ATTACHMENT THEORY AND SMARTPHONE USE: ARE SMARTPHONES TRANSITIONAL OBJECTS?

by

JONATHAN MCGRADY SHAY

(Under the Direction of Bernadette Heckman)

ABSTRACT

Smartphone use in the United States is prevalent with 81% of adults owning them (Gramlich, 2019). The present study proposes attachment and Winnicott's transitional objects (1954) as models for understanding smartphone use. A random-controlled, between-subject, single-factorial design, with three levels of smartphone presence (Own Phone, No Phone, and Other Phone) was used for the study. Participants in the Own Phone group kept their phones throughout the study. Participants in the No Phone group had their phones confiscated during the study. Participants in the Other Phone group had their phones replaced with an unfamiliar phone during the study. Smartphone presence was manipulated to explore its effects on state attachment (ECR-RS), state anxiety (STAI form Y-1), smartphone attachment (MAQ), and health self-efficacy (SRAHP). MANOVA analyses were used to explore potential differences between conditions. In partial support of hypothesis 3, results of the MANOVA analysis indicated that there was not a significant effect of smartphone presence on smartphone attachment ($F(26, 162) = 1.066$, $p = .387$; Wilks' $\Lambda = .729$; partial $\eta 2 = .146$). However, results of this analysis also did not support hypotheses 1 and 2, that phone presence would influence on state

attachment and state anxiety. A significant main effect of health self-efficacy was found ($F(2, 93) = 3.317$, $p < .05$, partial $\eta 2 = .067$). Post-hoc analysis indicated that participants reports of health self-efficacy were significantly higher in the Own Phone ($M = 9.584$, $SD = .71$) condition compared to the No Phone condition ($M = 9.057$, $SD = .94$) ($p <. 05$). Implications of these findings are expanded upon in the Discussion section of this document. Additionally, strengths and limitations of this study and recommendations for future study directions are addressed.

INDEX WORDS: Addiction, Attachment, Attachment Figure, Attachment Style, Deactivation Strategy, Hyperactivation Strategy, Smartphone, Transitional Object

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# DEDICATION

I dedicate this dissertation to all those graduate students who will come after me. May you find strength to endure this brutal process; may your heart find love in your work and your life; and may you find respite in that which sustains your mind and soul.

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# CHAPTER I

## INTRODUCTION

Smartphone use in the United States is prevalent with 81% of adults owning them (Gramlich, 2019). Despite their popularity, information on the implications of their use is relatively sparse. This is likely due to the rapid and constant evolution of technology which is particularly notable on smartphone platforms. Additionally, the implications of smartphone use may be difficult to measure due to device convergence, or the coming together of several technologies. In the case of smartphones, both hardware devices (i.e. cameras and phones) and software technology (i.e. social media apps and email) are present on single cellular devices. This makes conducting research on smartphones difficult due to the varied ways in which individual users may interact with their devices. For instance, where one person may use their smartphone primarily for making calls, another may use his or her device primarily to check emails. Survey research supports the idea that people use their phones in diverse ways, and varied use is most notable when observing users' age and their engagement with social media on portable devices (Pedotto, Chen, & McElyea, 2016).

The way in which smartphones are used is important since certain types of use can lead to vastly different physical and mental health outcomes. For example, detrimental outcomes of social media use have been linked to "mobile phone addiction," depression, and body image concerns when accessed either on or off of portable devices (i.e. Salehan & Negahban, 2013; Tandoc, Ferrucci, & Duffy, 2015; Elhai, Levine,

Dvorak, & Hall, 2016). However, positive effects of social media have also been observed, and findings suggest that the social support social networking sites can provide users with a defense against stress, depression, and loneliness (i.e. Grieve et al., 2013; Wright et al., 2013; Clayton, Osborne, Miller, Oberle, 2013). Similarly, Rosen, Carrier, Miller, Rokkum, & Ruiz (2016) found that placing a phone far away from the bed or room predicted sleep problems; which the researchers described as an indication of nomophobia (fear of not having a phone; King et al., 2013).

The variation in the ways in which smartphones may be used and the variation in the ways that the media accessed on them may affect users suggests that a theoretical basis for describing smartphone use would be beneficial. One theoretical lens through which to view smartphone use is the potential for smartphones to be addictive. Addiction models, which focus on the disruptions to normal functioning caused by smartphone use, do not fully explain why or what users are 'addicted' to on these devices. Further, there is not a consensus among studies of smartphone addiction on terminology, what constitutes problematic use, or the mechanisms that may promote or prevent addiction to smartphones. This lack of consensus may hinge on the various ways in which smartphones may be used - an idea reflected in the terminology used by addiction models which include: mobile phone addiction, mobile phone dependence, excessive mobile use, problematic mobile use, social media addiction, gaming addiction, and internet addiction (Bianchi & Phillips, 2005; Hong, Chiu, & Huang, 2012; Toda, Monden, Kubo, & Morimoto, 2006; Andreassen, Pallesen, & Griffiths, 2017; Lemmens, Valkenburg, & Peter, 2009; Caplan, 2010). The variation among these explanations for detrimental

technology use may suggest that addiction models are not yet developed enough to adequately explain smartphone use in general.

An alternative explanation of smartphone use is attachment (Bowlby, 1969, 1973, & 1980; Ainsworth, Blehar, Waters, and Wall, 1978). Attachment theory was originally proposed by Bowlby (1969, 1973, and 1980), but was later expanded upon by other researchers including Ainsworth, Blehar, Waters, and Wall (1978) and Bartholomew (1990). In short, attachment theory suggests that bonds formed between children and attachment figures promote survival. These bonds, along with strategies employed by children when attachment figures are unavailable, continue to affect the relationships formed by individuals through adulthood (Hazan and Shaver, 1987). Bartholomew and Shaver (1998) described that adult attachment styles fit into a two-dimensional model with avoidance and anxiety defining the dimensions. The resulting model consists of four styles of attachment: *secure*, *preoccupied*, *dismissing-avoidant*, and *fearful-avoidant*.

Cassidy & Kobak (1988), termed the strategies formed by individuals in the absence of attachment figures as *secondary attachment strategies*. These strategies take two forms: *hyperactivation* and *deactivation*. Hyperactivation strategies are employed by individuals with an overdependence on the security provided by attachment figures. Therefore anxious, proximity seeking, or coercive behaviors may be observed among individuals high in attachment anxiety as they attempt to reconnect with or prevent the loss of an attachment figure (Shaver & Mikulincer, 2007). Deactivation strategies on the other hand are likely to be employed by individuals high in attachment avoidance and may be observed as withdrawal from attachment figures and favoring self-reliance over relationship formation (Bowlby, 1969/1982).

Recent research in the area of attachment has found that attachment may exist between individuals and non-human entities or objects (i.e. Granqvist & Kirkpatrick, 2008; Birgegard & Granqvist, 2004; Bodford, Kwan, & Sobota, 2017) and to smartphones specifically (i.e. Konok, Gigler, Bereczky, & Miklósi, 2016; Konok, Pogány, & Miklósi, 2017). Winnicott (1971) suggested that the relationships children form with objects can help them understand the world around them and negotiate emotional states like anxiety and depression. While Winnicott emphasized that transitional objects do not take on a specific form, they do share specific characteristics including the ability for the infant to manipulate the object, the object must seem to have "vitality," it must be constant, and, with time, it loses meaning though remains in memory. In line with Winnicott's proposal, Sugarman (2017) suggests that the use of transitional phenomena extends into adulthood and posits that the transitional objects chosen may vary based on the cognitive ability, maturity, and environmental demands.

Konok et al.'s (2017) study is one of the most recent studies investigating the intersection of attachment to objects, and smartphones specifically. In their study, the authors attempted to determine if humans showed similar attachment to phones as they do toward attachment figures. To determine the existence of attachment relationships, the researchers devised a modified version of Ainsworth et al.'s Strange Situation Test (SST). In Konok et al.'s version of the SST, participants' mobile phones were removed from the testing environment in lieu of the caregiver/attachment figure in Ainsworth et al.'s original SST. Konok et al. also devised a measure, the Mobile Attachment Questionnaire (MAQ), to assess participants' attachment to their phones. To determine if participants experienced separation anxiety from their devices, the researchers assessed

state anxiety (STAI), biometric data (heartrate), observational data (proximity seeking behavior, and displacement activity), and cognitive tasks (emotional Stroop task) into their analysis. Three groups were analyzed in their final analysis: No mobile, Unfamiliar Mobile, and Own Mobile. In the No Mobile group, participants were deprived of their mobile phones. In the Unfamiliar Mobile group, participants were given an unfamiliar mobile phone after their personal mobile phone was removed; while in the Own Mobile Group, participants maintained possession of their mobile device throughout the study. They found that there were no significant differences between the Unfamiliar Mobile and Own Mobile groups when assessing their attachment to their phone and its effect on measures designed to assess separation anxiety (reaction times to separation-related words, proximity seeking behavior, or displacement activity). They did find significant differences between the No Mobile and Own Mobile groups regarding proximity seeking behaviors, displacement activity, and the emotional Stroop test; and differences between the Unfamiliar Mobile and No Mobile groups regarding displacement activity. In other words, participants allocated to the No Mobile group showed increased cognitive, physiological, and behavioral expressions of separation-related anxiety. Given the indications of separation anxiety in the No Mobile group, Konok et al. suggest that attachment to objects is at least similar to attachment to caregivers or attachment figures.

While Konok et al.'s (2017) study does suggest that separating someone from their mobile device has detectable effect on their behavior, somatic symptoms, and displacement activity, it is not without its flaws. First, Konok et al.'s measure of mobile attachment, the MAQ, has not seen extensive use and was validated on a relatively small sample of participants. Additionally, the criterion validity of the MAQ seems to hinge on

the physiological outcomes associated with heartrate and observations of participants in their study. Second, no measures were administered to assess for trait or global attachment. It is possible that global attachment across groups was not homogenous. Third, the items of the MAQ do not explicitly measure state attachment. Therefore, scores on the MAQ may not have measured the effect of the intervention, but instead how "characteristic" specific items were of a participant. Lastly, participants in Konok et al.'s study did not all have smartphones. Though a large majority did have smartphones (94%), device convergence may have large effect on the way participants used their mobile phones. In other words, a participant with a smartphone may have greater attachment to certain aspects or apps on their device that are not available to participants who own a 'non-smart' or regular mobile phone.

**Purpose of the Study**

Konok et al.'s (2017) study suggests that people are attached to smartphones are attachment figures. This study explores the notion that people may exhibit attachment to smartphones, but that this attachment is inherently different than attachment to caregivers. Specifically, attachment to mobile devices is better explained by the content that can be accessed on the smartphone platform. With this in mind, considering the impact that global attachment, trait anxiety, and addiction may have on smartphone attachment. By taking these characteristics into account in analysis this study can better control for the actual impact of smartphone attachment upon separation from the device. Hence, the purpose of this study is to provide an alternate explanation for anxiety following smartphone separation.

This study also aims to account for many of the limitations present in Konok et al.'s study (2017). This study will add additional measures to assess for global attachment and smartphone addiction. This allows the researcher to account for the existing attachment styles of participants and addiction when examining the effect of the intervention on state attachment and state anxiety. Second, the inclusion of measures of trait anxiety, depression, and health self-efficacy will help to provide context to the results of the study.

The researchers in Konok et al.'s (2017) study randomized participants into one of four groups: Own Mobile Present/Other Mobile Present; Own Mobile Present/Other Mobile Absent; Own Mobile Absent/Other Mobile Present; Own Mobile Absent/Other Mobile Absent. They later combined their two Phone Present groups into one group during their analysis stage, leaving three groups; No mobile, Unfamiliar Mobile, and Own Mobile. Given Konok's findings, the present study will only randomize participants to one of three groups, effectively mimicking the three groups included in the Konok analysis (Own Phone; Other Phone; No Phone). Additionally, the present study will assess the relationships between other smartphone-related variables including health self-efficacy, problematic social media use, smartphone attachment, global attachment, depression, state attachment, and smartphone addiction. Finally, this study will not include observational measures (proximity seeking behavior, and displacement activity) and cognitive measures (emotional Stroop task), but will include the use of a biometric measure (heartrate).

The current study will contribute to the existing psychological literature for smartphone use, attachment, and attachment to objects. Specifically, this study's aim is

to determine if further support is warranted for attachment theory as an explanation of smartphone use. Support for this theory, or lack thereof, may inform future investigations of smartphone use, its clinical utility, as well as definitions of problematic and productive smartphone use.

**Research Question**

"Does global attachment account for anxiety experienced upon separation from one's smartphone, and does it better account for the smartphone use in college students compared to trait anxiety, smartphone addiction, and smartphone attachment?"

Qualifying participants will receive pre-test measures including measures of global attachment (ECR-RS), smartphone addiction (SAS), and trait anxiety (STAI Form Y-2). Participants will then be assigned to one of three experimental groups in which the possession of their smartphone is manipulated (Own Phone, Other Phone, No Phone). Post-test measures will include measures of state attachment (modified ECR-RS), depression (BDI-II), and mobile attachment (MAQ).

**Research Hypotheses**

<u>Primary Hypotheses:</u>

1. Participants randomized to the No Phone group will report higher anxious scores on all subscales of the state-modified ECR-RS when compared to participants randomized to the Own Phone and Other Phone groups.

If attachment to smartphones is a result of the potential for contact that they provide, removing participants' smartphones should trigger secondary attachment strategies (hyperactivation and deactivation) which will be observable as scores on the state attachment measure. By controlling for global attachment, depression, trait anxiety,

and smartphone addiction it can be ensured that these factors do not interfere with the phone presence intervention.

This hypothesis will be tested by conducting a one-way MANOVA. If significant group differences are observed, post hoc analysis will be used to determine where such differences reside between the Own Phone, No Phone, and Other Phone groups.

2. Scores of participants randomized to the Own Phone group and Other Phone group will not differ significantly concerning attachment anxiety on all subscales of the state-modified ECR-RS.

If attachment to smartphones is a result of the potential for contact that they provide, then ownership of the device (Own Phone) would not alone affect state-related outcomes. Rather, the availability of any device (Other Phone) offering the potential to connect should quell attachment anxiety. Thus, whether in the presence of their own phone or an unfamiliar phone, secondary attachment strategies (hyperactivation and deactivation) should not be activated or observable as differences in scores on state attachment.

This hypothesis will be tested by conducting a one-way MANOVA. If significant group differences are observed, post hoc analysis will be used to determine where such differences reside between the Own Phone, No Phone, and Other Phone groups.

3. Participant's scores on the MAQ will not differ between the Own Phone, No Phone, and Other Phone groups.

Our belief is that the triggering of secondary attachment strategies is due to perceived threat to one's ability to connect with attachment relationships through their smartphones, but not to their smartphones specifically. In other words, the smartphone

serves merely as a conduit to these relationships rather than an attachment figure itself. Therefore, measurements of attachment to smartphones as attachment figures should not differ between groups.

This hypothesis will be tested by conducting a one-way MANOVA. If significant group differences are observed, post hoc analysis will be used to determine where such differences reside between the Own Phone, No Phone, and Other Phone groups.

Exploratory Hypotheses:

1. Participants randomized to the No Phone group will have lower scores on measures of health self-efficacy.

In line with the hypothesis that the removal of a person's access to attachment relationships will activate secondary attachment strategies, this study asserts that activation of these strategies, and anxiety specifically, will lower health self-efficacy.

This hypothesis will be tested by conducting a one-way MANOVA. If significant group differences are observed, post hoc analysis will be used to determine where such differences reside between the Own Phone, No Phone, and Other Phone groups.

# CHAPTER II

# LITERATURE REVIEW

## Smartphones and Media Use

Mobile phone use is incredibly prevalent in the United States with 92% of adults in the U.S. between the ages 18-29 owning them and using them to go online (Gramlich, 2019). While mobile phones of the past were used primarily for calling, modern *smartphones* are perhaps better described by *device convergence* (Pon, Seppälä, and Kenney, 2014; Ojanperä, 2006), or the meeting of several technologies within one device or program. Smartphones, for example, have the ability to function as phones, heartrate monitors, gaming consoles, video players, web browsers, pedometers, cameras, and have nearly all the capabilities of home computing devices; all accessible from a single, portable platform. This is made possible by *applications* (apps), built-in or downloadable software programs which enable users to customize the accessibility and function of their smartphones.

Smartphone use is particularly prevalent among college and university students. Studies have found that U.S. college students spend an average of 12 hours per day using media and 9.5 of these hours on personal computing devices (Harris Interactive, 2009). Further, college aged adults (aged 8 – 24) use their mobile phones 5.2 hours per day (Salesforce Marketing Cloud, 2014) and check their cell phones 60 times each day (Roberts & Pirog III, 2013) in multiple locations (Emanuel, 2013).

Because of the wide variety of apps presented to users on smartphones, it is reasonable to suspect that app use is not consistent between individual devices.

However, categories of apps have been established based on their roles and function. *Social media apps*, for example, are "mobile and web-based…platforms via which individuals and communities share, co-create, discuss, and modify user-generated content (Kietzmann, Hermkens, McCarthy, & Silvestre, 2011)." Common examples of social media apps include Facebook, Twitter, Instagram, and Snapchat. The popularity of social media apps is notable, accounting for 20% of the time spent on mobile devices (which includes tablets; Pedotto, Chen, & McElyea, 2016). To put this in perspective, in 2016 Facebook CEO, Mark Zuckerberg, reported that the average person spends 50 minutes per day on Facebook platforms which include: Facebook, Instagram, and Messenger.

The use of social media is not equivalent across all ages, and is noticeably higher among *millennials* (generation born between 1982 – 2004; Howe & Strauss, 2000) and persons of college age (18–24 years). For example, 86% of 18 to 29-year-old adults report using their smartphones for social networking through Facebook, compared to 79% by users 30-49 years of age and 80% of those between the ages of 50 and 64 (Smith, 2017). This is consistent with comScore Inc.'s 2016 Mobile App Report (Pedotto, Chen, & McElyea, 2016) that 88% of millennials use the Facebook app, and a survey conducted by the Pew Research Center (Perrin, 2015) which shows that 18-29 year-olds consistently used social media apps more than any other age group. Unlike the most popular social media apps. Overall, individuals of college age tend to use smartphones to connect to the web than any other media platform and more than older age groups (Pedotto, Chen, & McElyea, 2016). Because college students seem to use smartphones differently that previous generations, it is important to investigate possible differences in the ways they are influenced by these devices.

**Social media use.** Independent of smartphone use, social media use (also referred to as *social networking*), has been studied extensively in the psychological literature. Psychological research has found mixed results regarding the effects of social networking use among college students. Studies of social media use have found that social media use may lead to addiction behaviors (Salehan & Negahban, 2013). Salehan and Negahban (2013) found that the use of social networking apps predicted mobile phone addiction. Other studies suggest that use of social networking sites is connected to psychopathology and may be connected to psychological disorders such as depression (Tandoc, Ferrucci, & Duffy, 2015; Wright et al., 2013; Elhai, Levine, Dvorak, & Hall, 2016). Tandoc, Ferrucci, and Duffy (2015), specifically, found a link between Facebook use and depression. They found that among users with *Facebook envy* depression was more prevalent. They defined Facebook envy as negative emotions that arise from the surveillance and the comparison of one's self to others' Facebook profiles. Lastly, a large body of research suggests that social media use may be connected to body image concerns especially when social media is used for comparison purposes (Kim & Chock, 2015; Fardouly, Diedrichs, Vartanian, & Halliwell, 2015).

Researchers have also found that the social support and accessibility of social networking sites can provide users with a defense against stress, depression, and loneliness (Grieve et al., 2013; Wright et al., 2013; Clayton, Osborne, Miller, Oberle, 2013) and even contribute to improved quality of life (Apaolaza et al., 2013; Grieve et al., 2013; Lee, Lee, & Kwon, 2011). Additionally, attraction to providers of support has also been found to predict an increase in emotional support users receive from Facebook along with lower levels of stress (Manago, Taylor, & Greenfield, 2012; Wright, 2012). A

study by Kim and Lee (2011) suggests that having more friends on Facebook and projecting a positive self-presentation on Facebook was correlated with greater happiness. Tandoc, Ferrucci, and Duffy (2015) found that social media use among college students lessened depression provided the students had a low Facebook envy score. The ability to voice emotionally laden content or concerns may also be beneficial to social media users with depression (Moreno et al., 2011). Moreover, even among eating disorder populations, greater Facebook use has been associated with decreased eating disorder behavior (Walker et al., 2015).

In summary, social media use has been linked to a variety of psychological and physiological outcomes, but the nature of these outcomes is mixed. Some studies suggest that the use or misuse of social media may lead to detrimental outcomes like addiction, depression, and poor body image. In contrast, other studies suggest that social media use may serve as a protective measure for those with body image concerns and is positively correlated with happiness. Therefore, suggesting that social media is solely hurtful or helpful is not defensible. It is possible that understanding why individuals use social media or find it meaningful may help researchers distinguish between problematic and productive social media use. In other words, the dichotomous outcomes of social media use may be better approached through broader theoretical explanations that may account for the differences in social media use between individuals.

**Smartphone Use, Depression, and Anxiety**

Several studies have assessed smartphone use, depression, and anxiety and found varying results (i.e. Smetaniuk, 2013; Lemola et al., 2015; Demirci, Akgonul, & Akpinar, 2015; Rosen, et al., 2016). However, one problem with assessing the relationships

between psychopathology and smartphone use is that what constitutes problematic use is ill defined. While detecting that problematic use has an effect on psychosocial outcomes is possible, determining the cause of that usage has not been studied extensively. In other words, because smartphones can be used in a variety of ways, indicating 'problematic use' is likely not as telling as indicating what type of use preceded said problematic use. Therefore, assessing problematic smartphone use, smartphone addiction, or other indicators of detrimental smartphone use are likely not the best explanations for related psychosocial variables.

However, a recent study by Elhai, Levine, Dvorak, & Hall (2016) addresses smartphone usage type as the core premise of the study. The researchers distinguished between process and social use in addition to their assessment of problematic smartphone use, depression, and anxiety. In line with reports of a similar study by van Deursen, Bolle, Hegner, & Kommers (2015), Elhai et al. (2016) described *process use* as smartphone use consisting primarily of news consumption, entertainment, relaxation, and other non-social activities and *social use* as smartphone use consisting of social interaction through social networking, messaging, and phone calls. The researchers found that anxiety was related to process use, but not social use. They also found that depression severity was inversely related to social smartphone use. These findings suggest that anxious individuals may avoid interactions by delving into process-related content on their devices, while those that are more depressed avoid using their phones for social purposes perhaps as a component of social isolation. A major limitation of this study is that many types of smartphone use cannot be confined solely to process or social use types (i.e. the YouTube app can be used for both entertainment and social

interaction). However, the overarching premise of the study suggests a new direction for studying the positive and negative effects of smartphone use on psychosocial outcomes is worth consideration.

**Health Self-Efficacy and Anxiety**

According to the Pew Research Center's Internet and American Life Project (Fox, S. and Duggan, M. (2013); a survey of 3,014 adults), thirty-five percent of adults have used the internet to research which medical conditions they or someone else may have. Forty-six percent of these individuals indicated that what they found out about their health led them to seek services from a medical professional. Thirty-one percent of smartphone owners have used their smartphone to access this information. Though these numbers do not indicate whether accessing the internet for health information leads to more positive or negative health outcomes, they do provide perspective for the scope of this practice. It is evident that the internet has greatly influenced health-related decision making and help seeking behavior.

*Self-Efficacy* is a concept originally proposed by Bandura through his Social Learning Theory (1977a, 1977b, 1982) to describe an individual's ability to complete a task or make a decision. Bandura suggested that an individual's self-efficacy expectations, or their beliefs about their abilities, are key components to behavior engagement and outcomes. In other words, a person's belief about their ability to begin or cease a certain behavior plays a large role in that person's decision to execute said behavior. While Bandura's Social Learning Theory was founded as an explanation for behavior and behavior change, his self-efficacy concept has been used in the realm of health and health psychology to describe the mechanisms of health-related behaviors. In

fact, one of the most recent and popular explanations of health behavior, The Health Promotion Model (Pender, 2011), incorporates self-efficacy as a core component. Additionally, research suggests that self-efficacy on its own is a predictor of short and long-term health behavior change. For instance, Strecher, McEvoy, DeVellis, Becker, & Rosenstock (1986) found that self-efficacy plays an important role in an individual's decision to engage or disengage from the following behaviors: smoking cessation, exercise, weight control, and contraception use.

Bandura (1986) also suggested that self-efficacy expectations may influence internal forces which themselves may affect behavior, stating that low self-efficacy may lead to "a state of anticipatory apprehension over possible deleterious happenings" (Bandura, 1997). This suggests that cognitive states, such as anxiety, may lower self-efficacy expectations. This notion is supported by several studies examining the relationship between anxiety and self-efficacy (i.e.: Matsuo, N. & Arai, 1998; Yue, 1996; Murris, 2002; Ho, Lai, Lo, Nan, & Pon, 2016).

Studies examining self-efficacy and health behaviors have found that health behaviors are largely influenced by self-efficacy and anxiety. For example, Gilles, Turk, & Fresco (2006) found that social anxiety, social expectancy, and self-efficacy all contributed to alcohol consumption and consumption frequency, with socially anxious students with low self-efficacy reporting more alcohol consumption. In a study by Jones et al. (2010), researched found that a cognitive behavioral stress management program reduced anxiety among female, HIV positive participants who had increased their self-efficacy for coping. Joekes, Van Elderen, & Schreurs (2007) found that anxiety was negatively correlated with self-efficacy among participants with congestive heart failure

and myocardial infarction. Together these finding suggest the importance of promoting health-related self-efficacy to manage anxiety symptoms, which itself is linked to treatment adherence (Santana & Fontenelle, 2011). Considering help-seeking behaviors in the realm of health, it is possible that ability to access the internet through a smartphone may decrease anxiety by promoting self-efficacy.

**Models Explaining Smartphone Use**

There are several existing theoretical lenses through which to view smartphone use: addiction models, Extended Self Theory, and Nomophobia.

Addiction models are often used to account for smartphone use. Though smartphone addiction is not a formally recognized psychological diagnosis (DSM-5; American Psychiatric Association, 2013), *addiction* in the context of these models suggests that excessive or compulsive device use disrupts a person's life. Many addiction models suggest that an individual can become addicted to smartphones such that they experience symptoms of withdrawal in the absence of the device or develop tolerance with regular use (e.g. Walsh, 2014; Kwon et al., 2013). Other models suggest that smartphone addiction is facilitated by the theory of optimal flow and usage gratification theory (Csikszentmihalyi, 1990; Kim & Shin; 2013) in that the enjoyable 'flow state' induced by technology use might discourage a user from putting down the device. Salehan & Negahban (2013) suggest that flow states or technology use itself might facilitate work addiction (Porter & Kakabadse, 2006). Media addiction (Park, 2005) and internet addiction (Douglas et al., 2008) are other examples of addiction to technology that might relate to smartphone use. The basis for these models is that use of media for extended periods of time are potentially addictive (Oulasvirta et al., 2012; Kwon et al.,

2013; and Lee et al., 2017). Unfortunately, definitions of what constitutes smartphone addiction exactly varies across the literature, and a wide range of terms have been proposed to describe detrimental smartphone use including: mobile phone addiction, mobile phone dependence, excessive mobile use or problematic mobile use (Bianchi & Phillips, 2005; Hong, Chiu, & Huang, 2012; Toda, Monden, Kubo, & Morimoto, 2006).

Defining addiction to smartphones is difficult because the way in which smartphones are used by individuals varies greatly. Given the difference in the prevalence of app use between different age groups (Pew Research Center, 2015), it is likely that the way a college age student uses their smartphone is different from how someone over the age of 40 uses their smartphone. Additionally, other models of addiction can overlap or better explain smartphone use in certain contexts. For example, Hormes, Kearns, and Timko (2014) suggest that social networking sites are addictive. Consider the instance in which someone's phone use is interfering with their life, but they are primarily using a social networking app on a smartphone. Is it the app that's addictive, or the platform through which it is being accessed? Alternatively, perhaps this person would not be addicted if access to social media on their smartphone was not constantly available. With these considerations in mind, it seems important that researchers attempt to first explain why people use smartphones, rather than how to best measure the problems they may cause. The Extended Self Theory take this approach.

Extended Self Theory posits that objects owned by an individual can become an extension of one's self with or without the awareness of the individual (Belk, 1988; Belk, 2013). Belk (2013) suggests, while referencing McClelland (1951), that when an individual can exhibit power or control over an object, the individual will incorporate that

object as part of the self. Interestingly, Winnicott (1953) proposed that children learn to differentiate between themselves and their environments through exploring what objects around them they can or cannot control; objects that they can control (i.e. hands, feet, and transitional objects) become incorporated into the self. In line with this premise, Clayton, Leshner, and Almond (2015) found that when participants' iPhones (models of smartphones produced by Apple Inc.) were removed during a cognitive task, participants' performance on the task was significantly reduced. Furthermore, they displayed physiological symptoms of anxiety and stress, and reported higher levels of unpleasantness compared to measures taken by participants when they had access to their phones. According to Clayton et al. (2015), these findings suggest that a participant's unintentional loss of the iPhone is being viewed as a "loss or lessening of self." Given that the Extended Self Theory shares similarities with Winnicott's proposed attachment model, it is possible that attachment theory could also account for the study's findings.

The addiction models and the Extended Self Theory lend themselves well to the idea of nomophobia. Like mobile phone addiction or problematic smartphone use, nomophobia serves as a descriptor of smartphone use as opposed to an explanation of its use. Nomophobia describes the fear, anxiety, or discomfort associated with technology deprivation (King et al., 2013). Nomophobia has been studied across several theoretical contexts. For instance, Argumosa-Villar, Boada-Grau, and Vigil-Colet (2017), investigated personality and self-esteem as predictors of nomophobia. Argumosa-Villar, et al. found significant negative correlations with self-esteem, emotional stability, conscientiousness, agreeableness, and openness; and found positive correlations with extraversion. Han, Kim, and Kim (2017) found that smartphone attachment mediated the

relationship between viewing one's smartphone as an extension of self and nomophobia. In other words, users who perceived their smartphones as extensions of themselves were more likely to become attached to their smartphones and subsequently experience a greater degree of nomophobia. Unfortunately, Han, et al.'s measure of attachment was limited to 3 questions (see Argumosa-Villar, et al. 2017) which do not appear to adequately gauge attachment as proposed by Bowlby (1969, 1973, and 1980), Ainsworth, Blehar, Waters, and Wall (1978), or Winnicott (1971). Furthermore, some of the questions used by the researchers for determining self-extension mimic constructs of object attachment (e.g. *My smartphone reminds me of who I am; If I lose my smartphone, I would feel like I have lost a little bit of myself*) as proposed by Winnicott (1971). Given the results of this study an attachment relationship likely exists, but it is unclear if extension of self explains smartphone attachment or if extension of self is a byproduct of object attachment.

Though it is possible to identify that smartphone use is in some way connected to detrimental effects experienced by users, models of smartphone use overall have not clearly established what constitutes problematic use. Among addiction models, it has not been explicitly established what separates smartphone addiction from other addiction frameworks. Is problematic use attributable to the amount of social media used? Is it the actual time spent on a smartphone that matters? Perhaps the best course is to step away from viewing smartphone use as definitively addictive and instead determine what characteristics or predispositions may promote unhealthy smartphone use. This may be facilitated by approaching future research through theoretical models such the Extended Self-Theory. Recent studies have investigated and suggested that attachment, particularly

attachment to objects, may play an important role in understanding individuals' smartphone usage (Ribak, 2009; Keefer, Landau, Rothschild, & Sullivan, 2012; Bodford et al., 2017; Krueger & Djerf, 2016; Trub & Barbot, 2016; Konok, Gigler, Bereczky, & Miklósi, 2016; and Konok, Pogány, & Miklósi, 2017).

**Attachment Theory**

Bowlby (1969, 1973, and 1980) first proposed the theory of attachment in his trilogy on attachment and loss. Attachment theory states that human children have an evolutionary-based need to form a bond or attachment between oneself and an *attachment figure* (caregiver). Maintenance of this bond is thought to promote survival of the child and subsequently the species. Starting in infancy, the child's experiences with an attachment figure (or figures) gradually shape that child's attachment system into what is believed to be a somewhat stable trait attachment style in adulthood (Fraley, 2002; Groh et al., 2014; Hazan and Shaver, 1990; Weller, J., Shackleford, C., Dieckmann, N., & Slovic, P., 2013; Waters et al., 2000). An *attachment style* is "a systematic pattern of relational expectations, emotions, and behaviors, that results from a particular attachment history" (Mikulincer, Shaver, Gillath, Nitzberg, 2005 p. 818). Bowlby (1969, 1973, and 1980) theorized that this "history" led to internal working models that guide attachment behavior throughout life; a notion that gained traction through subsequent research and empirical support (Egeland & Farber, 1984; Erickson, Sroufe, & Egeland, 1985; Hazan & Shaver, 1987).

Ainsworth expanded on Bowlby's theory as the first researcher to use Bowlby's theory to establish parent-child interaction patterns. Using the Strange Situations Procedure, Ainsworth, Blehar, Waters, and Wall (1978) identified three parent-child

interaction patterns including secure, insecure-avoidant, and insecure-ambivalent. Secure attachment described children who perceived their attachment figure to be dependable and promote safety. Securely attached children felt safe to explore their environments and seek the attachment figure when distressed (Main and Cassidy, 1988). Insecure-avoidant attachment described children who had a caregiver that did not promote security and may have actively rejected the child. Insecure-avoidant children displayed emotional and physical independence from their attachment figures (Behrens, Hesse, & Main, 2007). Insecure-ambivalent attachment described children that perceived an inconsistent type and level of response from their caregiver. These children exhibit both desires for closeness to the attachment figure and rejecting behaviors of the caregiver (Ainsworth, Blehar, Waters, and Wall, 1978). Subsequent research by Hazan and Shaver (1987) examined the parent-infant attachment pattern which paved the way for research exploring the extension of attachment into adulthood.

Hazan and Shaver's (1987) research led to the establishment of adult attachment styles that reflect the original parent-infant patterns established by Ainsworth and colleagues in 1978. These three adult attachment styles include secure, insecure-avoidant, and insecure-preoccupied. Bartholomew (1990) expanded on the three-style model by including a fourth attachment style, *fearful*, and by suggesting that attachment style was determined by the relationship of avoidance to dependence. Bartholomew and Shaver (1998) described that adult attachment styles fit into a two-dimensional model and equated the dependence dimension with degree of anxiety. The resulting model consists of four styles of attachment: *secure*, *preoccupied*, *dismissing-avoidant*, and *fearful-avoidant* (see Figure 1). According to this model, secure attachment is defined as low

anxiety and low avoidance. Preoccupied attachment is defined as low anxiety and high avoidance. Dismissing-avoidant attachment is defined as high anxiety and low avoidance. Fearful-avoidant is defined by high anxiety and high avoidance.

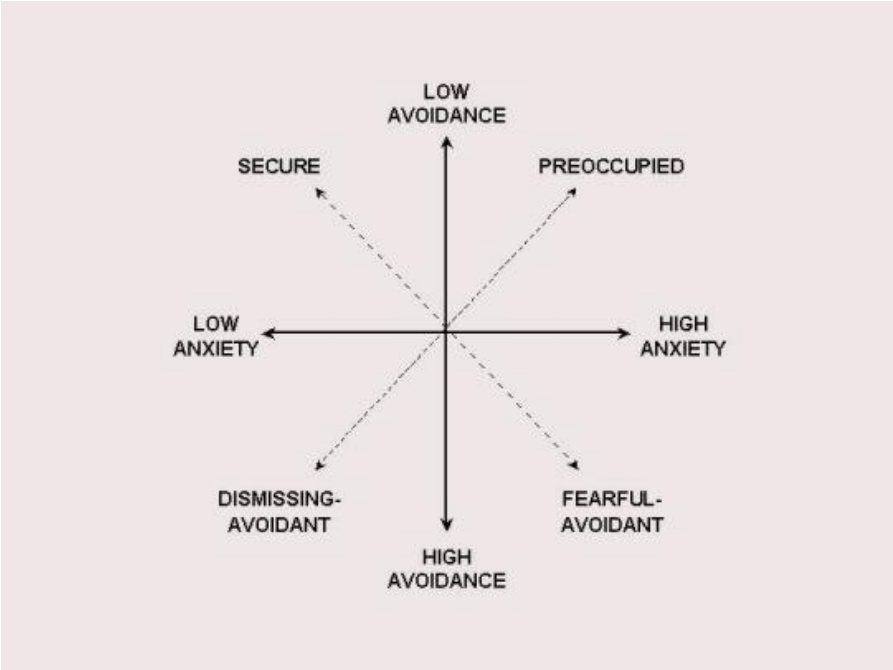


Figure 1: Styles of Adult attachment according to Bartholomew and Shaffer, 1998.

Attempting to directly seek security from an attachment figure is an individual's *primary attachment strategy* (Shaver and Mikulincer, 2007). Attachment theorists (*i.e.* Bowlby, 1969/1982; Cassidy and Kobak, 1988) have suggested that *secondary attachment strategies* are employed when secure attachment is not attainable. Secondary attachment strategies are developed as tools for emotion regulation in the event that an attachment figure is not reliable or supportive. Therefore, children with dismissing, preoccupied, and fearful attachment styles are more likely to exhibit secondary attachment strategies. According to Cassidy & Kobak (1988), secondary attachment strategies take two forms: *hyperactivation* and *deactivation*. Hyperactivation is defined by incessant or intense efforts to reach closer emotional and/or physical proximity to an

attachment figure. Hyperactivation strategies include clinging and coercive behaviors as well as an overreliance on attachment figures for security (Shaver & Mikulincer, 2002). Deactivation, on the other hand, is defined by withdrawal from attachment figures and increased self-reliance (Bowlby, 1969/1982).

Considering attachment strategies, research suggests that individuals with separate attachment styles would be more likely to employ strategies that are characteristic of their attachment. For example, an individual with a preoccupied attachment style may engage in a hyperactivation strategies (Brennan, Clark, & Shaver, 1998; Mikulincer & Shaver, 2007), whereas an individual with a dismissing-avoidant attachment would likely use deactivation strategies (Mikulincer & Shaver, 2007; Brennan, Clark, & Shaver, 1998). While a secure individual would not need to use any secondary strategies (Mikulincer & Shaver, 2007; Brennan, Clark, & Shaver, 1998), an individual with fearful-avoidant attachment would use both hyperactivation and deactivation strategies. In other words, an individual with a fearful-avoidant style may engage in proximity seeking behaviors when a threat is perceived, but might also avoid intimacy out of fear of harm and/or abandonment (Coan, 2010; Brennan, et al., 1998).

**Attachment to Material Objects.** The importance of attachment in childhood, the ability to become attached to objects, and the effects object attachment can have on adult development are supported by numerous research studies. Harlow's studies of neonatal rhesus monkeys are among the most well-known of these (Harlow 1958, 1959, 1960a, and 1960b; Harlow & McKinney, 1971; Harlow, Gluck, and Suomi, 1972; and Harlow, Plubell, and Baysinger, 1973). In the context of attachment frameworks, Harlow found significant variations in behavior between the object preference of the monkeys

and their behavior in the presence or absence of the cloth and wire surrogate mothers. Further, Harlow found that psychopathology and social behavior was linked to the presence or absence of attachment figures.

Bowlby's proposition of attachment (1969, 1973, and 1980) focused on attachment relationships as result of the availability, or lack thereof, of human-to-human interactions. However, Winnicott (1953) suggested that children's relationships with the world around them (i.e. physical sensations, experiences, and objects), also play an important role in development. Specifically, Winnicott suggested that young children have experiences, thoughts, or fantasies that help them experience and differentiate between their inner and outer worlds, determine what is and is not them, and determine what they have and do not have control over. Winnicott called these experiences *transitional phenomena*. Transitional phenomena are associated with identifiable objects that serve specific purposes known to the infant or child, or ward off emotional states like anxiety or depression. Transitional objects do not take a specific form, and can include anything from a teddy bear, a mannerism, a song lyric, or a caregiver. Winnicott suggests that key components of transitional objects include: the ability for the infant to manipulate the object, the object must seem to have "vitality," it must be constant, and, with time, it loses meaning though remains in memory. Sugarman (2017) suggest that the use of transitional phenomena extends through adolescence and into adulthood. Sugarman notes that the transitional objects chosen may vary based on the cognitive ability, maturity, and environmental demands.

Research also supports the notion that humans can become attached to non-human entities (Kirkpatrick, 2005; Granqvist & Hagekull, 2000; Granqvist & Kirkpatrick, 2008;

and Granqvist, Ljungdahl, & Dickie, 2007). Kirkpatrick (2005) proposed that an individual's relationship with deities or other spiritual entities is closely tied to attachment. Granqvist & Hagekull (2000) proposed that when individuals have inadequate attachment to others, they may lean on beliefs in a deity to compensate. This is supported by a study conducted by Granqvist & Kirkpatrick (2008) in which researchers found that belief in a powerful, symbolic agent may promote feelings of security and validation when individuals encounter adversity. Research using anxiety priming (Granqvist, Ljungdahl, & Dickie, 2007) showed that children believed a god or deity was more present when their attachment system was activated. These studies suggest that people may turn to non-human entities for comfort, particularly when under stress or other attachment figures are absent. Further, experimental research suggests that priming the unreliability of close others increases desire to be close to god (Birgegard & Granqvist, 2004).

Similarly, research has shown that tangible objects can be the target of attachment (Czikzentmihalyi & Rochberg-Halton, 1981; Belk, 1995; Bodford, Kwan, & Sobota, 2017; Konok, Gigler, Bereczky, & Miklósi, 2016; and Konok, Pogány, & Miklósi, 2017). A study of collectors conducted by Belk (1995) suggests that collectors see their behavior as a means of preserving personal or collective memories. However, Belk indicates that collectors regularly cherished items based on their perceived value. Czikzentmihalyi & Rochberg-Halton (1981) interviewed individuals in the Chicago area and consistently found that the meanings people imbue to their objects derive from the interpersonal relationships that those objects signify. It should be noted however, that Csikszentmihalyi and Rochberg-Halton's (1981) findings may have been influenced by

the salience of gender roles in the environments (participants' homes) in which participants were interviewed (Klein and Baker, 2004). Despite this, Csikszentmihalyi and Rochberg-Halton's findings (1981) suggest that material objects, in addition to holding derivative value (Belk, 1995), may also serve as representations of emotional states, memories, or community.

Studies of adult attachment to objects have often investigated attachment to objects alongside pathology, mainly as object attachments relate to ego development, hoarding, and personality disorders (Winnicott, 1971; Neave, Tyson, and Hamilton, 2016; and Hooley and Wilson-Murphy, 2012). However, research also supports the notion that normal-functioning adults become emotionally attached to objects (Myers, 1985; Wapner, Demick, & Redondo, 1990). The possession of these objects seems to be soothing in times of stress or uncertainty (St. George, 2013; Keefer, Landau, Rothschild, and Sullivan, 2012) and contributes to greater psychological health (Wiseman & Watt, 2004). Though material objects do not have the ability to provide care or compassion, they are persistent in the world and their meaning and function can be controlled (Keefer, et al., 2012) which Winnicott (1953) suggests are characteristics of transitional objects. In a phenomenological study by Myers (1985), researchers interviewed 12 healthy adults and found they could readily name and report the importance of attachment objects across their life spans. Some of these objects included toys, jewelry, children, clothing, and awards received. Wapner, Demick, and Redondo (1990) found that nursing home residents with identifiable cherished possessions tended to be more well adapted (as measured by phone calls, conflict response, visitation by friends and relatives, stress, and individual control).

Recent studies have assessed for the prevalence and role of object attachment with larger samples. Erkolahti and Nystrom (2009) found that adolescents that used transitional objects had higher rates of depression than those that did not. Erkolahti and Nystrom suggest that children continuing to use transitional objects may be doing so to provide a defense against anxiety and depression. In the specific context of Erkolahti and Nystrom's study, children may be using transitional objects because they are depressed. In an experimental study, Keefer et al. (2012) found that when participants were primed with the *uncertainty of their relationships with close others* as compared to *uncertainty of their own abilities*, they reported increased attachment to belongings which was moderated by attachment anxiety. In the third part of their study, Keefer et al. (2012) found that participants exhibited higher separation anxiety when their mobile phone was removed. Lastly, participants were told that they could collect their phone after a writing task in which they could elect to write as little or as much as they wished. Participants that were primed with uncertainty of their relationships completed the writing task more quickly, which suggested higher motivation to reunite with the object. In accordance with Keefer et al.'s (2012) study, attachment to mobile phones has been the topic of recent attachment research.

**Attachment to Smartphones.** In addition to the study conducted by Keefer et al. (2012), several studies propose the existence of attachment relationships to mobile phones. Krueger & Djerf, (2016) found that attachment anxiety predicted *phantom ringing and notifications*. Phantom phone ringing and phantom notifications describe sensations of phone ringing or notifications in the absence of actual ringing or notification indicators (audio cue or vibration). This study also assessed participants'

sensation seeking tendencies, but did not find evidence that sensations seeking was related to phantom phone sensations.

A qualitative study by Ribvak (2009) investigated the use of mobile phones as transitional objects. Ribvak (2009) argues that mobile phones, when viewed as devices used exclusively for telecommunication, do not fit Winnicott's definition of transitional objects. However, her study revealed that mobile phones primary function in the context of teen-parent relationships is to provide the *potential* for communication. In other words, unlike a teddy bear or security blanket, mobile phones are not necessarily chosen by a child, rather, they are often bought by parents. Similarly, mobile phones directly link children with attachment figures or caregivers rather than serving as an object that eases developmental transitions. With this in mind, Ribvak's (2009) study suggests that this actual link is not as important as the potential-to-link as determined by the child. Thus, it is not the mobile phone as a communication device that is the transitional object per se, but the phone as a representation of the *potential-to-connect* that suggests its transitional nature.

In line with the analysis provided by Ribvak (2009), Konok, Gigler, Bereczky, and Miklosi (2016) found that the effects of separation from one's mobile phone were not contingent on the ownership of the mobile phone. In Konok et al.'s study (2017), college students were placed in one of two treatment groups (own mobile and unfamiliar mobile) which each had two levels (present or absent) which resulted in four groups. In group 1, participants' phones were removed from the room and replaced with a calculator; in group 2, participants' phones were removed, but replaced with an unfamiliar phone; in group 3, participants maintained possession of their own mobile phone and were given a

calculator; and in group 4 participants maintained possession of their own mobile phone and were given an unfamiliar mobile. This was later merged into 3 groups: No Mobile, Unfamiliar Mobile, and Own Mobile when no differences were found between the 2 groups that maintained possession of their own mobile phone. Konok et al. (2017) found that the effects of separation (e.g. increased heart rate and displacement activity) were not significant among Unfamiliar Mobile and Own Mobile groups. This may suggest that the actual ownership of the phone is not as important to users as the '*potential'* provided by having access to a mobile phone. Unfortunately, Konok et al. (2017) did not asses for trait attachment or the ways in which participants used their smartphones. Trait attachment measures may have provided insights regarding trait attachment styles that could account for: 1) the effects of separation, 2) if trait attachment is related to the way in which smartphones are used, or 3) if the type of smartphone use is related to separation effects.

One of the major difficulties in determining adults' attachment to objects is available measures for object-attachment. Konok et al. (2017) constructed a self-report questionnaire to measure mobile attachment: The Mobile Attachment Questionnaire (MAQ). The MAQ is based on the social attachment research of Bowlby (1969) and Ainsworth et al. (1971). It is comprised of 4 components: *Separation insecurity* (decreased sense of security when separated from the mobile), *Separation anxiety* (increased tension or anxiety upon separation from the mobile), *Safe haven* (turning to the mobile in tense situations to decrease anxiety), and *Secure base* (being more confident/at ease in the presence of the mobile). While Konok et al. (2017) found that MAQ scores were associated with higher state anxiety (as measured by the 'state' scale of the STAI),

this was not the case for the other measures of attachment style including measures of heart rate, displacement activity, and proximity seeking behaviors. As one of the assessments aimed at assessing multiple dimensions of mobile phone attachment, this measure may allow researchers to gain greater insights regarding the relationships that exists between attachment, smartphone use, and problematic behaviors.

**Smartphones and Attachment Theory**

In summary, attachment and attachment to material objects have been studied extensively, but the study of smartphones as attachment objects is comparatively limited. In general, smartphone usage may be difficult to study due to the paradoxical nature of smartphones as potentially harmful, beneficial, or both. Though technology use can certainly be beneficial, research has recognized that problems are associated with both the content users engage on smartphones (i.e. social media; e.g. Salehan & Negahban, 2013; Tandoc, Ferrucci, & Duffy, 2015; and Kim & Chock, 2015) and the device itself (i.e. sleep; e.g. Lemola et al., 2015; Johansson, Petrisko, and Chasens, 2016; Rosen et al., 2016; and White, Buboltz, and Igou, 2010).

While several theoretical models exist to explain general and problematic smartphone use, they do not entirely account for the complexity of smartphone use. Smartphone use is comprised of a complex interaction between media, technology, and individual characteristics, and it is difficult to isolate the device itself from its social and technical functions. However, attachment to objects shows promise as a lens through which to view smartphone use (e.g. Bodford, Kwan, & Sobota, 2017; Konok, Gigler, Bereczky, & Miklósi, 2016; Sugarman, 2017; and Konok, Pogány, & Miklósi, 2017). Addressing smartphone use from an attachment perspective may help researchers more

accurately distinguish between helpful and harmful use, by explaining why individual smartphone owners use their phones the way they do.

In the context of attachment theory, smartphones may be viewed as transitional objects or transitional phenomena. Sugarman (2017) proposes that smartphones, as transitional phenomena, may be influencing the development of adolescents. He suggests, from a psychoanalytic framework, that smartphones may serve as objects that aid in the internalization and stabilization of the *self*. In this same vein, Kieffer (2011, 56) offers that "virtual worlds" may serve as a safe, "transitional space" where participants can engage in autonomous experimentation without real-world consequences. However, Sugarman also posits that smartphones can be used in a maladaptive, defensive manner in which the adolescent uses the smartphone to "compensate for structural deficiencies." In such a case, the user may have difficulty clearly distinguishing between the virtual world and reality. An exploratory study by Konok et al. (2016) suggests that attachment to mobile phones can lead to distress upon separation of their device and lead to proximity seeking behavior. In a separate experimental study, Konok et al. (2017) found that behavioral and physiological stress was induced when research participants were separated from their smartphones. Researchers also observed proximity seeking behavior and separation-related attentional response patterns among individuals high in smartphone attachment. Together these findings suggest that smartphones may be more than the sum of their parts and serve to promote emotional security in addition to their utilitarian value as communication, social, and entertainment platforms.

The notion that attachment to smartphones as a platform is relatively novel. Only recently have studies emerged that have focused on the ways in which smartphones have been used as opposed to the effects of their problematic use (Elhai et al., 2016; van Deursen, et al., 2015). In addition to Konok et al.'s (2017) finding that separation anxiety symptoms resulted after removal of participants' mobile phones, the researchers' findings may suggest that attachment to mobile phones is more closely linked with the ability of their phone to potentially connect with others. Specifically, among the three groups analyzed in the study: No Mobile (participants were deprived of their phones), Unfamiliar Mobile (participants were given an unfamiliar mobile phone after their personal mobile phone was removed), and Own Mobile (participants maintained possession of their mobile device throughout the study), few differences were found between the Own Mobile and Unfamiliar Mobile groups. If the attachment to one's smartphone is similar to attachment to attachment figures, anxiety should be observed in both the No Mobile and Unfamiliar Mobile groups. For instance, in comparing the smartphone to a caregiver, Konok et al.'s (2017) findings suggest that participants were statistically 'O.K.' with their caregiver being replaced by a different but equally capable caregiver. Though Konok et al. (2017) indicate that they believe that there are differences between bonds to objects and attachment figures, the findings beg the question: "Why are participants content with the replacement of their own mobile phone with an unknown device?"

This proposed study, which was greatly inspired by Konok et al. (2017), continues the investigation of smartphone attachment and attempts to address this question. However, based on the literature this study poses that attachment to

smartphones is more akin to attachment to objects or even Winnicott's proposed transitional objects. This distinction separates attachment to smartphones from the aforementioned 'caregiver' metaphor, and provides space for attachment to smartphones to be explained by other characteristics like trait variables of attachment or anxiety. In accordance with the findings of Elhai et al. (2016), this study asserts that in assessing smartphone use the multidimensional nature of use cannot be adequately described categorically (i.e. 'good' or 'bad'). In the present study, we propose that smartphone users are attached to the *access to* relationships their smartphones provide, but not the smartphone devices *themselves*.

To ensure the sample has the greatest impact, this study assesses the population with the highest prevalence of smartphone use: university students (Smith, 2017). This age group has also been observed as the highest users of social media (Pedotto, Chen, & McElyea, 2016). Additionally, university students are among the first adults who have grown up with access to mobile phones; in fact, Forgays, Hyman, & Schreiber (2014) consider university students to be "cell phone natives." Attachment theory and Winnicott's view of development suggest that attachment relationships begin in childhood. Since current college students have had access to mobile phones in their youth, they are more likely to have developed attachment to their mobile devices than other adult age group. Therefore, the use of smartphones as attachment objects should be more readily observed among these individuals who have used these devices through various developmental stages. In other words, individuals that have grown up with smartphones are more likely to value smartphones for something other than their explicit use as communication devices.

# CHAPTER III

# METHODOLOGY

## Recruitment and Participants

Research was conducted at a large university in the southeastern United States. The researcher recruited and enrolled 115 undergraduate college student participants through a university department's research pool (Sona Systems). Sona Systems is an online, human-subjects management system designed for universities. This particular subject pool typically contains 180-220 students each semester. In Sona Systems, participants can review available studies and elect to participate in them to receive course credit. Participants within the subject pool were enrolled in counseling and education courses housed within the university's College of Education. Additionally, all participants were screened for age and smartphone ownership. All consenting adult participants that own smartphones were included in the study.

## Measures

Participants acknowledged reception and understanding of an informed consent letter prior to completing any measures or questionnaires online through Qualtrics (a web-based survey tool used for research and data collection). Continuing through Qualtrics, and following the provision of informed consent, participants were screened for smartphone ownership. If participants answered "no" to the question, "Do you currently own a smartphone (a cellular phone capable of connecting to the internet, has an integrated camera, and can be used to access email and various forms of media)?" then

they were excluded from the study. Screening for smartphone ownership allowed the researchers to assess the group that is most likely to have regular interaction with smartphones, which is a major component of smartphone attachment (Konok et al., 2017). Participants were then screened for age. Only participants 18 years or older were permitted to continue the study.

Skip Logic was utilized with the display of the screening questions; in the event that a participant failed to meet criteria for the study they were automatically exited from the survey. In doing this, no unnecessary participant information was gathered. Participants that began the study but did not meet criteria for the study were still awarded credit for the portion of the study they completed in accordance with IRB guidelines. The Screening and Demographics form can be found in the Appendix A.

**The Beck Depression Inventory 2 (BDI)** is a 21-item measure of symptoms of depression. It is one of the most valid and reliable measures of depression in use today. Scores range from 0-63, with higher scores indicating greater depressive symptomatology. In the present study excellent internal consistency was observed (Cronbach's alpha = .900). See Appendix B for a list of items.

**The State-Trait Anxiety Inventory (STAI)** is a measure of trait and state anxiety (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). It can be used in clinical settings to diagnose anxiety and to distinguish it from depressive syndromes. The measure consists of 2 forms: Y-1 and Y-2. Form Y-1 is comprised of 20 items assessing trait anxiety and Form Y-2 contains 20 items for state anxiety. STAI items are rated on a 4-point scale (e.g., from "Almost Never" to "Almost Always"). Higher scores indicate greater anxiety. The STAI is appropriate for those who have at least a sixth-grade

reading level. Internal consistency coefficients for the scale have ranged from .86 to .95; test-retest reliability coefficients have ranged from .65 to .75 over a 2-month interval (Spielberger et al., 1983). In the present study excellent internal consistency of the STAI form Y-1 and Y-2 were observed with Cronbach's alphas of 0.915 and 0.928 respectively. In the context of the present study, the STAI Form Y-2 will be used to assess anxiety created by separation from their smartphone. See Appendix C for a list of items for Form Y-1 and Appendix D for a list of items for Form Y-2.

**The Self-Rated Abilities for Health Practices Scale (SRAHP)** is a 28-item scale which measures self-reported ability to engage in health-promoting behaviors. The SRAHP contains four subscales: Exercise, Nutrition, Responsible Health Practice, and Psychological Well Being, which contain has seven, 5-point items each. Participants rate the extent to which they feel capable of engaging in a behavior described by the items which range from 0-*Not at all* to 4-*Completely*. Ratings for each subscale are summed to yield subscale scores, which are themselves summed to obtain a total score. Total scores range from 0-112, and higher scores indicate greater self-efficacy for health practices. In the present study excellent internal consistency was observed (Cronbach's alpha = .919). See Appendix E for a list of items.

**The Mobile Attachment Questionnaire (MAQ)** The MAQ is based on the social attachment research of Bowlby (1969) and Ainsworth et al. (1971). The MAQ is comprised of 4 components: *Separation insecurity* (decreased sense of security when separated from the mobile), *Separation anxiety* (increased tension or anxiety upon separation from the mobile), *Safe haven* (turning to the mobile in tense situations to decrease anxiety), and *Secure base* (being more confident/at ease in the presence of the

mobile). In the present study, the total score on the MAQ had acceptable internal consistency (Cronbach's alpha = .752). See Appendix F for a list of items.

**The Experiences in Close Relationships-Relationship Structures questionnaire (ECR-RS)** is a self-report instrument designed to assess attachment patterns in a variety of relational domains including: maternal, paternal, partner, and friend relationships (Fraley, Heffernan, Vicary, & Brumbaugh, 2011). In the present study, Cronbach's alphas for these relational domains by attachment dimension are as follows: Anxiety-Mother = .882, Anxiety-Father = .903, Anxiety-Partner = .901, Anxiety-Friend = .836; Avoidance-Mother = .919, Avoidance-Father = .923, Avoidance-Partner = .887, and Avoidance-Friend = .895. The ECR-RS can also be used as a state and global measure of attachment (Fraley, Vicary, Brumbaugh, & Roisman, 2011). Initial validation of the ECR-RS assessed global attachment by averaging anxiety and avoidant attachment scores across relational domains (Cranbach's alpha for Anxiety-Global = .838 and Avoidance-Global = .854).

Each relational domain of the ECR-RS is comprised of nine items, for a total of 45 items (with the inclusion of the global domain). Of these, three items measure attachment anxiety and six items measure attachment avoidance. In the context of this measure, attachment anxiety is viewed as the extent to which a person is concerned about the availability and responsiveness of the possible attachment figure. Attachment avoidance on the other hand, is viewed as the extent to which the individual is comfortable depending on the possible attachment figure. See Appendix G for the list of items.

**The Smartphone Addiction Scale (SAS)** is a 33-item measure designed to assess the degree to which individuals' smartphone use may affected them across six factors and yields a total score. In this study the SAS total score, which had good internal consistency in the present study (Cranbach's alpha = .892), was used. See Appendix H for a list of items.

*Design and Procedures*

An experimental, between-subject, single-factorial design, with three treatments (Own Phone, No Phone, and Other Phone) was used for the study. A random number generator was used to randomly assign participants to one of the experimental groups and ensure equal distribution of participants across groups. The 'Own Phone' group served as the control group. In the 'No Phone' group, participants' own phone was confiscated halfway through the study. In the 'Other Phone' group, participants' phones were replaced with a phone unfamiliar to the participant. The dependent variables include scores on measures of state anxiety and state attachment.

The study occurred in two phases: pre-intervention phase and intervention phase. The pre-intervention phase was administered online through Qualtrics survey software. The intervention phase of the study took place in a controlled test room. The test room contained two desks, two chairs, and one table.

The pre-intervention phase took place at least one week prior to the intervention phase of the study. During this phase, participants that satisfied participation criteria completed the online screening questionnaire after which they completed the demographics questionnaire (see Appendix A) and pretest measures. The pretest measures are comprised of inventories assessing global attachment (ECR-RS),

smartphone addiction (SAS), trait anxiety (STAI - Form Y-1), and Depression (BDI-2). After completion, participants were contacted to set up an appointment for the intervention phase of the study.

The intervention phase of the study took place in the controlled test room. Participants were given a brief, misleading description about the aims of the study. Specifically, participants were told that the experimenters were assessing the effect of cognitive tasks on heartrate. To add to this illusion, participants were asked to equip an active heartrate monitor. Like Konok et al.'s (2017) study, deception was used to obtain realistic results; all participants were informed that they may be deceived in the informed consent. Because this study is assessing constructs that are closely tied to technology use, all intervention phase tasks were presented on paper to avoid possible priming effects that the use of a computer, laptop, or other media device may have introduced.

Upon entering the room, participants equipped the active heartrate monitor and were asked to complete a problem set of 30 multiplication problems over the course of two minutes. Participants were informed that that they were permitted to use the calculator on their personal smartphone during the task. The researcher left the room and started the timer as the participant began the problem set.

At the end of two minutes, the researcher returned to the room and asked the participant to stop working. The experimenter then provided participants in each of the indicated groups with the following information:

> Own Phone & No Phone: "That was the warm-up. Now the real test will begin, and your performance will be measured. In order for the test to be standardized,

that is, assuring it is the same for everybody, you will not be allowed to use your phone, but you will receive calculator that everybody will use for the task."

Other Phone: "That was the warm-up. Now the real test will begin, and your performance will be measured. In order for the test to be standardized, that is, assuring it is the same for everybody, you will not be allowed to use your phone, but you will receive a calculator and another phone that have each been approved for the task."

At this point, for the Own Phone group, the experimenter asked the participant to place their mobile phone face down on the table and provided the participant with a calculator. For the No Phone group, participants were asked to forfeit their phone for the duration of the study and were given a 'standardized' calculator. Lastly, the Other Phone group participants were asked to forfeit their phone and were given an unfamiliar phone to use in addition to the calculator. Participants in the No Phone and Other Phone groups were told that their phones would be held in a separate, but secure room.

After the phone manipulation, experimenters introduced a second 30 item multiplication problem set and asked the participants to complete the problem set over the course of the next 2 minutes. The researcher left the room and started the timer as the participant began the problem set.

Two minutes later the experimenter returned to the room, and asked the participant to stop working. The experimenter then collected the problem sets from the participant and left the room for an additional 2 minutes to "record [the participant's]

responses." This 2 minute recording period was intended to make the presence, removal, or replacement of their smartphone more salient.

After the break, the experimenter reentered the room and presented the participant with a packet containing the ECR-RS, STAI Form Y-2, the MAQ, the BDI-II, and the SRAHP. To assess state attachment, participants were asked to complete the items of the ECR-RS with respect to how they felt "at the moment" (Fraley et al., 2011). These measures were followed by a questionnaire assessing the participants' smartphone history and usage, life events since the pretest that may have disrupted or enhanced attachment relationships, and questions assessing the participants' awareness of the true aims of the study (see Appendix I).

*Data Analysis Plan*

IBM SPSS Statistics 25 was used for all data analytic procedures. Data was initially entered into SPSS by the primary investigator and then verified by a second person on the research team. The researcher then screened the data, assessed for missing data, linearity, normality, homogeneity of variance, and outliers; all of which are assumptions of the study's main data analytic procedures. Descriptive statistics quantified demographics variables, smartphone ownership history, scores on pretest items measuring depression, trait anxiety, smartphone addiction, attachment-anxiety and attachment-avoidance. Outcome measures included measures of state anxiety, state attachment, mobile attachment, and self-rated health self-efficacy.

Following descriptive analyses, one-way analysis of variance (MANOVA) was conducted to determine if the presence, absence, or replacement of participants' smartphones influenced outcome measures. The extant literature suggests that factors

including depression, trait anxiety, and trait attachment may have an effect on state anxiety and state attachment; therefore, confirming the effectiveness randomization across groups will be necessary before interpreting the results of the analyses. Because a one-way MANOVA is an omnibus test statistic, post hoc analysis will be necessary to determine group differences, if significant differences are identified.

**Hypotheses**

Primary Hypotheses:

1. Participants randomized to the No Phone group will report higher anxious scores on all subscales of the state-modified ECR-RS when compared to participants randomized to the Own Phone and Other Phone groups.

If attachment to smartphones is a result of the potential for contact that they provide, removing participants' smartphones should trigger secondary attachment strategies (hyperactivation and deactivation) which will be observable as scores on state attachment. Controlling for global attachment, depression, trait anxiety, and smartphone addiction we attempted to identify factors that might interfere with the effects of the phone presence intervention.

This hypothesis will be tested by conducting a one-way MANOVA. If significant group differences are observed, post hoc analysis will be used to determine where such differences reside between the Own Phone, No Phone, and Other Phone groups.

2. Scores of participants randomized to the Own Phone group and Other Phone group will not differ significantly concerning attachment anxiety on all subscales of the state-modified ECR-RS.

If attachment to smartphones is a result of the potential for contact that they provide, ownership of the device (Own Phone) would not affect state-related outcomes. Rather, the availability of any device (Other Phone) offering the potential to connect should quell attachment anxiety. Thus, whether in the presence of their own phone or an unfamiliar phone, secondary attachment strategies (hyperactivation and deactivation) should not be activated or observable as differences in scores on state attachment.

This hypothesis will be tested by conducting a one-way MANOVA. If significant group differences are observed, post hoc analysis will be used to determine where such differences reside between the Own Phone, No Phone, and Other Phone groups.

3. Participant's scores on the MAQ will not differ between the Own Phone, No Phone, and Other Phone groups.

Our belief is that the triggering of secondary attachment strategies is due to perceived threat to one's ability to connect with attachment relationships, but not to smartphones specifically. In other words, the smartphone serves merely as a conduit to these relationships rather than an attachment figure itself. Therefore, measurements of attachment to smartphones as attachment figures should not differ between groups.

This hypothesis will be tested by conducting a one-way MANOVA. If significant group differences are observed, post hoc analysis will be used to determine where such differences reside between the Own Phone, No Phone, and Other Phone groups.

<u>Exploratory Hypotheses:</u>

1. Participants randomized to the No Phone group will have lower scores on measures of health self-efficacy.

In line with the hypothesis that the removal of a person's access to attachment relationships will activate secondary attachment strategies, activation of these strategies, and anxiety specifically, will lower health self-efficacy.

This hypothesis will be tested by conducting a one-way MANOVA. If significant group differences are observed, post hoc analysis will be used to determine where such differences reside between the Own Phone, No Phone, and Other Phone groups.

# CHAPTER IV

# RESULTS

## Participant Demographics

Participants were 115 undergraduate students (*M* = 20.57 years of age, *SD* = 1.26 years). Of the 115 participants, 82.6% identified as female and 17.4% identified as male. Concerning race, 73% self-identified as "White/Caucasian," 10.4% as "Black/African American," 7% as "Asian," 5.2% as "Hispanic/Latinx," 2.6% as "Biracial," and 1.7% as "Other." Two participants reported their race as "Other" and self-identified as "Middle Eastern" and "Black/Hispanic." In terms of relationship status, 94.8% of participants identified as "single," 4.3% as "living with a romantic partner," and 0.9% as "divorced."

After completing pre-intervention measures, a random number generator assigned participants to one of three conditions: Own Phone, No Phone, or Other Phone (Urbaniak and Plous, 2013). This process produced an uneven number of assignments across conditions. A breakdown of demographic information by condition can be found in Tables 1, 2, 3, and 4.

Table 1

*Gender by Condition*

| Gender | Own Phone | No Phone | Other Phone | Total |
|---|---|---|---|---|
| | *n* (%) | *n* (%) | *n* (%) | *n* (%) |
| Females | 34 (85%) | 27 (79.4%) | 34 (82.9%) | 95 (82.6%) |
| Males | 6 (15%) | 7 (20.6%) | 7 (17.1%) | 20 (17.4%) |

| Gender | Own Phone | No Phone | Other Phone | Total |
|---|---|---|---|---|
| | *n* (%) | *n* (%) | *n* (%) | *n* (%) |
| Total | 40 (--) | 34 (--) | 41 (--) | 115 (--) |

Table 2

*Race by Condition*

| Race | Own Phone | No Phone | Other Phone | Total |
|---|---|---|---|---|
| | *n* (%) | *n* (%) | *n* (%) | *n* (%) |
| White/Caucasian | 32 (80%) | 23 (67.6%) | 29 (70.1%) | 84 (73%) |
| Black/Afr. American | 4 (10%) | 5 (14.7%) | 3 (7.3%) | 12 (10.4%) |
| Asian | 1 (2.5%) | 2 (5.9%) | 5 (12.2%) | 8 (7%) |
| Hispanic/Latinx | 2 (5%) | 1 (2.9%) | 3 (7.3%) | 6 (5.2%) |
| Biracial | 0 (0%) | 2 (5.9%) | 1 (2.4%) | 3 (2.6%) |
| Other | 1 (2.5%) | 1 (2.9%) | 0 (0%) | 2 (1.7%) |
| Total | 40 (--) | 34 (--) | 41 (--) | 115 (--) |

Table 3

*Relationship Status by Condition*

| Status | Own Phone | No Phone | Other Phone | Total |
|---|---|---|---|---|
| | *n* (%) | *n* (%) | *n* (%) | *n* (%) |
| Single/Never Married | 40 (100%) | 31 (91.2%) | 38 (92.7%) | 109 (94.8%) |
| Living with Partner | 0 (0%) | 3 (8.8%) | 2 (4.9%) | 5 (4.3%) |

| Status | Own Phone | No Phone | Other Phone | Total |
|---|---|---|---|---|
| | *n* (%) | *n* (%) | *n* (%) | *n* (%) |
| Divorced | 0 (0%) | 0 (0%) | 1 (2.4%) | 1 (0.9%) |
| Total | 40 (--) | 34 (--) | 41 (--) | 115 (--) |

A series of ANOVAs and crosstabs was conducted to evaluate differences in participant demographic and pre-intervention measures scores between conditions (Table 4). No statistically significant differences were found between participants across conditions.

Table 4.

*Analysis of Pre-Intervention Demographic Variables and Measures*

| Variable | *M* | *SD* | *F* | df between, df within | Significance |
|---|---|---|---|---|---|
| Age | 20.57 | 1.25 | .578 | 2, 112 | .563 |
| Gender | -- | -- | .197 | 2, 112 | .821 |
| Race | -- | -- | .770 | 2, 112 | .466 |
| R. Status | -- | -- | 1.786 | 2, 112 | .172 |
| HR1 Max | 92.36 | 14.88 | .268 | 2, 112 | .766 |
| SAS Total | 96.83 | 19.29 | .472 | 2, 112 | .625 |
| STAI Trait | 43.03 | 8.51 | .171 | 2, 112 | .843 |
| BDI 2 | 12.42 | 8.86 | .429 | 2, 112 | .652 |

**Data Analysis**

Prior to the study's main outcome analyses, 19 participants were excluded due to missing data. Twelve of the 19 participants were excluded because of technology issues

with the heartrate monitor for the HR3 Max outcome variable. The remaining seven participants had missing dependent variable values that appeared to be distributed randomly. There were no multivariate outliers in the data, as assessed by Mahalanobis distance ($p > .001$). Given these exclusions, group sizes by condition for analysis were as follows: Own Phone ($n = 33$), No Phone ($n = 29$), Other Phone ($n = 34$).

Upon review, 11 of outcome variables violated the assumption of normality (Shapiro-Wilk, $p < .05$) and appeared positively skewed. Therefore, a square root transformation was conducted to meet the assumption of normality for the analysis across conditions. Despite this, eight of the outcome variables violated the assumption of normality within each condition as assessed by Shapiro-Wilk ($p < .05$). See Table 5 and 6 in Appendix M for pre and post-transformation normality statistics as well as skewness and kurtosis of the dependent variables. Linearity was assessed through observation of scatterplots of the dependent variable per condition; the data appear to be largely non-linear. See Appendices J, K, and L for scatterplot matrices for Own Phone, No Phone, and Other Phone conditions, respectively. There was homogeneity of variances as assessed by Lavene's test ($p > .05$). The assumption of homogeneity of covariances matrices was met as assessed by Box's M test of equality of covariance matrices ($p = .107$).

A one-way MANOVA was conducted to characterize the relationship between smartphone presence and max heart rate (HR2 Max and HR3 Max), attachment avoidance (ECRRS AVD) for mother (M), father (D), partner (P), and friend (F) relationships, attachment anxiety (ECRRS ANX) for mother, father, partner, and friend relationships, state anxiety (STAI State), mobile phone attachment (MAQ Total), and

health self-efficacy (SRAHP Total). The differences between participants in each condition on the combined dependent variables was not statistically significant, $F(26, 162) = 1.066$, $p = .387$; Wilks' $\Lambda = .729$; partial $\eta 2 = .146$.

However, follow-up univariate ANOVAs showed a statistically significant main effect of phone presence on SRAHP Total, $F(2, 93) = 3.317$, $p < .05$, partial $\eta 2 = .067$. Bonferoni post-hoc tests showed that for health self-efficacy, participants in the Own Phone condition ($M = 9.584$, $SD = .714$) had significantly higher mean scores than participants in the No Phone condition ($M = 9.057$, $SD = .94$) ($p < .05$). SRAHP Total mean scores did not significantly differ between the Own Phone and Other Phone conditions ($p = .751$) or the No Phone and Other Phone ($p = .432$) conditions.

# CHAPTER V

# DISCUSSION AND CONCLUSION

Previous research suggests that removal of attachment figures from young children leads these children to engage in secondary attachment strategies (Cassidy & Kobak, 1988 and Mikulincer & Shaver, 2007). These strategies persist through adulthood and are activated when relationships with attachment figures are perceived to be threatened (i.e. proximity seeking behaviors). Research suggests that similar attachment bonds can be made with tangible objects such as smartphones (Bodford et al., 2017; Konok, et al., 2016; Sugarman, 2017; and Konok et al., 2017). The nature of smartphones as attachment-objects is also in-line with Winnicott's (1953) description of transitional phenomena and Sugarman's (2017) proposal that use of transitional objects continues through adulthood. In contention with the notion that smartphones are attachment objects or transitional objects, Ribvak (2009) proposed that smartphones may represent potential connections to attachment figures for smartphone users. In other words, smartphone users may not be attached to their phones as much as they might be to the idea that they can connect with attachment figures through a phone if they need to.

Based on these models, it was hypothesized that removal of participants smartphones during a stressful experiment would lead to the activation of secondary attachment strategies. Furthermore, it was expected that these attachment strategies would be elicited because participants' ability to contact attachment figures had been compromised not because the device was removed. It was also proposed that phone

presence would influence participants' reported health self-efficacy as a result of anxiety elicited by secondary attachment strategies.

**Hypothesis 1**

Our findings indicated that smartphone presence did not have any effect on anxiety or attachment. It was expected that participants who had their phones removed would score higher on state anxiety and attachment anxiety. These expectations were based on previous research conducted on attachment to objects and transitional objects. These studies suggest that removal of an object one is attached to might elicit anxiety (Cassidy & Kobak, 1988 and Mikulincer & Shaver, 2007) and limit self-soothing strategies (Winnicott, 1953). Similarly, Konok et al. (2017) proposed that one's phone might serve as an attachment figure and may elicit secondary attachment strategies for that reason. In other words, removing a participant's phone from the room would have a similar effect on the participant as a child whose mother left the room in Ainsworth et al.'s Strange Situation study (1971). However, this study found no difference between any of the conditions on measures of state attachment or anxiety. This suggests that smartphones do not seem to serve as attachment objects or transitional objects, nor do they seem to function as attachment figures (at least when removed for a short period of time).

**Hypothesis 2**

The current study did not find a significant difference between the Own Phone and Other Phone conditions. Though the results of the analysis suggest that this hypothesis was confirmed, this hypothesis was built upon the expectation that smartphone presence would have a detectable effect on attachment anxiety in one or

more of the study conditions groups. Specifically, this hypothesis was established with Ribvak's (2009) proposal that smartphones serve as a representation of the potential-to-connect to attachment figures as its premise. Therefore, the expectation of this hypothesis was that participants in the No Phone condition would have greater attachment anxiety while participants in the remaining groups did not significantly differ from each other. This would have demonstrated that secondary attachment strategies are elicited in the absence of a smartphone, but if any smartphone was present the potential-to-connect provided by that device would act as a safeguard against anxiety. However, this was not the case. The results of the analysis indicate that smartphone presence did not have a notable effect on attachment anxiety at all.

**Hypothesis 3**

The present study did not find a significant difference between conditions for mobile attachment (MAQ). While this hypothesis was confirmed, results should be considered carefully. This finding suggests that the MAQ may not be an effective measure for state attachment to smartphones, and that smartphone users are not attached to their devices as attachment figures. If users were attached to their devices as attachment figures, notably higher anxiety scores would have been expected in the No Phone and Other Phone conditions. However, this finding does not necessarily support the premise of this hypothesis - that people are attached to the potential-to-connect provided by smartphones. This premise was not supported by the analysis as seen in the first two hypotheses of this study.

**Exploratory Hypothesis**

The current study found a significant difference in health self-efficacy scores between the Own Phone and No Phone conditions. Specifically, participants in the Own Phone condition reported a notably higher average on the health self-efficacy measure. However, the absence of significantly higher anxiety scores in the No Phone condition (Hypothesis 1) suggests that the observed difference is not attributable to state anxiety levels like expected (Batholomew, 1998; Cassidy & Kobak, 1988; and Mikulincer & Shaver, 2007).

In light of the overwhelming use of smartphones and the internet to access health information, this finding may be attributable to the various ways in which smartphones can be used – device (Pon et al., 2014; Lane & Manner, 2011; and Ojanperä, 2006). In addition to providing university students with access to health information through apps and web browsing, health appointments at the campus health center may have to be scheduled online. In such an instance, a person's ability to access services might truly depend on their ability to access the internet. Similarly, certain health-related apps perform computations that may not be reasonable for an average college student to perform. For example, exercise for some students may greatly be facilitated by having access to real-time heartrate measurements and maintaining a healthy diet might be made manageable by an easily accessible database of nutrition information for various food items. Additionally, access to social support that might facilitate health goals such as call-based support, social media posts, or education-based media among other possibilities should be considered. Therefore, not having access to a smartphone as a

member of a demographic in which smartphones have been wholly integrated into daily life might pose a notable barrier to health self-efficacy if not also access to healthcare.

**Strengths, Limitations, and Future Directions**

Core strengths of the study included effective randomization, use of a technology free test room, and inclusion of preintervention measures of global attachment, depression, anxiety, smartphone addiction, and heartrate. Together these factors contributed to this study being well controlled and replicable.

The first major limitation of the study were the violations of assumptions of normality and linearity. MANOVA analyses are robust analyses of group differences, however violations of these assumptions may lead to error. The researcher has made every effort to provide transparency of the data collected and analysis for this reason. It is recommended that future researchers replicate this study to determine if these findings are repeatable.

The second limitation was that measures for all existing models of smartphone use including Fear of Missing Out (FoMO) were not included. FoMO takes into account social factors that may play a large role in attachment-like relationships with smartphones (Alt, 2015; Elhai et al., 2016; and Przybylski, Murayama, Dehaan, & Gladwell, 2013). Such models may also help explain the social aspects of health self-efficacy observed in this study.

Third, though gender distribution across conditions of this study was adequate, the present study's sample was comprised of a large majority of female participants. While effects of gender on dependent variables was not observed, a larger sample of male participants would make these findings more generalizable.

Lastly, Hudson et al. (2015) suggests that attachment anxiety and avoidance varies across the lifespan and technology use between generations is vastly differential. This university student sample represents a limited age range, and as a result the findings of this study may not be applicable to other populations that vary on age or education level.

Given the wide array of types of smartphones and their use, future studies should consider Elhai et al.'s (2016) when designing studies of smartphone use. Understanding how people use their smartphones is fundamental to understanding problematic use. This study attempted to provide an explanation for *why* people use their smartphones, but more studies are needed to advance understanding of the increasing prevalence of smart devices in society.

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# APPENDIX A

## SCREENING AND DEMOGRAPHICS QUESTIONNAIRE

Screening Question

Do you currently own a smartphone (a cellular phone capable of connecting to the internet, has an integrated camera, and can be used to access email and various forms of media)?

Demographic Questions

**Age:**

**Gender – Please select all that apply.**

Female

Male

Transgender

**Race/Ethnicity – Please select all that apply.**

Asian

Black or African American

Latina/o

Native American or Alaska Native

Native Hawaiian or Pacific Islander

White

Biracial

Multiracial

# APPENDIX B

## THE BECK DEPRESSION INVENTORY-II

**1. Sadness**

0 I do not feel sad.
1 I feel sad much of the time.
2 I am sad all the time.
3 I am so sad or unhappy that I can't stand it.

**2. Pessimism**

0 I am not discouraged about my future.
1 I feel more discouraged about my future than I used to be.
2 I do not expect things to work out for me.
3 I feel my future is hopeless and will only get worse.

**3. Past Failure**

0 I do not feel like a failure.
1 I have failed more than I should have.
2 As I look back, I see a lot of failures.
3 I feel I am a total failure as a person.

**4. Loss of Pleasure**

0 I get as much pleasure as I ever did from the things I enjoy.
1 I don't enjoy things as much as I used to.
2 I get very little pleasure from the things I used to enjoy.
3 I can't get any pleasure from the things I used to enjoy.

**5. Guilty Feelings**

0 I don't feel particularly guilty.
1 I feel guilty over many things I have done or should have done.
2 I feel quite guilty most of the time.
3 I feel guilty all of the time.

**6. Punishment Feelings**

0 I don't feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.

**7. Self-Dislike**

0 I feel the same about myself as ever.
1 I have lost confidence in myself.
2 I am disappointed in myself.
3 I dislike myself.

**8. Self-Criticalness**

0 I don't criticize or blame myself more than usual.
1 I am more critical of myself than I used to be.
2 I criticize myself for all of my faults.
3 I blame myself for everything bad that happens.

**9. Suicidal Thoughts or Wishes**

0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

**10. Crying**

0 I don't cry anymore than I used to.
1 I cry more than I used to.
2 I cry over every little thing.
3 I feel like crying, but I can't.

**11. Agitation**

0 I am no more restless or wound up than usual.

1 I feel more restless or wound up than usual.

2 I am so restless or agitated that it's hard to stay still.

3 I am so restless or agitated that I have to keep moving or doing something.

**12. Loss of Interest**

0 I have not lost interest in other people or activities.

1 I am less interested in other people or things than before.

2 I have lost most of my interest in other people or things.

3 It's hard to get interested in anything.

**13. Indecisiveness**

0 I make decisions about as well as ever.

1 I find it more difficult to make decisions than usual.

2 I have much greater difficulty in making decisions than I used to.

3 I have trouble making any decisions.

**14. Worthlessness**

0 I do not feel I am worthless.

1 I don't consider myself as worthwhile and useful as I used to.

2 I feel more worthless as compared to other people.

3 I feel utterly worthless.

**15. Loss of Energy**

0 I have as much energy as ever.

1 I have less energy than I used to have.

2 I don't have enough energy to do very much.

3 I don't have enough energy to do anything.

**16. Changes in Sleeping Pattern**

0 I have not experienced any change in my sleeping pattern.

1a I sleep somewhat more than usual.

1b I sleep somewhat less than usual.

2a I sleep a lot more than usual.

2b I sleep a lot less than usual.

3a I sleep most of the day.

3b I wake up 1–2 hours early and can't get back to sleep.

**17. Irritability**

0 I am no more irritable than usual.

1 I am more irritable than usual.

2 I am much more irritable than usual.

3 I am irritable all the time.

**18. Changes in Appetite**

0 I have not experienced any change in my appetite.

1a My appetite is somewhat less than usual.

1b My appetite is somewhat greater than usual.

2a My appetite is much less than before.

2b My appetite is much greater than usual.

3a I have no appetite at all.

3b I crave food all the time.

**19. Concentration Difficulty**

0 I can concentrate as well as ever.

1 I can't concentrate as well as usual.

2 It's hard to keep my mind on anything for very long.

3 I find I can't concentrate on anything.

**20. Tiredness or Fatigue**

0 I am no more tired or fatigued than usual.

1 I get more tired or fatigued more easily than usual.

2 I am too tired or fatigued to do a lot of the things I used to do.

3 I am too tired or fatigued to do most of the things I used to do.

**21. Loss of Interest in Sex**

0 I have not noticed any recent change in my interest in sex.

1 I am less interested in sex than I used to be.

2 I am much less interested in sex now.

3 I have lost interest in sex completely.

# APPENDIX C

## THE STATE-TRAIT ANXIETY INVENTORY FORM Y-1

**DIRECTIONS:**

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel *right* now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

| | NOT AT ALL | SOMEWHAT | MODERATELY SO | VERY MUCH SO |
|---|---|---|---|---|
| 1. I feel calm | 1 | 2 | 3 | 4 |
| 2. I feel secure | 1 | 2 | 3 | 4 |
| 3. I am tense | 1 | 2 | 3 | 4 |
| 4. I feel strained | 1 | 2 | 3 | 4 |
| 5. I feel at ease | 1 | 2 | 3 | 4 |
| 6. I feel upset | 1 | 2 | 3 | 4 |
| 7. I am presently worrying over possible misfortunes | 1 | 2 | 3 | 4 |
| 8. I feel satisfied | 1 | 2 | 3 | 4 |
| 9. I feel frightened | 1 | 2 | 3 | 4 |
| 10. I feel comfortable | 1 | 2 | 3 | 4 |
| 11. I feel self-confident | 1 | 2 | 3 | 4 |
| 12. I feel nervous | 1 | 2 | 3 | 4 |
| 13. I am jittery | 1 | 2 | 3 | 4 |
| 14. I feel indecisive | 1 | 2 | 3 | 4 |
| 15. I am relaxed | 1 | 2 | 3 | 4 |
| 16. I feel content | 1 | 2 | 3 | 4 |
| 17. I am worried | 1 | 2 | 3 | 4 |
| 18. I feel confused | 1 | 2 | 3 | 4 |
| 19. I feel steady | 1 | 2 | 3 | 4 |
| 20. I feel pleasant | 1 | 2 | 3 | 4 |

APPENDIX D

THE STATE-TRAIT ANXIETY INVENTORY FORM Y-2

**DIRECTIONS**

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

| | ALMOST NEVER | SOMETIMES | OFTEN | ALMOST ALWAYS |
|---|---|---|---|---|
| 21. I feel pleasant | 1 | 2 | 3 | 4 |
| 22. I feel nervous and restless | 1 | 2 | 3 | 4 |
| 23. I feel satisfied with myself | 1 | 2 | 3 | 4 |
| 24. I wish I could be as happy as others seem to be | 1 | 2 | 3 | 4 |
| 25. I feel like a failure | 1 | 2 | 3 | 4 |
| 26. I feel rested | 1 | 2 | 3 | 4 |
| 27. I am “calm, cool, and collected” | 1 | 2 | 3 | 4 |
| 28. I feel that difficulties are piling up so that I cannot overcome them | 1 | 2 | 3 | 4 |
| 29. I worry too much over something that really doesn’t matter | 1 | 2 | 3 | 4 |
| 30. I am happy | 1 | 2 | 3 | 4 |
| 31. I have disturbing thoughts | 1 | 2 | 3 | 4 |
| 32. I lack self-confidence | 1 | 2 | 3 | 4 |
| 33. I feel secure | 1 | 2 | 3 | 4 |
| 34. I make decisions easily | 1 | 2 | 3 | 4 |
| 35. I feel inadequate | 1 | 2 | 3 | 4 |
| 36. I am content | 1 | 2 | 3 | 4 |
| 37. Some unimportant thought runs through my mind and bothers me | 1 | 2 | 3 | 4 |
| 38. I take disappointments so keenly that I can’t put them out of my mind | 1 | 2 | 3 | 4 |
| 39. I am a steady person | 1 | 2 | 3 | 4 |
| 40. I get in a state of tension or turmoil as I think over my recent concerns and interests | 1 | 2 | 3 | 4 |

# APPENDIX E

## SELF-RATED ABILITIES FOR HEALTH PRACTICES SCALE

The following scale asks whether you are able to perform various health practices within the context of your lifestyle. Read each statement and use the following scale to indicate how well you are able to do each of the health practices, not how often you actually do it.

0 = Not at all  1 = A little  2 = Somewhat  3 = Mostly  4 = Completely

I AM ABLE TO:

| | | |
|---|---|---|
| 1. | Find healthy foods that are within my budget | 0 1 2 3 4 |
| 2. | Eat a balanced diet | 0 1 2 3 4 |
| 3. | Figure out how much I should weight to be healthy | 0 1 2 3 4 |
| 4. | Brush my teeth regularly | 0 1 2 3 4 |
| 5. | Tell which foods are high in fiber content | 0 1 2 3 4 |
| 6. | Figure out from labels what foods are good for me | 0 1 2 3 4 |
| 7. | Drink as much water as I need to drink every day | 0 1 2 3 4 |
| 8. | Figure out things I can do to help me relax | 0 1 2 3 4 |
| 9. | Keep myself from feeling lonely | 0 1 2 3 4 |
| 10. | Do things that make me feel good about myself | 0 1 2 3 4 |
| 11. | Avoid being bored | 0 1 2 3 4 |

| | | |
|---|---|---|
| 12. | Talk to friend and family about the things that are bothering me | 0 1 2 3 4 |
| 13. | Figure out how I respond to stress | 0 1 2 3 4 |
| 14. | Change things in my life to reduce my stress | 0 1 2 3 4 |
| 15. | Do exercises that are good for me | 0 1 2 3 4 |
| 16. | Fit exercise into my regular routine | 0 1 2 3 4 |
| 17. | Find ways to exercise that I enjoy | 0 1 2 3 4 |
| 18. | Find accessible places for me to exercise in the community | 0 1 2 3 4 |
| 19. | Know when to quit exercising | 0 1 2 3 4 |
| 20. | Do stretching exercises | 0 1 2 3 4 |
| 21. | Keep from getting hurt when I exercise | 0 1 2 3 4 |
| 22. | Figure out where to get information on how to take care of my health | 0 1 2 3 4 |
| 23. | Watch for negative changes in my body's condition (pressure sores, breathing problems) | 0 1 2 3 4 |
| 24. | Recognize what symptoms should be reported to a doctor or nurse | 0 1 2 3 4 |
| 25. | Use medication correctly. | 0 1 2 3 4 |
| 26. | Find a doctor or nurse who gives me good advice about how to stay healthy | 0 1 2 3 4 |
| 27. | Know my rights and stand up for myself effectively | 0 1 2 3 4 |
| 28. | Get help from others when I need it | 0 1 2 3 4 |

# APPENDIX F

## THE MOBILE ATTACHMENT QUESTIONNAIRE

The MAQ is comprised of 4 components: *Separation insecurity* (decreased sense of security when separated from the mobile), *Separation anxiety* (increased tension or anxiety upon separation from the mobile), *Safe haven* (turning to the mobile in tense situations to decrease anxiety), and *Secure base* (being more confident/at ease in the presence of the mobile).

SI - Separation insecurity: 5, 8, 9, 11, 13

SA - Separation anxiety: 2, 4, 7, 14(R)

SH - Safe haven: 1, 10, 12(R)

SB - Secure base: 3, 6, 15(R)

*(R) - reversed scored item

Please rate the following items based on how characteristic they are of you:

| Not Characteristic | | | | Very Characteristic |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

1. In a tense situation, I take out my phone.
2. I am nervous/tense when I leave my phone at home.
3. If a phone is in my hand I can behave more easily/unreserved.

4. I am nervous/tense when my phone runs out of battery.
5. If I am stressed I take out my phone to calm down.
6. If my phone is in my hand, I feel more confident.
7. If I left my phone at home, I would be willing to go home for it even from a distance (more than 5 min away from home).
8. If I do not have my phone on me, I do not feel safe.
9. If my phone runs out of battery, I do not feel safe.
10. If I feel uneasy/tense in a company, I take out my phone.
11. If I leave my phone at home, I do not feel safe.
12. If I am nervous, dealing with my phone does not calm me down.
13. If I lost my phone, I would not feel really safe for long.
14. It does not bother me when I leave my phone at home/it runs out of battery.
15. I am not more confident/easygoing if I have my phone with me.

# APPENDIX G

## EXPERIENCES IN CLOSE RELATIONSHIPS - RELATIONSHIP STRUCTURES QUESTIONNAIRE

This questionnaire is designed to assess the way in which you mentally represent important people in your life. You'll be asked to answer questions about your parents, your romantic partners, and your friends. Please indicate the extent to which you agree or disagree with each statement by circling a number for each item.

Use the following scale to rate each item:

Strongly Disagree 1 - 2 - 3 - 4 - 5 - 6 - 7 Strongly Agree

Please answer the following questions about your mother or a mother-like figure

1. It helps to turn to this person in times of need.
2. I usually discuss my problems and concerns with this person.
3. I talk things over with this person.
4. I find it easy to depend on this person.
5. I don't feel comfortable opening up to this person.
6. I prefer not to show this person how I feel deep down.
7. I often worry that this person doesn't really care for me.
8. I'm afraid that this person may abandon me.
9. I worry that this person won't care about me as much as I care about him or her.

Please answer the following questions about your father or a father-like figure

1. It helps to turn to this person in times of need.
2. I usually discuss my problems and concerns with this person.
3. I talk things over with this person.
4. I find it easy to depend on this person.
5. I don't feel comfortable opening up to this person.
6. I prefer not to show this person how I feel deep down.
7. I often worry that this person doesn't really care for me.
8. I'm afraid that this person may abandon me.
9. I worry that this person won't care about me as much as I care about him or her.

Please answer the following questions about your dating or marital partner. **Note**: If you are not currently in a dating or marital relationship with someone, answer these questions with respect to a former partner or a relationship that you would like to have with someone.

1. It helps to turn to this person in times of need.
2. I usually discuss my problems and concerns with this person.
3. I talk things over with this person.
4. I find it easy to depend on this person.
5. I don't feel comfortable opening up to this person.
6. I prefer not to show this person how I feel deep down.
7. I often worry that this person doesn't really care for me.
8. I'm afraid that this person may abandon me.

9. I worry that this person won't care about me as much as I care about him or her.

Please answer the following questions about your best friend

1. It helps to turn to this person in times of need.
2. I usually discuss my problems and concerns with this person.
3. I talk things over with this person.
4. I find it easy to depend on this person.
5. I don't feel comfortable opening up to this person.
6. I prefer not to show this person how I feel deep down.
7. I often worry that this person doesn't really care for me.
8. I'm afraid that this person may abandon me.
9. I worry that this person won't care about me as much as I care about him or her.

Please read each of the following statements and rate the extent to which you believe each statement best describes your feelings about close relationships in general.

1. It helps to turn to people in times of need.
2. I usually discuss my problems and concerns with others.
3. I talk things over with people.
4. I find it easy to depend on others.
5. I don't feel comfortable opening up to others.
6. I prefer not to show others how I feel deep down.
7. I often worry that other people do not really care for me.
8. I'm afraid that other people may abandon me.
9. I worry that others won't care about me as much as I care about them.

# APPENDIX H

## SMARTPHONE ADDICTION SCALE

Please use this scale to indicate the degree to which you agree with the following statements:

| **Strongly disagree** | **Disagree** | **Weakly disagree** | **Weakly agree** | **Agree** | **Strongly agree** |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |

1. Missing planned work due to smartphone use
2. Having a hard time concentrating in class, while doing assignments, or while working due to smartphone use
3. Experiencing lightheadedness or blurred vision due to excessive smartphone use
4. Feeling pain in the wrists or at the back of the neck while using a smartphone
5. Feeling tired and lacking adequate sleep due to excessive smartphone use
6. Feeling calm or cozy while using a smartphone
7. Feeling pleasant or excited while using a smartphone
8. Feeling confident while using a smartphone
9. Being able to get rid of stress with a smartphone
10. There is nothing more fun to do than using my smartphone.
11. My life would be empty without my smartphone.
12. Feeling most liberal while using a smartphone

13. Using a smartphone is the most fun thing to do.
14. Won't be able to stand not having a smartphone
15. Feeling impatient and fretful when I am not holding my smartphone
16. Having my smartphone in my mind even when I am not using it
17. I will never give up using my smartphone even when my daily life is already greatly affected by it.
18. Getting irritated when bothered while using my smartphone
19. Bringing my smartphone to the toilet even when I am in a hurry to get there
20. Feeling great meeting more people via smartphone use
21. Feeling that my relationships with my smartphone buddies are more intimate than my relationships with my real-life friends
22. Not being able to use my smartphone would be as painful as losing a friend.
23. Feeling that my smartphone buddies understand me better than my real-life friends
24. Constantly checking my smartphone so as not to miss conversations between other people on Twitter or Facebook
25. Checking SNS (Social Networking Service) sites like Twitter or Facebook right after waking up
26. Preferring talking with my smartphone buddies to hanging out with my real-life friends or with the other members of my family
27. Preferring searching from my smartphone to asking other people
28. My fully charged battery does not last for one whole day.
29. Using my smartphone longer than I had intended
30. Feeling the urge to use my smartphone again right after I stopped using it

31. Having tried time and again to shorten my smartphone use time, but failing all the time

32. Always thinking that I should shorten my smartphone use time

33. The people around me tell me that I use my smartphone too much.

Daily-life Disturbance: 1, 2, 3, 4, 5

Positive Anticipation: 6, 8, 9, 10, 11, 12, 13

Withdrawal: 14, 15, 16, 17, 18, 19

Cyberspace-oriented Relationship: 20, 21, 22, 23, 24, 25, 26

Overuse: 27, 28, 29, 30

Tolerance: 31, 32, 33

# APPENDIX I

## FOLLOW-UP QUESTIONNAIRE

1. What do you think was the purpose of this experiment?
2. Was there anything strange, unusual or suspicious during the test?
3. Was there any difficulty or problem with the programs?
4. In the past week have you experienced any notable life events or interactions with others (i.e. death of a significant other, a breakup with a romantic partner, formation of a new friendship, etc.)?
5. How old were you when you first received a smartphone?
6. How long have you been a smartphone owner?
7. Why did you buy your first smartphone or why was it given to you?
8. What do you primarily use your smartphone for? Please indicate the top three (3) functions of your smartphone in order of importance to you:

    1._____

    2._____

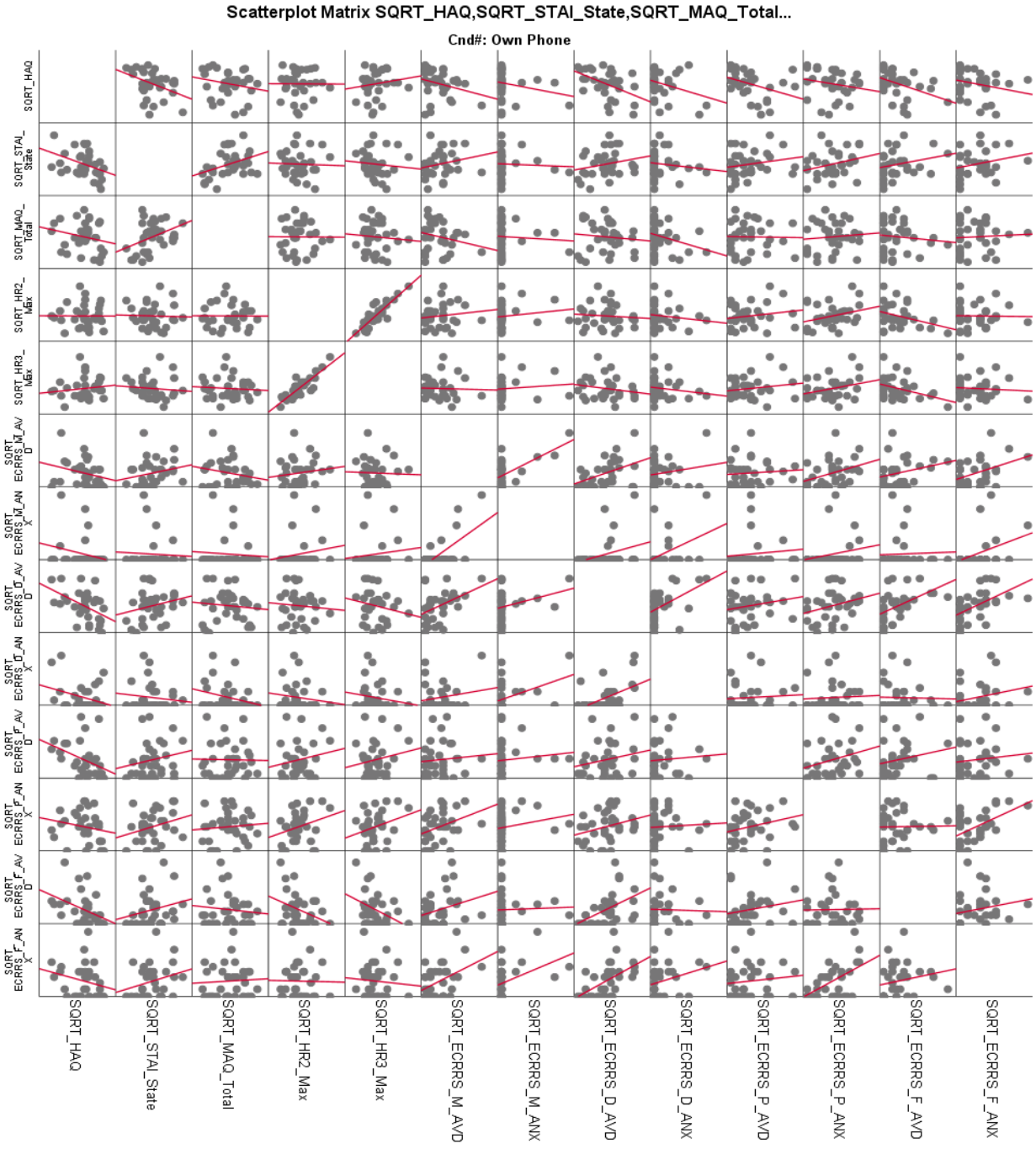
    3._____

9. What is the make of your smartphone (eg: Apple, Samsung, etc.)?
10. What is the model of your smartphone (iPhone 8, Galaxy S7, etc.)?
11. What operating system does your smartphone use (eg: iOS, Android, etc.)?
12. If you were sick and did not have your smartphone, how difficult would it be to access medical services?

Very Difficult 1 - 2 - 3 - 4 - 5 - 6 - 7 Not at all difficult

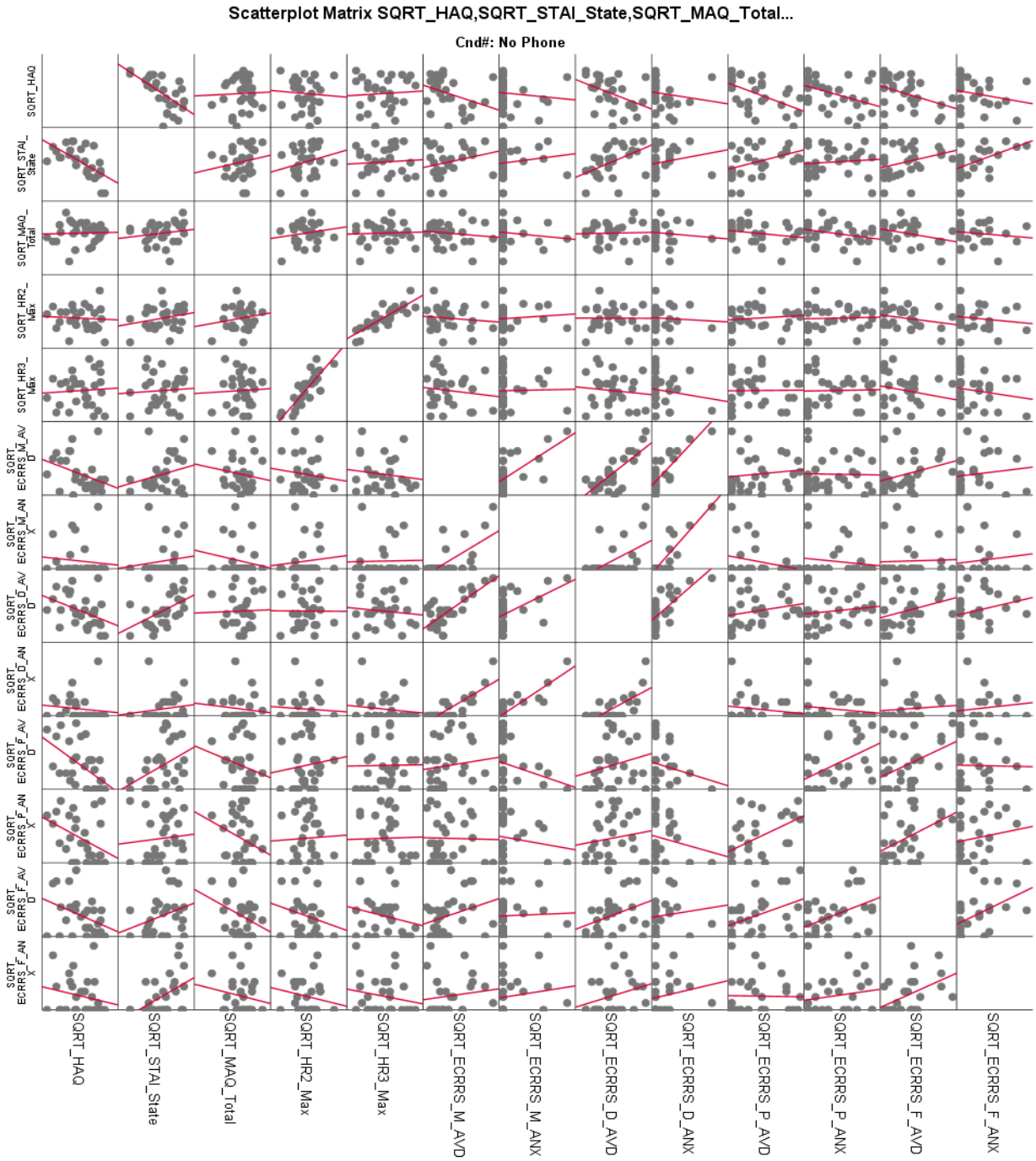
# APPENDIX J

## Scatterplot Matrix for the Own Phone Condition



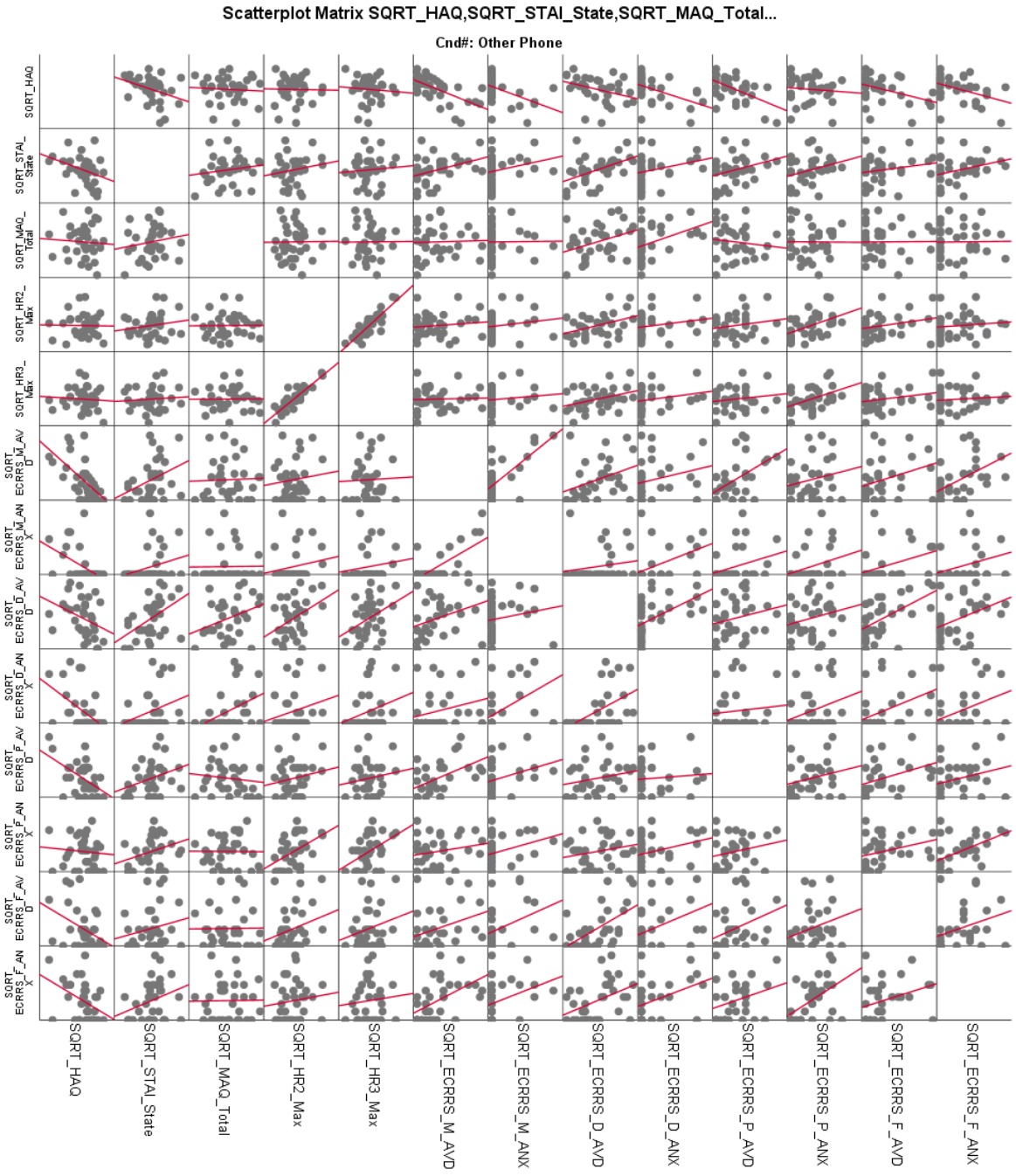
# APPENDIX K

## Scatterplot Matrix for the No Phone Condition



# APPENDIX L

## Scatterplot Matrix for the Other Phone Condition



APPENDIX M

NORMALITY STATISTICS OF THE OUTCOME VARIABLES

Table 5

Normality Statistics of the Outcome Variables prior to Square Root Transformation

| | | Shapiro-Wilk | | | | | Skewness | | Kurtosis | |
|---|---|---|---|---|---|---|---|---|---|---|
| Measure | Condition | Statistic | *df* | *p* | *M* | *SD* | Statistic | *SE* | Statistic | *SE* |
| SRAHP | | | | | | | | | | |
| | Own Phone | .94 | 33 | .075 | 91.00 | 13.33 | -0.48 | .37 | -.54 | .73 |
| | No Phone | .98 | 29 | .700 | 82.00 | 17.76 | -0.17 | .40 | -1.27 | .79 |
| | Other Phone | .94 | 34 | .071 | 87.98 | 13.28 | -0.54 | .37 | .16 | .72 |
| STAI State | | | | | | | | | | |
| | Own Phone | .92 | 33 | .013* | 42.28 | 10.40 | 0.35 | .38 | -.37 | .74 |
| | No Phone | .96 | 29 | .414 | 41.15 | 10.65 | -0.04 | .40 | -.74 | .79 |
| | Other Phone | .97 | 34 | .579 | 42.68 | 10.35 | 0.20 | .37 | .25 | .72 |
| MAQ | | | | | | | | | | |
| | Own Phone | .81 | 33 | .000* | 43.00 | 8.65 | -0.06 | .38 | -.97 | .74 |
| | No Phone | .84 | 29 | .000* | 42.10 | 8.13 | -0.22 | .42 | -.04 | .82 |
| | Other Phone | .84 | 34 | .000* | 44.25 | 9.24 | 0.28 | .37 | -.40 | .73 |
| HR2 Max | | | | | | | | | | |
| | Own Phone | .40 | 33 | .000* | 91.93 | 12.43 | 0.83 | .37 | 1.00 | .73 |
| | No Phone | .52 | 29 | .000* | 93.44 | 11.50 | 0.09 | .40 | .31 | .79 |
| | Other Phone | .55 | 34 | .000* | 91.12 | 13.83 | 0.75 | .37 | .35 | .72 |

| Measure | Condition | Shapiro-Wilk | | | *M* | *SD* | Skewness | | Kurtosis | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Statistic | *df* | *P* | | | Statistic | *SE* | Statistic | *SE* |
| HR3 Max | | | | | | | | | | |
| | Own Phone | .93 | 33 | .032* | 92.00 | 12.36 | 1.22 | .40 | 2.20 | .78 |
| | No Phone | .92 | 29 | .037* | 90.45 | 9.27 | -0.04 | .41 | -.94 | .80 |
| | Other Phone | .95 | 34 | .103 | 92.89 | 12.62 | 0.46 | .40 | .43 | .78 |
| ECRRS-M AVD | | | | | | | | | | |
| | Own Phone | .60 | 33 | .000* | 2.35 | 1.45 | 1.65 | .37 | 2.66 | .73 |
| | No Phone | .53 | 29 | .000* | 2.33 | 1.18 | 1.47 | .40 | 2.11 | .79 |
| | Other Phone | .64 | 34 | .000* | 2.17 | 1.28 | 1.55 | .37 | 2.12 | .72 |
| ECRRS-M ANX | | | | | | | | | | |
| | Own Phone | .83 | 33 | .000* | 1.43 | 1.10 | 2.68 | .37 | 6.54 | .73 |
| | No Phone | .85 | 29 | .001* | 1.47 | 1.00 | 2.49 | .40 | 6.42 | .79 |
| | Other Phone | .88 | 34 | .002* | 1.31 | 0.63 | 2.14 | .37 | 4.31 | .72 |
| ECRRS-D AVD | | | | | | | | | | |
| | Own Phone | .95 | 33 | .099 | 3.56 | 1.71 | 0.64 | .37 | -.21 | .73 |
| | No Phone | .87 | 29 | .002* | 3.32 | 1.41 | 0.62 | .40 | -.56 | .79 |
| | Other Phone | .92 | 34 | .017* | 3.08 | 1.43 | 0.37 | .37 | -.73 | .72 |
| ECRRS-D ANX | | | | | | | | | | |
| | Own Phone | .77 | 33 | .000* | 1.68 | 1.29 | 2.34 | .37 | 5.09 | .73 |
| | No Phone | .85 | 29 | .001* | 1.67 | 1.24 | 2.84 | .40 | 9.79 | .79 |
| | Other Phone | .75 | 34 | .000* | 1.41 | 0.76 | 1.96 | .37 | 2.70 | .72 |
| ECRRS-P AVD | | | | | | | | | | |
| | Own Phone | .80 | 33 | .000* | 1.83 | 0.88 | 1.55 | .37 | 2.22 | .73 |
| | No Phone | .73 | 29 | .000* | 2.29 | 1.21 | 0.76 | .41 | -.61 | .80 |
| | Other Phone | .86 | 34 | .000* | 1.87 | 0.77 | 1.21 | .37 | 1.81 | .72 |

| | | Shapiro-Wilk | | | | | Skewness | | Kurtosis | |
|---|---|---|---|---|---|---|---|---|---|---|
| Measure | Condition | Statistic | *df* | *p* | *M* | *SD* | Statistic | *SE* | Statistic | *SE* |
| ECRRS-P ANX | | | | | | | | | | |
| | Own Phone | .96 | 33 | .204 | 3.10 | 1.58 | 0.47 | .37 | -.67 | .73 |
| | No Phone | .96 | 29 | .382 | 2.59 | 1.52 | 0.75 | .41 | -.64 | .80 |
| | Other Phone | .96 | 34 | .272 | 2.60 | 1.43 | 0.71 | .37 | -.30 | .72 |
| ECRRS-F AVD | | | | | | | | | | |
| | Own Phone | .97 | 33 | .365 | 1.68 | 0.78 | 1.83 | .37 | 3.73 | .73 |
| | No Phone | .98 | 29 | .878 | 2.05 | 1.02 | 1.03 | .41 | .62 | .80 |
| | Other Phone | .98 | 34 | .767 | 1.86 | 1.03 | 1.60 | .37 | 2.05 | .72 |
| ECRRS-F ANX | | | | | | | | | | |
| | Own Phone | .94 | 33 | .070 | 1.83 | 0.98 | 1.82 | .37 | 4.86 | .73 |
| | No Phone | .96 | 29 | .305 | 1.90 | 1.24 | 1.77 | .41 | 3.25 | .80 |
| | Other Phone | .96 | 34 | .263 | 2.03 | 1.16 | 1.26 | .37 | 1.10 | .72 |

*Notes.* Significance level (*p*) was set to 0.05; * denotes violations of normality.

Table 6

Normality Statistics of the Outcome Variables after Square Root Transformation

| | | Shapiro-Wilk | | | | | Skewness | | Kurtosis | |
|---|---|---|---|---|---|---|---|---|---|---|
| Measure | Condition | Statistic | *df* | *p* | *M* | *SD* | Statistic | *SE* | Statistic | *SE* |
| SRAHP | | | | | | | | | | |
| | Own Phone | .93 | 33 | .031* | 9.51 | .72 | -.62 | .37 | -.39 | .73 |
| | No Phone | .95 | 29 | .223 | 9.00 | 1.00 | -.30 | .40 | -1.15 | .79 |
| | Other Phone | .94 | 34 | .070 | 9.35 | .73 | -.77 | .37 | .62 | .72 |

| | | Shapiro-Wilk | | | | | Skewness | | Kurtosis | |
|---|---|---|---|---|---|---|---|---|---|---|
| Measure | Condition | Statistic | *df* | *p* | *M* | *SD* | Statistic | *SE* | Statistic | *SE* |
| STAI State | | | | | | | | | | |
| | Own Phone | .97 | 33 | .586 | 6.45 | .80 | .08 | .38 | -.43 | .74 |
| | No Phone | .96 | 29 | .245 | 6.36 | .85 | -.33 | .40 | -.38 | .79 |
| | Other Phone | .97 | 34 | .342 | 6.48 | .80 | -.16 | .37 | .04 | .72 |
| MAQ | | | | | | | | | | |
| | Own Phone | .96 | 33 | .313 | 6.52 | .67 | -.21 | .38 | -.93 | .74 |
| | No Phone | .97 | 29 | .465 | 6.46 | .64 | -.50 | .42 | .23 | .82 |
| | Other Phone | .99 | 34 | .937 | 6.62 | .70 | .04 | .37 | -.42 | .73 |
| HR2 Max | | | | | | | | | | |
| | Own Phone | .96 | 33 | .199 | 9.57 | .64 | .63 | .37 | .57 | .73 |
| | No Phone | .98 | 29 | .730 | 9.65 | .60 | -.11 | .40 | .29 | .79 |
| | Other Phone | .96 | 34 | .220 | 9.52 | .71 | .58 | .37 | -.01 | .72 |
| HR3 Max | | | | | | | | | | |
| | Own Phone | .94 | 33 | .053 | 9.57 | .63 | .99 | .40 | 1.54 | .78 |
| | No Phone | .97 | 29 | .426 | 9.50 | .49 | -.12 | .41 | -.95 | .80 |
| | Other Phone | .98 | 34 | .875 | 9.62 | .65 | .25 | .40 | .25 | .78 |
| ECRRS-M AVD | | | | | | | | | | |
| | Own Phone | .89 | 33 | .004* | 1.47 | .42 | 1.05 | .37 | .79 | .73 |
| | No Phone | .90 | 29 | .007* | 1.49 | .35 | .98 | .40 | .57 | .79 |
| | Other Phone | .89 | 34 | .003* | 1.42 | .39 | 1.05 | .37 | .54 | .72 |
| ECRRS-M ANX | | | | | | | | | | |
| | Own Phone | .42 | 33 | .000* | 1.15 | .35 | 2.42 | .37 | 4.83 | .73 |
| | No Phone | .54 | 29 | .000* | 1.17 | .33 | 2.07 | .40 | 3.71 | .79 |
| | Other Phone | .56 | 34 | .000* | 1.12 | .24 | 1.87 | .37 | 2.59 | .72 |

| | | Shapiro-Wilk | | | | | Skewness | | Kurtosis | |
|---|---|---|---|---|---|---|---|---|---|---|
| Measure | Condition | Statistic | *df* | *p* | *M* | *SD* | Statistic | *SE* | Statistic | *SE* |
| ECRRS-D AVD | | | | | | | | | | |
| | Own Phone | .95 | 33 | .178 | 1.83 | .45 | .13 | .37 | -.52 | .73 |
| | No Phone | .96 | 29 | .288 | 1.78 | .38 | .29 | .40 | -.84 | .79 |
| | Other Phone | .97 | 34 | .377 | 1.70 | .42 | -.02 | .37 | -.92 | .72 |
| ECRRS-D ANX | | | | | | | | | | |
| | Own Phone | .66 | 33 | .000* | 1.23 | .40 | 1.91 | .37 | 2.94 | .73 |
| | No Phone | .62 | 29 | .000* | 1.23 | .38 | 2.02 | .40 | 4.57 | .79 |
| | Other Phone | .66 | 34 | .000* | 1.15 | .27 | 1.77 | .37 | 1.92 | .72 |
| ECRRS-P AVD | | | | | | | | | | |
| | Own Phone | .89 | 33 | .002* | 1.32 | .30 | 1.11 | .37 | .77 | .73 |
| | No Phone | .89 | 29 | .005* | 1.46 | .39 | .45 | .41 | -.97 | .80 |
| | Other Phone | .92 | 34 | .017* | 1.34 | .27 | .69 | .37 | .34 | .72 |
| ECRRS-P ANX | | | | | | | | | | |
| | Own Phone | .96 | 33 | .239 | 1.70 | .46 | .04 | .37 | -.93 | .73 |
| | No Phone | .89 | 29 | .006* | 1.54 | .46 | .43 | .41 | -1.10 | .80 |
| | Other Phone | .93 | 34 | .039* | 1.55 | .44 | .30 | .37 | -.93 | .72 |
| ECRRS-F AVD | | | | | | | | | | |
| | Own Phone | .84 | 33 | .000* | 1.27 | .27 | 1.32 | .37 | 1.69 | .73 |
| | No Phone | .89 | 29 | .007* | 1.39 | .34 | .60 | .41 | -.37 | .80 |
| | Other Phone | .81 | 34 | .000* | 1.32 | .34 | 1.19 | .37 | .72 | .72 |
| ECRRS-F ANX | | | | | | | | | | |
| | Own Phone | .86 | 33 | .000* | 1.31 | .33 | 1.07 | .37 | 1.34 | .73 |
| | No Phone | .78 | 29 | .000* | 1.32 | .40 | 1.20 | .41 | .96 | .80 |
| | Other Phone | .88 | 34 | .001* | 1.38 | .38 | .81 | .37 | -.12 | .72 |

*Notes.* Significance level (*p*) was set to 0.05; * denotes violations of normality