiction	.15	.12	.27
H3a. Social Usage > Smartphone Habit	.39		.39
H3b. Social Usage > Smartphone Addiction	-	.11	.11
H4a. Emotional Intelligence > Smartphone Habit	-		
H4b. Emotional Intelligence > Smartphone Addiction	-		
H5a. Social Stress > Smartphone Habit	-		
H5b. Social Stress > Smartphone Addiction	.13		.13
H6a. Self-Regulation > Smartphone Habit	-		
H6b .Self-Regulation > Smartphone Addiction	-.24		-.24

Note: numbers displayed are significant at $p < .05$ level, symbol '–' marks non-significant effects.

Smartphone addiction can develop through smartphone habits (H1). Addiction can appear with and without being first habitual behavior. When a person develops smartphone habits, the risk is present that the habitual behavior will transform into a problematic smartphone addiction.

Process usage directly affects smartphone habits and addiction (H2a, H2b). Thereby process usage affects smartphone addiction indirectly through smartphone habits. An intensive focus on usage for process gratification has a positive relation to smartphone habits and addiction. This means that people who use smartphones to a higher degree for process gratifications have a higher risk to develop smartphone habits and addiction. The effect of social usage is different than process usage. Social usage only leads to smartphone habits, but not directly to smartphone addiction (H3a). This means that people who use their smartphones to a higher degree for social gratifications have a higher risk of developing smartphone habits. There is an indirect effect of social usage on smartphone addiction. This means that social usage can become a habit and there is a risk to get addicted.

The strongest relations are between the process and social usage and habits. This means that the type of usage plays an important role in forming habits and, to a smaller extent, in the development of smartphone addiction.

The personal factors social stress and self-regulation directly affect smartphone addiction (H5b, H6b). However, they do not directly affect smartphone habits. This means that personal factors are important factors in addiction. A higher social stress level is positively related to smartphone addiction. Thus, people with high levels of social stress have a higher risk to get addicted. Self-regulation is negatively related to smartphone addiction. This means that people with lower self-regulation have a higher risk to get addicted.

Table 6. Significant direct effects of age and gender

	Direct effects β	Indirect effects β	Total effects β
Age > Process Usage	-.48		-.48
Age > Social Usage	-.22		-.22
Age > Emotional Intelligence	-		
Age > Social Stress	-.32		-.32
Age > Self-Regulation	-.25		-.25
Age> Smartphone Habits	.09	-.31	-.22
Age > Smartphone Addiction	-.18	-.22	-.40
Sex > Process Usage	-		
Sex > Social Usage	.12		.12
Sex > Emotional Intelligence	.11		.11
Sex - Social Stress	.10		.10
Sex > Self-Regulation	-		
Sex> Smartphone Habits	-	.05	
Sex > Smartphone Addiction	-	.01	

Note: numbers displayed are significant at $p < 0.05$ level; symbol '–' marks non-significant effects.

Furthermore, the standardized path coefficients reveal significant direct and indirect effects of age and gender on different determinants in this study. Age has a significant effect on social stress, self-regulation, process usage, social usage, smartphone habits, and smartphone addiction. Because of the difference in factors, the indirect effect of age on smartphone habit and addiction is relatively large. Gender does not have a significant (in)direct effect on smartphone habits or addiction, but has a significant effect on emotional intelligence, social stress, and social usage. Through these factors, there is a small indirect effect of gender on smartphone habit and addiction.

The significant effects of age on the variables are all negative. This means that older people have less social stress and are better in self-regulation. In addition, older people tend to use smartphones to a lesser extent for process or social gratifications than younger people do. The significant differences between men and women are less than between older and younger people. Women have a higher Emotional Intelligence than men. However, they have more social anxiety than men and, compared to men, use smartphones more for social purposes.

5. Discussion

5.1 Main findings

The present study investigated the role of personal factors, usage types on smartphone habits, and addiction. In addition, the effect of smartphone habits on smartphone addiction was investigated. The study used a sample of the Dutch population. It can be concluded that some personal factors and the type of usage affect smartphone habits and smartphone addiction. The results show that some people are at a higher risk to become smartphone addicts than others. Smartphone addiction and smartphone habits are complex issues. There are some factors that only affect habits or addiction.

The model consist two usage types: Process usage and Social usage.
Process usage of the smartphone is the biggest determinant of smartphone habits and addiction. Therefore, when people use their smartphones intensively for process usage purposes, they are at a higher risk to develop smartphone habits and a smartphone addiction. Process usage can lead to addiction because of the pleasurable experiences that function as a reward. Rewards can make people feel better and are responsible for small dopamine releases in the brain. Rewards re-enforce actions, making these actions likely to reoccur (Bandura, 1991). Addiction can develop when people keep seeking for this pleasure and do not have control over their behavior (Song, La Rose, Eastin, & Lin, 2004). This finding confirms the results of prior research on process usage and addiction. Yang and Tung (2007) state that internet addicts tend to more extensively use the internet for process purposes. An explanation for this finding is that process-oriented usage is focused on rewards; therefore, gambling, gaming, and even social media are so addictive because of their reward aspects, which include winning, unlocking new features, or receiving new notifications (Whang, Lee, & Chang, 2003). Smartphones have numerous applications focused on pleasure, escaping the reality and those features can be accessed 24/7.

There is also an indirect effect of process usage on smartphone addiction through smartphone habit. This effect enforces the relation between process usage and addiction. Process usage can cause an addiction directly and, thus, also indirectly. Therefore, process usage activities on smartphones are typical activities that entail the process of developing smartphone addiction, where the rewarding aspect is responsible for the repeating acts that lead to uncontrollable behavior. For example, when checking your Facebook account for new notifications or newsfeeds, this new notification or newsfeed act as a reward. Thus, checking will reoccur because of the reward and it can develop into an addiction that can no longer be controlled.

Social usage of the smartphone has a direct effect on smartphone habits but does not directly affect smartphone addiction. So, people who extensively use their smartphones for social purposes create smartphone habits faster; in an indirect way, this could lead to smartphone addiction. This finding to some extent contradicts past research on media addiction and social usage gratifications. In Li and Chung (2004), internet addicts used the internet extensively for social purposes. In a more recent study by Lopez-Fernandez, Honrubia-Serrano, Freixa-Blancart, and Wilson (2013), smartphone addicts were found to spend most time for social purposes. Past research conclude that media addicts spend most time on social applications and are dependent on those applications because they isolate themselves (Lopez-Fernandez et. al., 2013). Thus, prior research claims that social usage have a direct effect on smartphone addiction. An explanation for the conflicting findings could be

that a smartphone is a device designed for social and interaction purposes. Anno 2014, there are many social applications available used by the majority of people for communication to strengthen their business and for both online and offline private relationships. Most people declare that they use social media to maintain their offline social networks (Salehan & Negahban, 2013). Thus, this does not immediately mean a stronger focus or dependency on only digital interaction. Besides, the indirect effect still supports the findings of prior research where social usage was found to have an effect on smartphone addiction. So developing smartphone addiction can be a process. It could be that social usage smartphone habits can make a person less active in face-to-face communication and increase social stress. Therefore, the likelihood to get independent on digital communication increases (Sayrs, 2013). Note that this contrary finding must be carefully handled. The nature of the items on social usage is based on general social gratifications and is not specified into online or offline social gratifications.

Besides usage types, the effect of personal factors on habits and addiction was investigated. The model consists of three personality factors: Emotional Intelligence, Social Stress, and Self-Regulation. Emotional intelligence has no effect on smartphone habits or smartphone addiction. This contradicts prior research on Emotional Intelligence and (internet) addiction (Engelberg & Sjoberg, 2004; Kun and Demotrovics, 2010). Past research showed that a worse score on EI was negatively related to mental and physical well-being of a person (Engelberg & Sjoberg, 2004). In internet addiction literature, EI was negatively related to internet addiction. By contrast, no relation between EI and smartphone addiction was found in the present study. To our knowledge, this is the first study that investigated smartphone addiction and EI, as there are only seven studies on behavioral addiction and EI, which makes this phenomenon relatively new, especially in the domain of digital addiction (Kun & Demotrovics, 2010). An explanation of the finding is that EI is not completely responsible for the choice that people make how to communicate. It is the stress that makes people uncomfortable in social situations and how introvert one is. Introvert people are comfortable with lower level of social interaction than extraverts (Matthews, Roberts & Zeidner, 2004; Young, 1999). To conclude, it could be that emotional intelligence has an influence on addiction but in a rather indirect way, as compared to other factors, such as stress and personality.

Another explanation for the inconsistent finding is the method used. Emotional Intelligence is the skill to recognize emotions of self and others; therefore, it might not be correctly assessed with a self-report method because of the inappropriate self-perception or providing socially-desirable answers (Matthews, Roberts, & Zeidner, 2004).

Social stress is the most important personal determinant for smartphone addiction; however, it does not affect smartphone habits. When people have high levels of social stress, they are more likely to develop a smartphone addiction. This is in line with past research on (internet) addiction. A high level of social stress creates anxiety to be in the spotlight or interact with people in real life. Thus, people tend to escape social interactions in real life and focus more on online or more anonymous communication, such as communication via the internet or a smartphone (Whang, Lee, & Chang, 2003). While it is clear that social stress contributes to the development of an addiction, it is unclear how and why. There could be some explanations, however. A smartphone in particular can function as a safe environment where people do not have to communicate, socialize, or present themselves in real life with direct interaction (Jin & Park, 2009). At the same time, it is also possible that people in

an addiction use the smartphone to an excessive extent to escape from stress: smartphones have many applications and functions that are rewarding and can help relieve stress and escape from the reality (Haverlag, 2013; Park & Lee, 2011).

Research on self-regulation and smartphone addiction is relatively new. In the present study, self-regulation does affect smartphone addiction. However, self-regulation does not affect smartphone habits. So, while failure of self-regulation — a low score on self-regulation — causes a higher risk to get addicted to a smartphone, it does not contribute to habit forming. This finding contradicts a prior study La Rose and Eastin (2004). They state that failure of self-regulation could lead to more media habits and can develop into media addiction. Failure of self-regulation could lead to more media usage than desired and lead to reoccurring of self-regulation failure. This causes a negative spiral which leads to more and more exposure to media. This explains that habits can turn into an addiction. Metcalfe and Mischel's (1999) study can support this research finding. These authors call deficient self-regulation 'a hot state of mind', which is controlled by emotions and is an automatic process steered by impulses. However, they also claim that habits are still to some extent regulated by personal and social norms, so habits are not equivalent to total failure of self-regulation. A possible explanation that confirms the finding of the relation between self-regulation and addiction can be found in an overview of self-regulation failure (Baumeister & Heatherton, 1996). According to Baumeister and Heatherton (1996), failure of self-regulation is loss of (self-) control and behavior that is steered by emotions. Addiction is losing self-control, so that people with an addiction are out of control of their behavior. This is not the case when people develop habits. Habits are automatic behavior rituals, but without a total loss of self-control and, with habitual behavior, there is no complete loss of self-regulation (Metcalfe & Mischel, 1999).

Alongside with personal factors and type of usage, two demographic characteristics were investigated, namely, gender and age. The most significant results were on age, between older people (over 35 years old) and younger people (younger than 35 years old). Age has a significant effect on social stress, self-regulation, process usage, social usage, smartphone habits, and smartphone addiction. The significant differences in the results suggest the following. Older people have less social stress compared to younger people. Older people are better in self-regulation than younger people. Older people spend less time on the smartphone for process usages than younger people. Older people spend less time on the smartphone for social usages than younger people. Older people are less likely to develop smartphone addiction than younger people. Indirectly, the effect of age also suggests that, if older people develop a smartphone addiction, it is more likely to occur through smartphone habits.

The main conclusion that can be made from these findings is that, in general, older people have a lower risk to become smartphone addicts than younger people. The findings give a new insight into smartphone addiction and the important role of age. Above all, the results give a clue to the understanding of how differently people develop and use smartphones across different generations. Younger people use their smartphones more intensively in general and more for process and social usage than older people. Past research on internet addiction and age is relatively scarce. Most research is done with young (adolescents) samples (Weinstein & Lejoyeux, 2010). Therefore, reflecting on past research on smartphone addiction and age is difficult. It could be that the

environment plays a key role. Over the years, we learn differently and have different technologies at our disposal. Jones, Jo, & Martin (2007) state that the environment we live in has a important influence on our personality. Therefore, differences between generations could occur. This conclusion can be made because the younger generation of today — the Millenials — is more into digital communication than elderly. When people from this generation feel lonely or need belongingness, they will earlier use digital devices such as computers and smartphones (Pearson, Carmon, Tobola, & Fowler, 2010). Thereby, this generation does rely on digital communication for social interaction, learning, and in cases when they need a solution. In addition, they have more problems with causal communication (Kubiatko, 2013). In the research on the on Millenials, Cabral (2010) found that Millenials were heavy users of social media and some that quit had the same symptoms as drugs addicts in rehab.

Differences in personal factors (social stress and self-regulation) between age groups were also detected. Older people have less social stress and are better in self-regulation. Generation difference could play a role in the difference between personal factors. Millenials are grown up with an overload of digital innovations. New communication technologies influence our fear for communicating offline and present ourselves in real life. This is supported by Kabiatko (2013) who states that Millennials have more social anxiety. Also, prior research contends that younger people are more prone to react on impulses than older people. Younger people are used to immediate rewards and feedback (Strauss & Howe, 2004). An explanation could therefore be that older people are more often in a cool state of mind compared to younger people; so, they are less likely to react on impulses (Metcalfe & Mischel, 1999). Also, self-regulation can be learned and needs motivation to pursue and succeed in obtaining certain goals. It could be that older people are more settled and have different interests and motivational goals (Diehl, Siemegon, & Schwarzer, 2005). All these factors could lead to more self-control and self-regulation. In combination with the lower social stress level, it is possible that the degree of self-control and performance in offline communication is higher for older people than younger people.

The difference in personal factors also has an indirect effect on smartphone habit and smartphone addiction. In favor of older people, due to their personal factors, older people are less likely to create smartphone habits and smartphone addiction. If they develop an addiction, this happens through smartphone habits, as older people are less prone to impulsive behavior and are less expectant of immediate rewards. It could be that older people first develop habits and addiction through operant conditioning.

Beyond age, there are also significant gender differences. Gender has a significant effect on social stress and social usage of smartphones. The significant differences obtained in the results reflect the following: Men experience less social stress than women. Men use their smartphones less for social gratifications than women. Due to the significant effects, there is also an indirect effect of gender on smartphone habits and smartphone addiction. This proves that personal factors and type of usage are important factors that influence these phenomena.

The main conclusion of these findings is that gender has no direct effect on smartphone habits and smartphone addiction. This means that the risk to become a smartphone addict is not really

dependent on gender. However, due to the differences in social usage and social anxiety, women are slightly more prone to get addicted. The detected differences in personal factors and usage could explain why and how the smartphone is being used by males and females. The findings support past research on the topic. According to Lee, Chang, Lin, and Cheng (2014), males are more task-oriented, while females are more socially oriented. This means that, when compared to men, women use their smartphones more to maintain their social relationships. Women have more conversations than men and gossip more on the phone than men do (Jenaro, Gomez-Vela, Gonzalez-Gil, & Caballo, 2007). Furthermore, women have a stronger relationship with their smartphones. Jenaro et al. (2007) also state that females have more social anxiety related to speaking in public, speaking to strangers, speaking in groups, and presenting themselves. To reduce social anxiety, they use their smartphones more for social purposes. Therefore, they are more prone to develop an addiction.

In sum, this research explored and contributed to the smartphone addiction literature. First, our results provide an insight on who is likely to be a smartphone addict and how smartphone addiction develops. In our study, 1.3% of the sample was addicted to their smartphone. This addiction can be developed both directly and indirectly (i.e. via smartphone habits). But *who is the smartphone addict?* According to previous addiction studies, young introvert men are at a high risk of developing internet and game addiction (Young, 1999). This research partly supports past research but states that gender is not a determinant of smartphone addiction. Overall, our results suggest that the smartphone addict can be described as (1) a young person, younger than the average age of 35; (2) a person who has a social stress higher than average; (3) a person who has a below average self-regulation power and (4) uses the smartphone more extensively for process gratifications than others do on average. Finally, our results show that addiction can be developed through habits or directly, this will depends on each individual person.

5.2 Practical implications

This research can be helpful for institutions on new media, digital behavior, and addiction centers. It provides helpful clues on who the addicted person is and what kind of personal problems the addicted persons can have. Interventions to reduce social anxiety can be particularly helpful. Besides the personal factors, type of usage plays an important role. In education, it can be pointed out what effects a smartphone can have when it is extensively used for process and social purposes. Different alternatives for social and process gratifications could be presented to reduce the emphasis on digital devices such as the smartphone. The most important task is to make people aware of their smartphone behavior.

5.3 Limitations and notes for further research

There are some limitations that need to be mentioned. First, the present research is based on self-reports. This could lead to socially-desirable answers, i.e. the answers that seem favorable for others. In addition, other response biases could occur, such as over- or underestimating of the participants, or assessing themselves in an inappropriate way. On the other hand, these limitations or disadvantages can be overstated, as normally people can judge themselves better than others (Lee et al., 2004). A note for further research is to investigate smartphone addiction with other methods.

Another limitation of this research is that the data are purely quantitative. This leads to a somewhat limited interpretation of the results. Specifically, no conclusion can be made on why and how some effects exist. However, with the purpose and design of the study, quantitative data collection was appropriate to use.

In further research, a deeper look can be taken of smartphone addiction and its determinants. A qualitative research should be appropriate to investigate the phenomena to a deeper extent and can be expected to provide an insight on how smartphone addiction exists. In short, the following points could receive further investigation.

Further research is needed on the role of social stress in smartphone addiction, as the relation between the two is unknown. It could be that new media technologies and the use of smartphones have an effect on social stress and *vice versa*.

Next, deeper research is needed on the relation between social usage and smartphone addiction. In this study, no significant effects were found. Past research states that internet and smartphone addicts use their smartphone excessively for social gratifications. Because of different results a deeper look seems appropriate. Note that the formulation of the items was derived from previously validated research. However, with the modern smartphone technologies, such as the social usage items, some former validated items could cause some problems. Those items could be better adjusted to the smartphone context. For example, social relationships could be described as online or offline relationships.

This research investigated the role of the person and usage but it is also interesting to investigate the impact of new media and smartphones on behavior, personal situation, and personality. Does new media influence our behavior and our personality?

Future research should focus on a representive sample of the Dutch population or a sample with smartphone addicts. In this research only 1.3% of the sample were rated as smartphone addicts. To examine the model in further extent with other sample seems to be appropriate. The sample used in the present study was collected among the Dutch population and the participants voluntarily participated in the survey.

This also limits the generalizability of the results. Generalizing the results of the present study to other populations with different levels of technology usage and cultural differences must be done carefully. In addition, voluntary participation could have led to volunteer bias. 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).

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