

Spring 4-27-2018

# The Effect of Smartphones on Anxiety: An Attachment Issue or Fear of Missing Out?

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The Effect of Smartphones on Anxiety: An Attachment Issue or Fear of Missing Out?  
by  
Kelly Mannion

A Thesis Submitted in Partial Fulfillment of the Requirements for the Master of Science in  
Experimental Psychology with a Concentration in Behavioral Science

In

The Department of Psychology  
Seton Hall University  
May, 2018

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SETON HALL UNIVERSITY  
College of Arts & Sciences

APPROVAL FOR SUCCESSFUL DEFENSE

Masters Candidate, Kelly Mannion, has successfully defended and made the required modifications to the text of the master's thesis for the M.S. during this spring Semester 2018.

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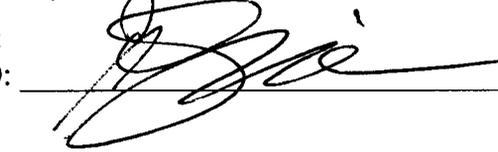
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## Acknowledgments

I would like to thank my thesis advisor, Dr. Susan Nolan, for all the help and support she has given me throughout the completion of my thesis. She never failed to make this project a priority and ensured I met every deadline, all the while providing constructive feedback each time. I can say with certainty that I have grown as both a writer and researcher during my time working with Dr. Nolan. I know this thesis would not have been possible without her continuous guidance during this process.

I would also like to thank my committee members, Dr. Paige Fisher and Dr. Andrew Simon. As my committee members, they have provided me with valuable feedback and insight that have helped me tremendously throughout this process. I am grateful to have had both of them as such supportive committee members.

I would also like to thank my fellow lab members, Stefano Lopez and Matthew McDevitt for their help in collecting data. This process went very smooth thanks to both of their efforts and contributions to the project.

Finally, I would like to thank my fellow graduate students and good friends at Seton Hall. Each of them has made a lasting impact on both me and on my experience here. They have been there for me every step of the way, and I don't know what I would have done without them.

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## Abstract

Previous research shows that college students tend to experience increased anxiety when they are separated from their smartphone. This anxiety has been suggested to be due to attachment, where college students have formed an attachment to their smartphone. Another explanation for this anxiety is the fear of missing out (FoMO), where college students experience worry when they cannot check in with their friends. No existing study to my knowledge has simultaneously examined the separate impact of attachment to phones and FoMO on anxiety levels, particularly during a stressful situation. The current study examines the separate and combined impacts of FoMO and attachment to phones on anxiety levels during a stressful situation. To induce anxiety, participants wrote a paragraph about a flaw of theirs and were told that they would be interviewed about this paragraph; however, the interview did not occur. Participants were assigned to two conditions – attachment, in which they were separated from their phone prior to the experiment, and FoMO, in which they either did or did not receive a phone call they were not able to answer. Participants' anxiety levels were measured via the STAI at the end of the experiment. Overall, the results suggest that both FoMO and attachment play a role in creating anxiety among smartphone users. Understanding how smartphones influence anxiety is important in determining how to prevent people from developing unhealthy relationships with this device.

## **Introduction**

Imagine walking into a food court on a college campus – students will be sitting with friends, eating, and chatting. However, more than likely, many will be sitting with their eyes glued to their smartphones. With the capabilities of smartphones growing, so is the amount of time spent on them (Pew Research Center, 2015). Although millions of users are enjoying this convenient technology, increasingly more studies are linking an overuse of the smartphone to anxiety. Researchers have proposed various explanations for this link to anxiety, two of which are examined in this study– attachment to the phone, and fear of missing out (FoMO). Research shows that college students have formed an attachment to their phone, seeing as they are with it almost all hours of the day (Konak, Gigler, Bereczky, and Miklosi, 2016; Cheever, Rosen, Carrier, and Chavez, 2014). Research also shows that college students utilize their smartphone to keep in constant contact with others and to avoid the experience called “fear of missing out” (FoMO; Przybylski, Murayama, DeHaan, & Gladwell, 2013; Rosen, Whaling, Rab, Carrier, & Cheever 2013b). Both scenarios seem to result in smartphone-related anxiety. This study sought to tease apart which of these two explanations is contributing to anxiety, or if it is a combination of both.

In the introduction to this thesis, I will provide statistics on smartphone use to exemplify the growing issue of smartphone overuse. Then, I will address some mental health consequences for this smartphone overuse, particularly anxiety. I will address whether smartphone use increases anxiety, and then whether separation from one’s smartphone increases anxiety. Specifically, first anxiety section will address how smartphone overuse is linked to higher overall

anxiety in smartphone users, whereas the second anxiety section will address how this overuse leads to dependency on the phone, such that separation from it increases anxiety.

Next, I will provide two additional possible consequences of smartphone overuse – “Nomophobia,” the fear of being without one’s phone, and smartphone addiction. Controversies of these consequences will be addressed. Finally, I will provide two potential explanations for the anxiety associated with smartphone use – attachment to the phone, and fear of missing out (FoMO).

### **Smartphone Statistics**

In the last decade, smartphones have taken over the mobile phone market (Yildirim & Correria, 2015). Of the existing 7.4 billion mobile phone subscriptions worldwide, 3.4 billion are smartphone subscriptions (Ericcson, 2016). As of 2015, 68% of Americans owned a smartphone, which has increased 35% since 2011; these numbers are higher among young people – 86% of those aged 18-29 and 83% of those aged 30-49 own a smartphone (Pew Research Center, 2015). In many countries, there are more mobile phone subscriptions than the country’s population because some people own multiple devices for different purposes (Ericcson, 2016). Research shows that by 2021, there will be 9 billion mobile phone subscriptions worldwide, 6.3 billion of these being smartphone subscriptions (Ericcson, 2016).

Not only are smartphones popular, but those who own them use them often. Research shows that Americans spend an average of 4.7 hours a day on their smartphone (Informate Mobile Intelligence, 2015). Rosen, Whaling, Rab, Carrier, and Cheever (2013) found that young adults check in with their smartphone more than once every hour. Of 7,000 U.S. participants who completed an online survey about smartphone use, 80% reported that they reached for their phone within 15 minutes of when they wake up each day(Levitas, 2013). About 79% of

smartphone owners reported having their smartphone with them for all but two of their waking hours. In addition, 25% of smartphone owners cannot even recall the last time their phone was not at least within earshot of them (Levitas, 2013). These numbers have more than likely increased since 2013 with smartphones becoming increasingly more popular.

Not only do smartphone users constantly have their device on hand, they are using them at every given opportunity. One study conducted a survey of 367 students and found that by that 95% of them had an account on some form of social networking site (Darcin, Kose, Onur, Nurmedov, Yılmaz & Dilbaz, 2016). Of this sample, 41% reported using their smartphone mainly to access the social media accounts. About 75% reported using their phone while walking, 12% while driving, more than 50% during class or meetings, and about 30% during movies or theatre performances (Darcin et al., 2016).

## **Mental Health Consequences**

### **Depression**

Frequency of smartphone use has been linked to mental health consequences, including depression. Researchers divided university students into three groups based on their overall smartphone usage – a no-use group, a low-use group, and a high-use group (Demirci, Akgonul, and Akpınar, 2015). Participants in the high-use group tended to have significantly higher depression level than participants in the low/no-use group. This finding suggests the possibility that university students who engage in maladaptive phone behavior tend to experience higher rates of depression. An additional study found strong, positive correlations among maladaptive mobile phone use, maladaptive internet use, depression, and anxiety in university students (Panova and Lleras, 2016). The results indicate that problematic overuse of smartphones in college-aged students is associated with higher levels of depression.

The overuse of smartphones in general may not be the only factor contributing to depression – there may be specific behaviors college students engage in when using the smartphone that contribute to depression. In the same study, the researchers singled out experiences with mobile phones specifically during periods of either escapism for boredom, or escapism for avoidance coping. Escapism for boredom refers to engaging in behaviors or activities to avoid feelings of boredom when stimulating activities are unavailable. Escapism for avoidance coping refers to the act of avoiding and ignoring a situation that is currently causing negative emotions (Panova & Lleras, 2016). Results showed that when participants used their phone to escape boredom, there were no correlations with depression; however, when participants used their phone to avoidance cope, there were strong positive correlations with depression levels (Panova & Lleras, 2016). This finding indicates that it may not be the act of using a mobile phone that affects depression levels, but perhaps it is the reason for the use of the phone. College students who use their phone because they are bored do not, on average, experience the same depression levels as those who are using their phone to cope. Having constant access to a smartphone makes avoiding negative life experiences that much easier; college students are equipped with an avoidance object constantly.

### **Smartphone Presence Increases Anxiety**

Research also shows that smartphone overuse correlates with higher levels of anxiety, where smartphone use was a predictor of anxiety symptoms. In a study by Demirci and colleagues (2015), the correlation between high/low smartphone use and depression was similar for anxiety. University students in the high smartphone use group tended to have higher levels of anxiety than those in the low smartphone use group. This finding indicates the possibility that an overall high engagement with smartphone technology can increase one's anxiety symptoms.

Another explanation for this finding could be that those with higher anxiety levels are engaging with their smartphone more often because it eases their anxiety or distracts them from it.

However, Demirci and colleagues (2015) conducted a regression analysis to determine predictors of anxiety symptoms. They found that smartphone overuse was a predictor of anxiety symptoms. This finding indicates that using the device excessively can predict one's anxiety levels as opposed to anxiety predicting one's severity of smartphone use.

The behaviors college students engage in with their smartphones has also been linked to anxiety symptoms. Panova and Lleras (2016) found that college students who use their smartphone excessively tend to experience higher levels of anxiety. When the researchers singled out the escapism for boredom/avoidance coping, the results were the same for anxiety as they were for depression – using the mobile phone to escape resulted in higher anxiety during avoidance coping, but not for boredom (Panova & Lleras, 2016). This finding indicates that the problematic coping strategies developed by college students are not only problematic for depression, but also anxiety, especially since the two go hand in hand in many cases.

### **Smartphone Presence Reduces Anxiety/Absence Induces**

The previous section explored the possibility that excessive smartphone use is both associated with and predicts anxiety symptoms in college students. This type of anxiety is trait anxiety, which is associated with general feelings of anxiety that is felt by individuals overall. Higher trait anxiety is associated with a greater likelihood of experiencing anxiety in a stressful situation (Spielberger, Gorsuch, and Lushene, 1983). The current section will focus on state anxiety, which is associated with feelings related to anxiety in the present moment when faced with a stressful situation (Spielberger et al., 1983).

Because of the overuse of smartphones in college students discussed in the prior sections, dependence on the smartphone may develop (Panova and Lleras, 2016). Being away from an object in which one is dependent can increase feelings of anxiety as well. Panova and Lleras (2016) exemplify this point in their second study. The researchers sought to explore whether college students view the smartphone as a security blanket object, helping them fight off anxiety symptoms in stressful situations. They randomly assigned participants to one of three groups – mobile phone present, mobile phone absent, and mobile phone absent but computer game present. The researchers instructed participants to write a paragraph about a flaw in themselves; participants were told that two graduate students would later interview them about their paragraph. The graduate students did not actually conduct the interview– the participants were told this with the intention of inducing anxiety.

The specific point of interest was the ten-minute waiting period participants had while they believed the graduate students read over their paragraphs before the interview. The researchers instructed participants to wait alone while the graduate students read over their paragraph for ten minutes, but each group had different instructions. The group who did not have their mobile phone had to wait there without distractors. Participants in the group who had their mobile phones were permitted to engage with their phones any way they liked during the wait time. The group without their mobile phone but with a computer game was permitted to play a specified computer game that was present in the room they were in. The researchers measured the participants' state anxiety levels at the beginning of the study, before the wait period, and after the wait period.

Results showed that participants in the mobile-phone-present group had, on average, lower overall anxiety scores than those in the mobile phone absent groups (Panova & Lleras,

2016). The overall anxiety score was computed by averaging the anxiety scores from the three anxiety rating periods. This finding indicates that while in a stressful situation, the presence of and ability to utilize a smartphone can reduce anxiety. The smartphone might act as a security blanket and as a protector from further stress. Similar to the results of the authors' first study, there is a connection between the smartphone and coping strategies. Participants who used their smartphone to cope with negative life experiences tended to have higher depression and anxiety levels. In the second study, participants who had access to their phones may have used them to cope with and to avoid the anxiety they felt in anticipation of the interview. Although participants in the mobile phone present group had the lowest average state anxiety scores, engaging in these behaviors in daily life may result in higher anxiety experienced overall, such as higher trait anxiety, as established in the previous section.

An additional study sought to measure anxiety in terms of phone presence and absence. University students were instructed to either keep their phone with them, but turned off and out of sight, or to have it taken from them completely (Cheever, Rosen, Carrier, and Chavez, 2014). Participants sat quietly in an auditorium for an hour. The researchers measured their anxiety using the State/Trait Anxiety Inventory (STAI) every twenty minutes, a total of three times. At the end of the study, participants responded to a survey assessing the average amount of time participants spend on their smartphone. The researchers used this data to define participants as low smartphone users (about 4 hours on phone per day), moderate smartphone users (about 11 hours on phone per day), and heavy smartphone users (about 17 hours on phone per day). Results showed that participants in the mobile-phone-absent group who were heavy smartphone users had, on average, significantly higher anxiety scores than both the lower smartphone users in their group and the mobile-phone-present group. Overall, participants in the mobile-phone-absent

group reported feeling significantly more anxiety, on average, as time went on than those in the mobile-phone-present group. The anxiety scores of the participants in the mobile-phone-absent group steadily increased as each STAI was administered. These results support the findings that the absence of a smartphone can increase anxiety in college students who are especially dependent upon them.

The previous study discussed provides insight into the emotional consequences of being without the smartphone. However, this study did not consider the emotional consequences of being without the smartphone and being directly reminded of this absence. Clayton, Leshner, and Almond (2015) studied smartphone separation with an additional component - the inability to answer the ringing phone. The researcher instructed participants to give the researcher their smartphone, supposedly because a Bluetooth signal on their smartphone would interfere with the researchers' heartrate/blood pressure measuring equipment. The researchers moved the participants' smartphones further away from the equipment, where it was still in sight but out of their reach. Participants were given various cognitive tasks to perform for the experiment. The researchers were able to switch on the participants' phone ringers and call participants during the experiment; thus, participants believed that someone was calling them, but they were unable to answer or access their phone. This manipulation resulted in increased heart rate and blood pressure and self-reported feelings of anxiety and unpleasantness (Clayton et al., 2015). These results support the above studies in which the inability to access the smartphone increases anxiety, but it introduces a new paradigm – inability to answer the ringing phone. There are different explanations for the participants' increased levels of anxiety when they were unable to answer their phone, which will be discussed at length later.

## **Nomophobia**

New research may shed some light as to why the inability to check-in with smartphones tends to increase anxiety. There has been growing research into a type of phobia related to the mobile phone, referred to as Nomophobia, with “nomo” being short for “no mobile phone.” Nomophobia is defined as the anxiety and discomfort associated with being away from a mobile device or computer, and with being out of touch with technology (King et al., 2013). Although King and colleagues include computers in their definition of technology, computers are mostly relevant as a replacement for phones. Those with nomophobia seek out an actual computer when a smartphone is unavailable. Most mobile phones are smartphones now, as indicated by the above statistics. Because smartphone technology is still considered new, the idea of nomophobia is quite recent.

To develop a better understanding nomophobia, King and colleagues (2013) conducted a case study of a thirty-year-old man diagnosed with social phobia. This man reported staying out of public places as much as possible to avoid contact with others. When he discovered he could engage with others on his computer and his phone, he began solely communicating with others through this technology. This man had been diagnosed with social phobia prior to the case study and was believed to have nomophobia after the case study (King et al., 2013). He felt as if his devices were a vital part of his identity. Without them, he could not engage with others in a meaningful way. The authors suggest that those with social phobia can feel as if they are overcoming their social phobia using mobile phones and computers. These devices provide an outlet and a comfort zone in which those with social phobia can operate. However, being without the technology only worsens the symptoms. The authors suggest therapy as a solution to treat both the social phobia and the nomophobia. The man in the present study began therapy and slowly stopped using his devices as often as he was which alleviated his overall symptoms. It is

possible that the man's symptoms were alleviated for other reasons unrelated to using the devices less. Perhaps the therapy sessions helped decrease his symptoms and his decline in device use was unrelated. However, the authors believe this therapy was impactful for both his nomophobia and social phobia (King et al., 2013).

In another study related to nomophobia, researchers conducted interviews on university students based on their smartphone use (Yildirim & Correia, 2015). The researchers interviewed students who were considered heavy smartphone users with a smartphone dependency. Questions included "what do you use your smartphone for?" and "would you feel anxious if you could not access your smartphone?" The interview responses indicate four themes related to nomophobia – not being able to communicate, losing connectedness, not being able to access information, and giving up convenience.

Not being able to communicate relates to feelings of not being able to use instant communication services on the device. Participants reported feelings of anxiety when they ran out of minutes or data on their device because it prevented them from being in constant contact with others. Losing connectedness relates to feelings of the inability to access social media and to stay up to date with notifications, online identity, and friendships. Participants reported using social media and staying up to date with their notifications as vital to their everyday lives. Viewing notifications was considered the way to stay connected to their online identity.

Not being able to access information relates to feelings of not being able to retrieve information on the device, specifically finding the answer to questions through internet searches. Participants reported that it was important to them to use their smartphones to find an answer to a question right away. Not having this instant information caused discomfort in participants. Giving up convenience relates to feelings of not being able to utilize the convenient features of

the smartphone in general. Participants reported going out of their way to ensure their smartphone was fully charged, which brought them peace of mind. When the device died, that peace of mind vanished, like forgetting a wallet or car keys at home.

Based on the results, the authors define nomophobia as “The fear of not being able to use a smartphone or a mobile phone and/or the services it offers” (Yildirim & Correia, 2015, p. 136). They consider nomophobia to be a situational phobia in which those affected would have an irrational fear of not having their smartphone or not being able to use the smartphone features. If those affected are without their phones or the use of them, they are likely to feel great distress and anxiety. The four specific components of nomophobia are an important insight into the potential explanations for anxiety regarding smartphone use and separation.

### **Smartphone Addiction**

There has been considerable controversy about identifying the negative experiences associated with phone separation as smartphone addiction as defined by the DSM (Lin et al., 2016). To date, smartphone addiction is not classified in the DSM; however, research has found similarities to the experiences associated with phone separation and addiction as defined by the DSM (Lin et al., 2016). Smartphone addiction does not have one accepted definition; however, Lin and colleagues (2016) define smartphone addiction as an uncontrollable desire to stay connected with the smartphone, despite the negative impacts of doing so. Increasingly more studies have examined this link between smartphone use/separation and addictive feelings. One such study was conducted by Darcin and colleagues (2016), where participants were given the Smartphone Addiction Scale, the UCLA Loneliness Scale, and the Brief Social Phobia Scale. The researchers also gave participants questionnaires pertaining to smartphone use. Results showed that participants who used their smartphones primarily to access social networking sites

were at greater risk for smartphone addiction than were those who used their smartphones primarily to surf the internet (Darcin et al., 2016). Participants who already had a form of social anxiety were at a high risk for smartphone addiction as well. Those with social anxiety tended to use their smartphone to avoid in-person interactions. It is possible that those with social anxiety use their smartphone excessively for that reason. On the other hand, perhaps smartphone over-users who have developed a smartphone addiction are showing increased signs of social anxiety due to their limited real-life contact. This point supports the idea Panova and Lleras (2016) suggested that smartphone use tends to be for a form of communication that replaces in-person communication. Darcin and colleagues (2016) provide evidence for the risk of this type of behavior.

The previous study discussed provides insight into the relationship between smartphone overuse and addictive qualities. García-Oliva and Piqueras (2016) provide an additional example of smartphone use leading to smartphone addiction. The researchers recruited participants aged 12-18 and surveyed them regarding their mobile phone use, internet use, video game playing, and experiential avoidance. The researchers define experiential avoidance as a strategy to escape from negative stimuli such as thoughts, feelings, or sensations that generate strong distress (García-Oliva & Piqueras, 2016). Results showed that when the participants used their smartphones for experiential avoidance reasons, their risk for smartphone addiction increased (García-Oliva & Piqueras, 2016). This supports the results of Panova and Lleras (2016) concerning escapism for avoidance coping. Panova and Lleras (2016) found that individuals who avoidance cope tend to have higher levels of depression and anxiety. The present study found correlations between this sort of coping strategy and smartphone addiction. Both studies stress

the important of *why* college students use their smartphone, not just the act, and what the negative mental health consequences may be when done in excess.

### **Attachment Theory**

John Bowlby was a psychoanalyst who believed children formed attachments to their caregivers, usually their mothers, beginning at birth. Bowlby (1969) defined attachment as an enduring emotional bond that connects one person to another. The reasoning for the attachment is that the infant needed someone to survive, thus latching onto his or her caregiver for survival. This attachment was also seen as vital to the child's development, not only physically to survive, but mentally and emotionally as well. Having the ability to form an emotional and physical attachment to a caregiver at a young age is crucial.

During a study conducted by Bowlby and James Robertson (1952), children who were separated from their mothers expressed extreme distress and discomfort as compared to those not separated. The children were in the presence of another adult, a "fake" caregiver who fed them still, and yet the children still felt distressed. This was due to the children's attachment to their mothers, not just for survival, but also because of the emotional aspect of the attachment definition. Having a nurturing caregiver during the first two years of life is essential to development, according to Bowlby (1969). This caregiver acts as an attachment figure, which provides safety and comfort. When separated from this attachment figure, discomfort could ensue.

People also can develop attachments to objects. When children are separated from their mothers, they are distressed and unsure of their surroundings. Bowlby (1969) suggested that when the primary caregiver was not available to the child, the child could form another sort of attachment to someone or something else. This form of attachment was not seen as crucial as the

infant-to-mother/caregiver attachment, but it would suffice in the moment. Keefer, Landau, and Sullivan (2014) suggested that children tend to form attachments to different toys, stuffed animals, blankets, etc. which provide them with a sense of safety in unfamiliar surroundings. These objects have the same emotional benefits as a caregiver or mother. This is especially essential when the mother or caregiver cannot be there, for example, at school. Being in close proximity to the safety object is useful for the child to exit their comfort zone and to develop.

Keefer and colleagues (2014) suggest that children are not the only ones able to form attachments to objects; adults are able to as well. In a review, they suggested that adults can form attachments to religious practices, media figures or fictional characters, pets, certain places or destinations, and various objects. For example, an individual may form an attachment to a pet dog in which the individual seeks out the dog in times of distress or other negative emotions, and may pet the dog, take it for a walk, etc. The dog provides emotional relief and comfort for the individual. These attachment objects are stress-relieving for adults and can provide them with comfort in times of need. Winnicott (1971) stated that objects are easy attachment targets because they are controllable. Objects are reliable and cannot let humans down in the way that other humans can. They are predictable, which is helpful when the outside world is quite unpredictable to humans.

One particular object that college students might utilize as an attachment object is the smartphone. In a study done by Konak, Gigler, Bereczky, and Miklosi (2016), participants aged 19-25 filled out various questionnaires that touched upon their smartphone use and attachment to phone. The attachment to phone questionnaire included items assessing proximity seeking or separation anxiety regarding the smartphone. Results showed that participants tend to ensure they are within close proximity of their phones and feel a great deal of distress when they are

separated from them. These two points are important characteristics of attachment theory – motivation to be with the attachment figure/object, and anxiety and stress when the attachment figure/object is absent. Infants/children constantly seek proximity to their caregiver and become distressed upon separation. This study provides insight into the connection between individuals and their smartphones and how this connection displays similar characteristics to attachment theory.

It also is possible, however, that the attachment to the phone is not akin to attachment as psychology theorists define it with respect to humans. For example, it is possible that participants felt a desire to stay within close proximity of their smartphones because they view it as a way of communicating with others. The smartphone's primary use is communication, so it would make sense for participants to feel this anxiety upon separation because of the inability to connect, not attachment. The researchers address this limitation by conducting a principal components analysis on the attachment to phone questionnaire. Two of the main components regarding phone attachment included the need to be near the smartphone and stress upon separation (Proximity Seeking) and then the need to be in contact with people via the phone (Need for Contact). Results of the principal components analysis showed that there are significant differences between the above two components, suggesting the difference between feeling attached to the phone as an object, and feeling attached to the phone to facilitate relationships. In other words, it appeared that people were attached to their phones as objects, not as communication devices. The attachment to the smartphone was found to be independent of the need for contact variable and the preference of mobile communication in uneasy social situations variable.

An additional study found similar results when participants were without their phones. Cheever and colleagues (2014) found that participants who were separated from their phones

experienced a great deal of anxiety, especially as time went on. The researchers suggest this is due to the phone as an attachment object. Taking the phone away induces anxiety because we rely on our phones for communication, entertainment, information, and to stay connected to loved ones and acquaintances (Cheever et al., 2014). However, the participants who were able to keep their phones with them but could not use it had significantly lower anxiety levels than those without their phones. This suggests that our phone reliance is not necessarily about communication and connection, but it is an external object of attachment. These results support the research done by Konak and colleagues (2016), where participants in both studies viewed their smartphone as more of an object of safety rather than an object of communication.

The combined results of the studies mentioned in this section suggest that college students may have formed attachments to their smartphones, where separation increases anxiety, and this attachment is similar to attachment seen in attachment theory with infants and caregivers. However, this is only a potential explanation for the heightened anxiety experienced upon separation. Bowlby (1969) includes an emotional component of attachment between infant and caregiver, something that is not entirely possible in the same way for an individual and his/her smartphone. However, research has found that adults can form attachments and these attachments can be to objects (Winnicott, 1971). This type of attachment still may not be parallel to an infant to caregiver attachment. Further, there is the possibility that anxiety upon separation from the phone results for other reasons that are unrelated to attachment. Regardless, it has been exemplified in the prior research that anxiety is increased when the smartphone is unavailable. Attachment to the phone and attachment theory serve as potential explanations for this anxiety and contribute to the literature and aim to continue attempting to answer the overall question of why smartphones increase anxiety.

## **Fear of Missing Out**

Another explanation for why college students become anxious when their phone is unavailable is fear of missing out (FoMO). FoMO is defined as “The fears, worries, and anxieties people may have in relation to being in (or out of) touch with the events, experiences, and conversations happening across their extended social circles” (Przybylski, Murayama, DeHaan, & Gladwell, 2013, p. 1842). Individuals may experience feelings of FoMO when they are aware of their friends engaging in social events in which the individual is not involved with or included in. These feelings of FoMO can emerge when individuals are not able to speak with their friends or be actively involved in their social circle. University students completed surveys regarding fear of missing out, smartphone habits, and social media usage (Przybylski et al., 2013). Results showed that college students who scored higher in FoMO tend to use social media more often. Those high in FoMO tend to go on Facebook more often, including when they first wake up, during meals, right before bed, and during class lectures. Those higher in FoMO also tend to check text messages during driving more often than those low in FoMO.

The rationale behind college students increased desire to check social media accounts is because they feel their peers are engaging in rewarding experiences or activities without them. Being in constant connection with social media allows the user to feel as if they are involved by commenting, liking, sharing etc. the various posts from their peers. These college students have a desire to connect to what is going on in their social circles. The desire becomes strong enough that these college students check their accounts even when doing important life activities – eating at the dinner table, sitting in class lecture, and even while driving. Their FoMO results in their manners, attention, and safety being at risk.

Not only does the need to be constantly connected compromise one's safety, it can also stimulate one's anxiety. When researchers separated participants from their ringing iPhones and instructed them to complete various cognitive tasks, participants' heart rate and self-reported anxiety increased (Clayton et al., 2015). The researchers suggest this is due in part to FoMO, because the participants knew someone was trying to reach them but were unable to answer. This can induce feelings of fear of missing out, especially when the participants did not know who was calling them or why. The researchers did not directly measure FoMO with a preexisting FoMO measure; however, the researchers believe the incoming call induced feelings of FoMO because of prior research on the topic. It is still possible, however, that this incoming call did not induce FoMO in participants, and their heightened anxiety was a result of the surprise of hearing their phone ring, or something else. The researchers only suggest a potential explanation for this anxiety.

Research also has been done to further explore the specific actions college students engage in on their phone and the consequences when unable to do so. Rosen and colleagues (2013) administered surveys to participants (ages 18-73) based on their smartphone use. Participants reported feeling anxiety and discomfort when they thought of a time they were unable to check their text messages and Facebook pages (Rosen et al., 2013). These results suggest the possibility that text messaging and social media applications are an additional way in which FoMO can be induced. The younger generation of this study, (ages 19-25) reported the highest anxiety when unable to check various aspects of their smartphones. This can indicate that FoMO affects the younger generation more than later generations due to this younger generation, referred to as the iGeneration, being the most active smartphone users and the first generation to grow up with this technology.

Anxiety is not the only mental health concern when college students experience FoMO – depression can be stimulated as well. Over 300 university students completed online surveys regarding FoMO, time spent on social media, and depressive symptoms (Baker et al., 2016). Results showed that FoMO positively correlated with time spent on social media. FoMO also positively correlated with depressive symptoms. This finding indicates that the more FoMO a person has, the more time they might seek out on social media sites in order to be in touch with others' activities. This could also indicate that those who spend a lot of time on social media are developing more FoMO, which in turn causes them to spend more time on the sites. As for depression, those with higher FoMO may be at a higher risk for depression. On the other hand, those with more depressive symptoms are more likely to report feelings of FoMO because of various aspects of their depressive symptoms.

While controlling for FoMO in the model, time spent on social media and depressive symptoms were no longer significantly correlated. This indicates that FoMO may have driven the relationship between depressive symptoms and time spent on social media. Perhaps when college students access social media sites but are not doing so because of FoMO, they are not at risk for depression. When college students seek out social media because they are experiencing FoMO, they may be at risk for depression. It is not just using social media that correlated with depressive symptoms; it is the fear of missing out that is resulting in these symptoms. Social media are just tools to access the emotions associated with FoMO.

### **The Current Study**

The goal of the present study was to expand the existing research on smartphone use, specifically while in a stressful situation. Some prior studies have found that participants separated from their smartphones experienced increased anxiety compared to those not

separated, potentially due to attachment theory. However, other studies, though limited, have found that participants who could hear their phone ringing but could not answer experienced increased anxiety compared to those unable to hear the ring, potentially due to FoMO. Although some studies have considered the smartphone as an attachment object and other studies as a FoMO inducer, to my knowledge, these two views have never been studied together in a single study to determine to what degree each contributes to anxiety. In addition, no existing study to my knowledge has studied the combined impact of smartphone separation and FoMO on anxiety levels, specifically during a stressful situation.

I manipulated phone presence (present/absent) and phone ringing (ringing/silent) in the current study. Phone presence was used to manipulate attachment to the phone and was defined as whether participants are instructed to keep their phone with them, or to give it to the researcher. Phone ringing was used to manipulate FoMO and was defined as whether participants receive a phone call from the researcher during the experiment. Participants were randomly assigned to one of the two levels of both independent variables, resulting in four groups, where two of the groups had their phones with them, and the other two groups did not. Participants in the first group turned their phones to airplane mode per the researcher's instructions and gave their phone to the researcher who locked the phone in a box within the experiment room. Participants in the second group turned their phones to airplane mode as well but were able to keep their phones with them. Participants in the third group were able to keep their phones with them and left them as is. Finally, participants in the fourth group gave their phone to the researcher who inconspicuously turned the phone ringer on so participants in this group could hear a later incoming call.

**Phone Presence**

		<b>Present</b>	<b>Absent</b>
<b>Phone Ringing</b>	<b>Ringing</b>	Present/Ringing	Absent/Ringing
	<b>Silent</b>	Present/Silent	Absent/Silent

*Figure 1.* Diagram representing each condition of the present study.

Considering past research, I had two hypotheses. The first hypothesis was that, on average, participants separated from their phones will have higher anxiety than those not separated after the wait period. It is likely that both groups who are separated from their phones will experience higher anxiety than both groups able to keep their phone because of attachment theory. College students have likely formed an attachment to their phone, where separation from

this device results in heightened anxiety. All participants should feel a sense of anxiety due to the anxiety induction, but only half the groups get to keep their comfort object with them.

The second hypothesis was that, on average, participants who receive a phone call and hear/see their phone ringing will have higher anxiety than those who do not. Participants who are aware someone is contacting them and cannot answer are likely to experience heightened anxiety due to FoMO. These participants will either see someone calling them or will hear their phone ringing, indicating someone is calling them, but neither group will be able to answer. The incoming call will bring participants' attention to their phone, where thoughts of someone trying to contact them will likely lead to FoMO.

## **Method**

### **Participants**

To achieve a power level of 0.80 with an effect size of 0.25 and an alpha of 0.05, 128 participants were needed. This was determined by an a priori power analysis run using G\*Power (Faul, Erdfelder, Lang, & Buchner, 2007). The 143 students in the study were recruited from the Seton Hall Psychology Department participant pool. Prior to data collection, we determined that participants would be excluded from analysis who do not have their phone with them, are unaware of the incoming call, or are suspicious of the incoming call being from the researcher. Of the 143 participants, 10 were dropped because they did not hear or see their phone ring during the wait period or their phone was off. Three participants were dropped because they were suspicious of the incoming phone call being from the researcher. The remaining two participants were dropped because they did homework during the wait period. This leaves 128 participants for analysis.

About half of participants were in their sophomore year of college (45%), with 39% freshman, 9% juniors and 7% seniors. The study consisted mostly of women (73%). The sample was 52% white, 13% Asian, 13% Hispanic, and 12% African American, with the remaining 10% listing multiple ethnicities. All students received class credit for their participation. All participants gave informed consent in accordance with the Institutional Review Board approval. In addition, each participant was debriefed at the end of the study.

### **Materials**

**Speilberger State-Trait Anxiety Inventory (STAI).** The Speilberger State-Trait Anxiety Inventory, Form Y (STAI-Y) (Speilberger et al., 1983) was used to measure the anxiety of participants during the experiment. Only the State subscale was used to measure the state

anxiety of participants. The STAI-Y state is composed of 20 questions rated on a scale from 1-4, with higher scores indicating higher state anxiety. The STAI-Y state test-retest reliability has been reported to range from 0.40 to 0.54 (Spielberger et al., 1970). This measure has good internal consistency with Cronbach's alphas of 0.83 to 0.94 in previous research (Gaudry et al., 1975), and 0.90 in the current study.

**Young Adult Attachment to Phone Scale (YAPS)** The Young Adult Attachment to Phone Scale (YAPS) (Trub & Barbot, 2016) was administered at the end of the study to measure participants' attachment to their phones. The YAPS consists of two subscales – Refuge and Burden. Refuge refers to the idea that the phone is a refuge in which being with the phone is calming and separation causes anxiety. Burden refers to the idea that the phone is burdensome, where being with the phone is distracting and being without it provides relief. Both YAPS scales are scored on a continuum, in which an individual taking the YAPS will have a score (3-15) for each subscale. The Refuge subscale has good internal consistency in previous research (Cronbach's Alpha = 0.82). The Burden subscale has acceptable internal consistency in previous research (Cronbach's Alpha = 0.72) (Trub and Barbot, 2016). To assess convergent validity, Trub and Barbot (2016) found that the Refuge scale was positively correlated with a compulsion and withdrawal scale of phone addiction ( $r = 0.55$ ), whereas the Burden scale was negatively correlated ( $r = -0.37$ ). Divergent validity was demonstrated by there being no correlation between both YAPS scales and attachment avoidance ( $r = 0.07$ ,  $p < 0.05$ ). Coefficient alpha of the Refuge subscale for the current study was  $\alpha = 0.79$ . Coefficient alpha of the Burden subscale for the current study was  $\alpha = 0.77$ . In the current study, attachment style was used as a covariate.

**Media and Technology Usage and Attitudes Scale.** The Media and Technology Usage and Attitudes Scale (Rosen et al., 2013) was administered at the end of the study to measure

participants' interactions with their mobile phones. I used five out of the eleven subscales, including Smartphone Usage, General Social Media Usage, Internet Searching, Phone Calling, and Texting. The subscales included in the measure have good internal consistency in previous research, with Cronbach's alphas ranging from 0.71 to 0.97 (Rosen et al., 2013). Coefficient alpha for the current study was  $\alpha = 0.92$ . In the current study, daily phone usage was used as a covariate.

**Demographics Form.** Each participant filled out a demographics form. The demographics form consisted of information such as gender, ethnicity, year in school, email address, and phone number. These data provided a better understanding of the sample population. More importantly, this form provided us with the participant's phone number, which was vital to complete the experiment for those in the conditions in which calling the participant was needed. The phone numbers and email addresses were not associated with participant data.

### **Design and Procedure**

Participants filled out an informed consent form and then a demographics questionnaire. Participants were randomly assigned to one of two levels of the two independent variables, resulting in four groups – Absent Silent, Present Silent, Present Ringing, and Absent Ringing. Participants in the Absent Silent group were asked to turn their phones to airplane mode, and to allow the researcher to lock the phone in a box within the room during the experiment. The researcher watched to ensure these participants switched their phone to airplane mode and locked the phone in the box. The researcher exited the room to retrieve the lock box, and then locked the phone in the box. The lock box remained in the room with the participants, but out of sight and reach. Locking the phone in the box was done in hopes of removing the attachment object from

the participant, inducing potential feelings of anxiety, as exemplified in prior studies discussed in the Introduction.

Participants in the Present Silent group were asked to turn their phone to airplane mode, to ensure their inability to use the internet or communicate with others. The researcher watched to ensure participants turn their phone to airplane mode. The researcher then asked the participants to place their phone on the desk in which the participant will be sitting, keeping the phone in view. Keeping the phone in view was vital for keeping conditions similar, seeing as participants in the Present Ringing group would later receive a phone call in which they would need to have their phone in view. Participants in the Present Silent group did not receive said phone call, but their phone was placed in a similar fashion to keep conditions comparable.

Participants in the Present Ringing group were told they could bring their phone but to please wait until the experiment is over to answer any phone calls or texts. The researcher asked participants to place their phone on the desk in which the participant was sitting, also keeping the phone in view for reasons described above. Later, participants would receive a phone call, as described below. Participants were asked to wait until the completion of the experiment to answer texts or calls to ensure they were not engaging with others, and we wanted to control for the potential confound of one participant texting the entire time, whereas another participant not using the phone at all.

Participants in the Absent Ringing group were asked to leave their phone with the researcher, which was locked in a box in the room during the experiment. The researcher took the participant's phone and exited the room to retrieve the lock box. While retrieving the box, the researcher first ensured the participant's phone was on. Then, the researcher disabled silence mode on the device in one of two ways. If the participant had an iPhone, silent mode was

disabled by flipping the on/off switch located on the left side of the iPhone. If the participant had an android phone, silent mode was disabled by holding down the power button and pressing the “disable silent mode” option when the menu popped up. This was done discreetly with the intention of the participant not noticing. The researcher then locked the phone inside the box and put the box out of sight on a desk within the room. Disabling silence mode was done to ensure participants would hear the later incoming call.

The researcher then instructed participants that they have five minutes to write a paragraph about a flaw in themselves that particularly bothers them. They were then told that two psychology graduate students at Seton Hall would read this paragraph and interview the participant on the paragraph as part of the graduate students’ training. However, the paragraph was not actually read nor did an interview take place – this was meant to induce anxiety, as exemplified in prior studies (Panova & Lleras, 2016). The researcher set a timer for five minutes and left the room.

After five minutes, the researcher reentered the room and took the paragraph from the participant, reminding them that their paragraph is being taken to the graduate students to read. The researcher informed the participants that the graduate students need ten minutes to assess the paragraph before interviewing the participant. At this point, participants were under the impression that their paragraph was being taken to the graduate students. As stated earlier, this was done with the intention of inducing anxiety in the participants. The researcher instructed participants to wait quietly while their paragraph is assessed.

Within two minutes of the ten-minute waiting period for the Present Ringing group, the researcher called the participant’s cell phone number, which was voluntarily given via the demographics form. It was not necessary to disable silent mode for this group because the

participants' phones were already sitting on their desk in their vision and within their reach. Because we instructed participants not to answer their phone during the experiment, the participant saw an incoming call but was not able to answer. This was done to see if participants' inability to answer their phone would increase their already induced anxiety from the upcoming interview.

Within two minutes of the ten-minute waiting period for the Absent Ringing group, the researcher called the participant's cell phone number. Because the researcher disabled silent mode earlier in the experiment, the participant heard the phone call during their waiting period. Because the phone was locked in a box out of sight, the participant was unable to look at their phone or answer it. This was done to see if the combination of being without the cell phone and participants' inability to answer their ringing phone will increase their already induced anxiety from the upcoming interview.

At the end of the waiting period, the researcher administered the participants the state portion of the STAI-Short to measure their anxiety. After completion of this questionnaire, participants were informed the graduate students would not be able to interview them. The researcher then administered the YAPS to measure phone attachment and The Media and Technology Usage and Attitudes Scale to measure daily phone use amount and motivation. An additional post-experiment questionnaire was administered to determine if participants who received a phone call were aware of the call and if they were suspicious. Participants responded to the following questions: "Were you aware of your phone ringing during the experiment?" and "If so, did you think it was the experimenter calling you?" The researcher then debriefed the participants and returned their flaw paragraphs to them, to do with whatever they choose.

## Results

A two-way between subjects ANCOVA was conducted to examine the effects of attachment (phone presence vs. absence) and FoMO (phone ringing vs. not ringing) on anxiety, as measured by the state portion of Spielberger's State-Trait Anxiety Inventory, form Y (STAI-Y). The covariates were daily phone use and phone attachment style. The covariate daily phone usage, measured by the Media and Technology Usage and Attitudes questionnaire, was included to control for individual differences in daily phone usage. The covariate phone attachment, measured by the Young Adult Attachment to Phone Scale (YAPS), was included to control for individual differences in attachment to phone style. Both covariates in this analysis were not statistically significant (all  $p$ 's > 0.40; all partial  $\eta^2$ 's < .01). Therefore, I will report the ANOVA results without the covariates.

Table 1.  
*Means and Standard Deviations of Covariates*

	<i>N</i>	Mean	<i>SD</i>
Refuge Subscale (YAPS)	128	8.21	2.79
Burden Subscale (YAPS)	128	7.46	2.81
Media Usage Scale	128	154.87	29.95

Results showed a significant main effect of FoMO on participants' anxiety scores ( $F(1,124) = 12.71, p = 0.001, \text{partial } \eta^2 = 0.09$ ), a medium-to-large effect. A Tukey *HSD* post-hoc test revealed that, on average, participants who received a call ( $M = 36.75, SD = 9.25$ ) had higher anxiety levels than those who did not receive a call ( $M = 31.40, SD = 7.59$ ). Specifically, participants in the Present Ringing and Absent Ringing groups had, on average, higher anxiety scores than participants in the Present Silent and Absent Silent groups.

Table 2.  
Means, Standard Deviations, and Confidence Intervals of Anxiety scores for FoMO

	N	Mean	SD	95% CI	
				Lower Bound	Upper Bound
Phone Ringing	56	36.75	9.25	34.19	38.19
Not Ringing	72	31.40	7.59	29.65	33.16

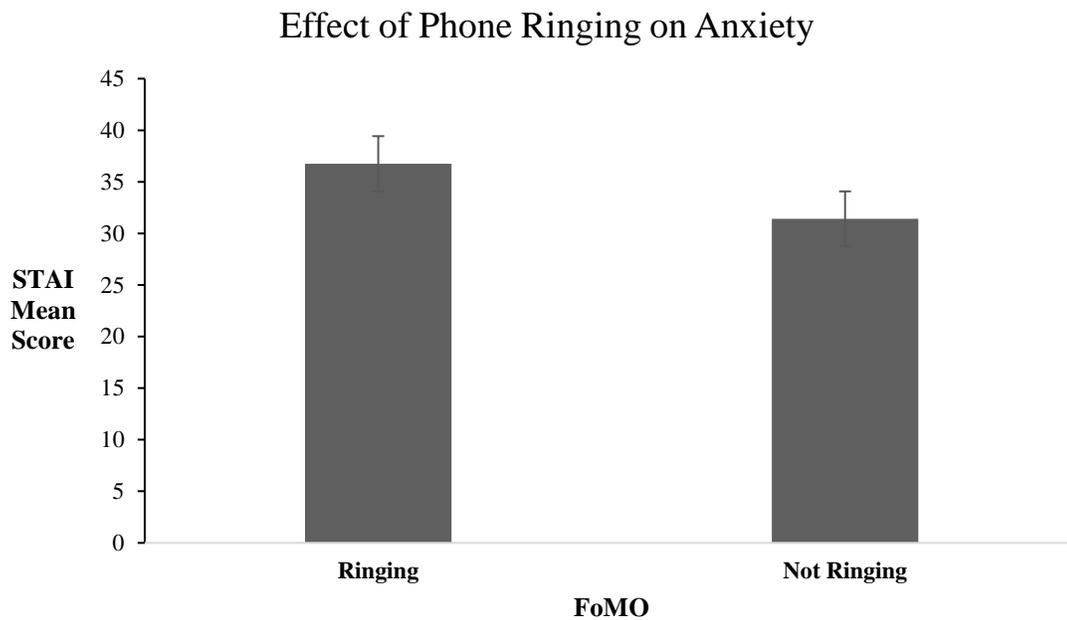


Figure 2. Error bars represent standard error.

These results suggest that participants who received an incoming call from the researcher experienced anxiety when they were aware of their inability to check in with their phone, especially when someone was directly contacting them, due to FoMO.

There also was a significant main effect of attachment ( $F(1,124) = 28.99, p < 0.001$ , partial  $\eta^2 = 0.19$ ), a large effect. A Tukey *HSD* post-hoc test revealed that, on average, participants who were separated from their phone ( $M = 37.12, SD = 9.40$ ) had higher anxiety levels than those not separated ( $M = 30.03, SD = 6.14$ ). Specifically, participants in the Absent

Silent and Absent Ringing groups had, on average, higher anxiety scores than participants in the Present Silent and Present Ringing groups.

Table 3.  
Means, Standard Deviations, and Confidence Intervals of Anxiety scores for Attachment

	<i>N</i>	Mean	<i>SD</i>	95% CI	
				Lower Bound	Upper Bound
Present Silent	61	30.03	6.14	28.24	32.12
Absent Silent	67	37.12	9.40	35.59	39.24

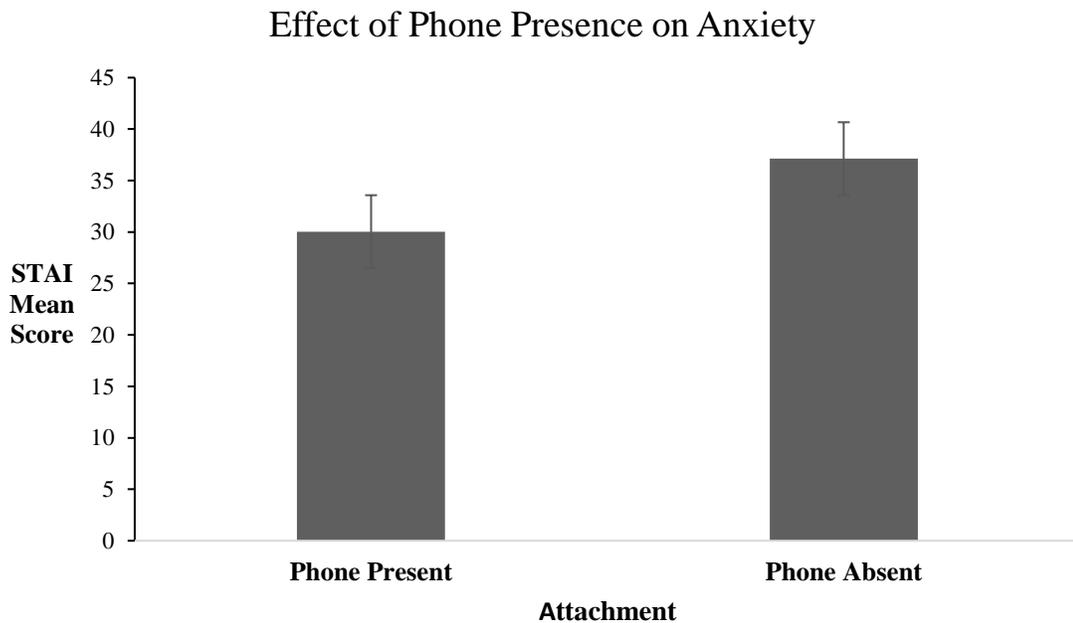


Figure 3. Error bars represent standard error.

These results suggest that the heightened anxiety participants experienced when separated from their phones is due to a possible attachment to their phone, where separation increases anxiety.

There was a significant interaction between FoMO and attachment ( $F(1, 124) = 5.50, p = 0.02$ , partial  $\eta^2 = 0.04$ ), a small-to-medium effect. A Tukey *HSD* post-hoc test revealed that

among those who did not have their phones, those who received a call had higher mean anxiety levels ( $M = 41.39, SD = 9.41$ ) than those who did not receive a call ( $M = 33.44, SD = 7.80$ ).

There was no such significant difference among those who had their phones (not ringing:  $M = 29.36, SD = 6.90$ ; ringing:  $M = 31.00, SD = 4.82$ ).

Table 4.  
Means, Standard Deviations, and Confidence Intervals for Interaction

		95% CI			
		<i>M</i>	<i>SD</i>	Lower Bound	Upper Bound
Not Ringing	Absent	33.44	7.80	30.96	35.92
	Present	29.36	6.90	26.89	31.84
Ringing	Absent	41.39	9.41	38.72	44.06
	Present	31.00	4.82	28.02	33.98

Interaction of Phone Presence and Phone Ringing on Anxiety

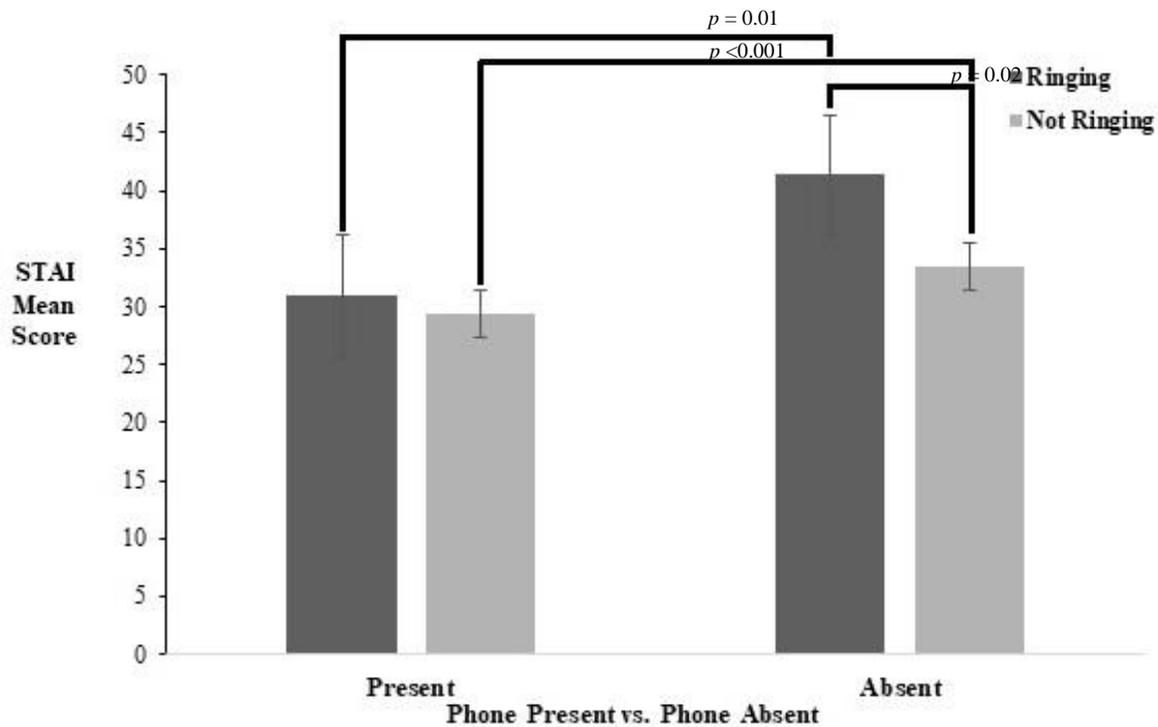


Figure 4. Error bars represent standard error.

These results suggest that anxiety scores may be dependent upon an interaction between phone presence and phone ringing. That is, being separated from the phone affects anxiety scores, but this depends on whether the participant received a phone call. The phone separation is more impactful when the participant received a phone call.

## Discussion

The rise of smartphone use in the United States is certainly not ending anytime soon. Knowing how prevalent these devices have become to our everyday lives, it is important to consider the negative impacts these devices can have. With increasingly more studies linking anxiety to smartphone use, understanding the roots of this anxiety has been a challenge. The current study investigated two potential explanations for this anxiety – attachment to phones, and fear of missing out (FoMO). The results suggest that both FoMO and attachment play a role in creating anxiety among smartphone users.

The findings of the current study support the first hypothesis that, on average, participants separated from their phones would have higher anxiety than those not separated after the wait period. Participants in the Absent Silent and Absent Ringing groups had higher average anxiety levels than those in the Present Silent and Present Ringing groups. These results suggest that college students have formed attachments to their phones and experience heightened anxiety when they are separated from their phones, like children would when separated from their caregivers. Participants in the latter two groups were able to keep their comfort object with them, which likely reduced their anxiety.

The results of the current study also provide support for the second hypothesis that on average, participants who receive a phone call and hear/see their phone ringing will have higher anxiety than those who do not. Participants in the Absent Ringing and Present Ringing groups had higher average anxiety levels than those in the Present Silent and Absent Silent groups. These results suggest that the incoming call likely induced FoMO in participants, where this call prompted participants to be aware of someone trying to contact them, knowing they cannot

respond. This indicates that college students experience anxiety when they cannot check in with their phone, especially when someone is directly contacting them, due to FoMO.

Although we did not hypothesize a significant interaction between FoMO and attachment, these results suggest that the interaction between the presumed feelings of FoMO and being separated from the attachment object is what drives the anxiety in college students. Perhaps this relationship between FoMO and attachment is the driving force of anxiety experienced in college students in relation to the smartphone. That is, smartphones become problematic when college students are in the presence of the phone often enough to become attached to the object itself. Additionally, the smartphone exists as a means of communication and ties to social circles, and the inability to connect with that circle impacts the anxiety to a higher degree.

### **Strengths and Limitations**

One strength of the current study is that, this is the first study to investigate the combination of smartphone presence for attachment theory and smartphone ringing for FoMO and the impact these have on anxiety levels. No existing study to our knowledge has induced both attachment anxiety and FoMO simultaneously to determine which is impacting anxiety, if it is both, or if it is a combination. The findings of the current study suggest both attachment to the phone and FoMO create anxiety in college students separately, and this anxiety is heightened when combined. These findings are important in understanding the implications of smartphone overuse and how the overuse is associated with anxiety. These findings also raise the possibility of implementing intervention programs and therapies that focus on smartphone overuse and its impacts, particularly in terms of anxiety. Educating the public on the negative impacts of

smartphone use can ease the ramifications of using smartphones, as well as offer information on appropriate coping strategies when in a stressful situation.

An additional strength of the current study was the incorporation of both iPhone users and Android users. Prior research has examined a population of iPhone users and their anxieties associated with the inability to answer the ringing iPhone, but this study did not include Android users (Clayton et al., 2015). This was due to the ease of disabling off silence mode on the iPhone, with disabling silence mode on other types of phones being less straightforward. The researchers mentioned in their future directions the importance of including other phone owner populations, such as Android users, to get more generalizable results. The current study used both types of phone users and we were able to effectively disable silence mode on both types of phones, therefore giving us a wider range of a population in the study.

A limitation of the current study is the sample used. Participants were undergraduate students at a small private catholic university. These students took part in the study willingly but were assigned course credit for participating. Although the population of interest for the current study was college students because of the existing research on this population and smartphone use, the findings may not be generalizable to other college students or age groups. We cannot assume external validity based on the limited sample.

An additional limitation is the self-report measures used in the study, which relied on participants responding openly and honestly. The use of self-report can be problematic in that participants may have been affected by demand characteristics or other biases. Specifically, using the state portion of the STAI provides us with information about the participant's anxiety in that moment, but not overall. When considering the implications of the study, we cannot make statements regarding overall anxiety, only state anxiety.

There were additional limitations regarding the Present Ringing and Absent Ringing groups. First, for the Present Ringing group, we instructed participants to refrain from answering or engaging with their phones until the completion of the experiment; however, a researcher was not in the experiment room with participants during the wait period, so it is possible that participants used their phones during this time. Second, participants in this group received a call during the wait period from an unknown number, not an already established contact in their phones. This creates a much different situation than if the incoming call were from an established contact. Therefore, we cannot assume that participants in this group experienced FoMO, as it is possible they believed the incoming call was a spam call; however, there remains the possibility that these participants were reminded of their phones and others attempting to contact them. The phone call could have still created a sense of FoMO in that participants knew they would have to wait to use their phones and would be out of the loop of their social circles until completion of the experiment.

For the Absent Ringing group, participants' phone ringers were secretly enabled for them to hear the incoming call. However, we did not keep track of whose phones were already on ringer and whose we had to disable silent mode on. Therefore, it is possible that participants who had their phone on silent mode upon entering the study may have been surprised and confused when they heard their phone ringing. This surprise element may have impacted their anxiety levels, and we therefore cannot say for sure it was FoMO inducing this anxiety. Despite this, there is still the possibility that the incoming phone call induced a heightened state of anxiety in participants because of their inability to know who was calling or to answer, likely due to FoMO. Moreover, we asked students during the debriefing if they had any suspicions that the experiment

was about their phones, so it is likely that we would know if such confusion had been widespread.

Moreover, for both the Present Ringing and Absent Ringing groups, receiving the phone call in general may have been surprising because most college students communicate through text more often than through phone calls (Pew Research Center, 2015). Further, there is a chance that participants in these groups received other phone calls and texts throughout the experiment. A researcher was not in the room during the wait period, so we were unable to record any other texts or calls that the participants in these groups may have received. One participant may have received several other calls, potentially making this participant more anxious as compared to a participant who only received the researcher's call. We therefore cannot assume consistency across participants in both groups. We do, however, know that all participants in these groups received at least the call from the researcher. If many participants noticed multiple contacts, the effect that we observed may have been stronger than it would have been had they only received the single call. Nonetheless, these findings suggest that those unable to respond to one or more contacts, as compared with those who were not aware of any contacts, were more anxious, on average.

Another limitation is the way in which FoMO and attachment are defined as independent variables. Although prior studies have linked smartphone use and the inability to answer the phone to FoMO, we did not specifically measure FoMO with a previously established FoMO measure. Additionally, although prior studies have linked smartphone use and separation with attachment anxiety and attachment theory, we did not specifically measure attachment with a previously established attachment measure. It is possible that participants who heard their phone ring or saw an incoming call had heightened anxiety for other reasons other than FoMO, as

discussed. It is also possible that participants separated from their phone had heightened anxiety for other reasons other than attachment. Regardless, these results suggest that phone separation, if not attachment per se, as well as inability to answer the phone, if not FoMO per se, lead to anxiety.

### **Future Directions**

Future directions may pursue other target populations such as adolescents and teenagers, as well as members of older generations who did not grow up with smartphones. As smartphone use continues to increase, it is likely that other age groups are experiencing negative impacts from smartphones as well as college students. Although the current research has studied the implications of smartphone use on college students, we should expand this and examine younger cohorts. Perhaps gaining an understanding of smartphone use at a young age can provide researchers with the necessary tools to alleviate these consequences or educate youth before the attachment to phones worsens.

Future research should address the limitations regarding the incoming phone call. Perhaps directly asking participants at the end of the experiment what specifically made them feel anxious when they received the call would help tease apart the factors that led to anxiety as well as any potential confounds. Further, it would be useful to make note of how many texts or calls participants received during the experiment to try and control for that across conditions. It may be useful to send a text message to participants instead of call, seeing as many college students text more than make phone calls daily (Pew Research Center, 2015). On the other hand, alerts for text messages are more subtle than the sustained ringing of a phone call, so participants may have been less likely to register that a text message had come in. Ideally, a text message group would be added as an additional condition.

Additionally, future research should consider incorporating previously established measures of FoMO and attachment when studying smartphone use. It would be informative to measure these directly in addition to using the experimental paradigm of the current study to more confidently ensure the anxiety was a result of FoMO and attachment. These measures could help to address the incoming phone call limitations as well, in that directly measuring FoMO could help elucidate the mechanism by which the incoming call affected participants' anxiety levels.

In conclusion, increasingly, studies have linked anxiety to smartphone use in college students. The present study sought to determine what specifically about smartphone use is contributing to anxiety – attachment to phones, FoMO, or both. The results suggest that both smartphone-related attachment and smartphone-related FoMO play a role in creating anxiety in college students. These results add to the existing literature on the relationship between smartphone use and anxiety and provide a better understanding of this link. Additionally, these results provide an important contribution to the literature on smartphone use with this study being the first to manipulate both attachment and FoMO in smartphone users.

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Appendix A

June 30, 2017

Kelly Mannion

Dear Ms. Mannion,

The Seton Hall University Institutional Review Board has reviewed the information you have submitted addressing the concerns for your proposal entitled "Smartphones and their Impact on Anxiety." Your research protocol is hereby approved as revised through expedited review. The IRB reserves the right to recall the proposal at any time for full review.

Enclosed for your records are the signed Request for Approval form, the stamped Letter of Solicitation, and the stamped original Consent Form. Make copies only of these forms.

The Institutional Review Board approval of your research is valid for a one-year period from the date of this letter. During this time, any changes to the research protocol must be reviewed and approved by the IRB prior to their implementation.

According to federal regulations, continuing review of already approved research is mandated to take place at least 12 months after this initial approval. You will receive communication from the IRB Office for this several months before the anniversary date of your initial approval.

Thank you for your cooperation.

*In harmony with federal regulations, none of the investigators or research staff involved in the study took part in the final decision.*

Sincerely,



Mary F. Ruzicka, Ph.D.  
Professor  
Director, Institutional Review Board

cc: Dr. Susan Nolan

**Office of Institutional Review Board**

Presidents Hall • 400 South Orange Avenue • South Orange, New Jersey 07079 • Tel: 973.313.6314 • Fax: 973.275.2361 • [www.shu.edu](http://www.shu.edu)

JUN 30 2017

Approval Date



Expiration Date

JUN 30 2018

Appendix

**Informed Consent Form**

Title of Study: Writing and Personality

Before agreeing to participate in this research study, it is important that participants read the following explanation of the study. The informed consent form describes the purpose, procedures, and precautions of the study, as well as any potential benefits, discomforts, and risks.

Researcher's Affiliation: Kelly Mannion is a graduate student in the Experimental Psychology program at Seton Hall University and is conducting this study for completion of her master's thesis. This study is under the advisement of Dr. Susan Nolan, Associate Professor in the Department of Psychology at Seton Hall University.

Purpose and Duration: The purpose of this study is to better understand individual differences in personalities and writing style. The study lasts approximately 30 minutes.

Description of Procedures and Instruments: In this study, participants will be given 5 minutes to write a paragraph about a flaw they feel they have. Each participant will complete measures related to mood and personality. Each participant will be asked to provide demographic data (such as age and gender).

Voluntary Participation: Participation in this study is voluntary. If a participant wishes to discontinue, he/she may do so at any time without penalty and his/her information will be discarded. Some details of this study may not be made known to participants until the session is completed. At the completion of the session, participants have the option of withholding their responses from subsequent analysis.

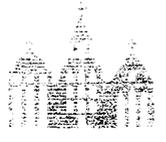
Anonymity: The data collected in this study will be labeled with numbers and no names will be connected to participant data.

Confidentiality: Informed consent forms and collected data will be stored separately in a secure location where only the researcher has access. The data will be stored on a USB memory key and labeled only with subject numbers in order to prevent any association between data and participant.

Extent of Confidentiality: The results of this study will be presented only in group form and no individual data will be reported. Access to the data will be restricted to the principal investigator, Kelly Mannion, and her advisor, Dr. Susan Nolan.

JUN 3 0 2017

Approval Date



SETON HALL UNIVERSITY

JUN 3 0 2018

Discomfort and Risks: There are no foreseeable risks associated with participation in this study. Participants may experience a brief, mild stressor.

Benefits: Participants will be given course credit for participation in this study. Participants may also better understand their personalities after participating in this study.

Compensation: The participant will receive 0.5 credits towards research participation as compensation for participating in the study.

Referral: This study is not expected to cause undue stress. If a participant does feel extreme discomfort, it may be helpful to speak to a friend, family member, or professional at a counseling center. The University Counseling Center can be reached by (973) 761-9500.

Alternatives: Participation in this study is entirely voluntary. If a professor offers course credit for participation in this experiment, he or she may also offer a non-experimental alternative for course credit.

Contact Information

Principal Investigator:

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Institutional Review Board

Mary F. Ruzicka, Ph.D.  
Presidents Hall Room 325  
400 South Orange Ave  
South Orange, NJ 07079  
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973-313-6314

Consent

Participants will receive a signed and dated copy of this form.

*By signing this form, participants certify that they have read and understood the above material, and all questions have been answered to their satisfaction. They agree to participate and realize that they may withdraw this consent at any time without fear of prejudice or penalty. In addition, they certify that they are at least 18 years old.*

\_\_\_\_\_  
Participant's Signature

\_\_\_\_\_  
Today's Date