# The Smartphone as a Pacifying Technology

SHIRI MELUMAD
MICHEL TUAN PHAM

In light of consumers' growing dependence on their smartphones, this article investigates the nature of the relationship that consumers form with their smartphone and its underlying mechanisms. We propose that in addition to obvious functional benefits, consumers in fact derive emotional benefits from their smartphone—in particular, feelings of psychological comfort and, if needed, actual stress relief. In other words, in a sense, smartphones are not unlike adult pacifiers. This psychological comfort arises from a unique combination of properties that turn smartphones into a reassuring presence for their owners: the portability of the device, its personal nature, the subjective sense of privacy experienced while on the device, and the haptic gratification it affords. Results from one large-scale field study and three laboratory experiments support the proposed underlying mechanisms and document downstream consequences of the psychological comfort that smartphones provide. The findings show, for example, that (a) in moments of stress, consumers exhibit a greater tendency to seek out their smartphone (study 2); and (b) engaging with one's smartphone provides greater stress relief than engaging in the same activity with a comparable device such as one's laptop (study 3) or a similar smartphone belonging to someone else (study 4).

*Keywords*: product attachment, psychology of technology, mobile marketing, digital marketing

Arguably, no recent technological innovation has had a more transformative effect on consumers' lives than the virtually indispensable smartphone. Eighty-one percent of adult Americans own the device (Pew Research Center 2019), with one-third of all consumer purchases—over $1 trillion—now occurring on mobile platforms (Wu 2018). Virtually everywhere, whether on public transit, at dinner, in bed, or even while crossing the street, consumers can be found engrossed in their devices, calling or texting friends, listening to music, or viewing the latest content posted on social media. Indeed, the extent of smartphone usage has become so immense that one-half of owners describe their device as something that they "could not live without" (Perrin 2017).

In spite of the central role that these devices play in the consumption economy, one question has received surprisingly little attention in consumer research: What is the nature of consumers' relationship to their smartphone? The purpose of this article is to explore this issue by shedding new light on the characteristics and underpinnings of this relationship. Drawing on results from a large field study and three controlled laboratory experiments, we offer evidence that consumers are drawn to their smartphones not just because of the immense array of practical benefits they provide, but also because of a deeper emotional benefit: smartphones can serve as a source of psychological comfort for their owners. In a sense, one's smartphone is not unlike an adult pacifier.

Shiri Melumad (melumad@wharton.upenn.edu) is an assistant professor of marketing, The Wharton School, University of Pennsylvania, Philadelphia, PA 19104. Michel Tuan Pham (Tdp4@columbia.edu) is Kravis Professor of Business, Graduate School of Business, Columbia University, New York, NY 10027. Please address correspondence to Shiri Melumad. This article is based on the first author's doctoral dissertation completed under the second author's guidance at Columbia University. The authors thank the other members of the dissertation committee—Jeffrey Inman, Robert Meyer, Oded Netzer, and Olivier Toubia—for their very useful input at various stages of this project. They also thank the Wharton Behavioral Lab and the various members of the Research on Emotions and Decisions (RED) lab at Columbia for their input on some of the studies. Supplementary materials are included in the web appendix accompanying the online version of this article. All data can be accessed on the Open Science Framework at https://osf.io/z36ru/?view_only=03e059d0e7064bde89bc5bf01242bf73.

*Editors: Darren W. Dahl and Amna Kirmani*

*Associate Editor: Peter R. Darke*

*Advance Access publication January 27, 2020*

 • Vol. 47 • 2020
DOI: 10.1093/jcr/ucaa005

Consistent with this general proposition, we show that consumers are especially drawn to their smartphone in moments of stress, and that once engaged with, smartphones are sufficiently comforting to alleviate the stress. Moreover, this effect is specific to feelings of comfort in particular—not just any type of positive affect. We also offer findings that shed light on the drivers of this relationship, showing that smartphones are particularly comforting because of a unique combination of properties: (a) they are highly personal objects; (b) they are highly portable; (c) they provide a private space where users can escape their external environment; (d) they possess haptic properties that consumers find pleasurable—all of which allow phones to (e) provide a reassuring presence for owners. The sense of reassurance afforded by one's phone, in turn, enables the device to act as a general source of psychological comfort.

We divide our presentation into four sections. We begin by reviewing prior work on which we base our predictions and propose a theoretical account of how the unique combination of physical and functional properties available on smartphones allows the device to serve as a source of psychological comfort for owners. We then report the results of four studies that test our hypotheses. We conclude by discussing the implications of our findings for consumer welfare, marketers, and the broader study of consumer product attachment.

## BACKGROUND AND THEORY

### How Do We Relate to Our Smartphones?

In recent years, an emerging body of academic literature—and much popular press—has discussed the relationship that people seem to develop with their smartphone (Alter 2017; Fullwood et al. 2017; Melumad, Inman, and Pham 2019; Wilmer, Sherman, and Chein 2017). Perhaps the most common account of this relationship is that it resembles a behavioral addiction (Alter 2017; Bernroider, Krumay, and Margiol 2014; De-Sola Gutiérrez, Rodríguez de Fonseca, and Rubio 2016; Grant et al. 2010; Roberts, Pullig, and Manolis 2015)—a compulsive desire to engage in a behavior despite the risks of social, physical, or financial harm that it might impose (Albrecht, Kirschner, and Grüsser 2007). As an illustration of this, prior work shows that respondents report a variety of problematic behaviors with their smartphone, such as use of the device that hinders productivity (e.g., using one's phone at work), the degradation of interpersonal interactions (e.g., using one's phone at dinner with a friend), or a generally unsafe style of usage (e.g., texting while driving; Bianchi and Phillips 2005; Vahedi and Saiphoo 2017; Yen et al. 2009). Relatedly, in one of the only studies of smartphone use in consumer research, Ward et al. (2017) found that participants restricted from their smartphones experienced cognitive load and consequently demonstrated impaired performance on a cognitive task. Likewise, research outside marketing consistently shows that people experience heightened anxiety and stress when restricted from interacting with their phones (Cheever et al. 2014; Clayton, Leshner, and Almond 2015; Hunter et al. 2018; Panova and Lleras 2016).

While research on cellphone addiction has been useful in documenting the apparent dependency of some consumers on the device, it is important to note that excessive smartphone use is not recognized as a clinical form of addiction according to the *Diagnostic and Statistical Manual for Mental Disorders (DSM-5)*, and debate exists over whether it could be clinically characterized as such (Panova and Carbonell 2018). More importantly, while extant research describes the class of behaviors some users demonstrate with their phone, it is relatively silent on the psychological mechanisms that give rise to this dependence. To the degree that such origins have been explored, the focus has been to examine covariation between personality types and reliance on specific functional applications of the devices—such as how extraversion versus introversion relates to users' dependence on text messaging (Bianchi and Phillips 2005; Igarashi et al. 2008), social media (van Koningsbruggen et al. 2017), and gaming (Cole and Hooley 2013). In fact, an important feature of this work is the assumption that there is nothing unique about smartphones per se that make them addictive; rather, the so-called addiction is thought to arise from the specific functionalities the phones provide (e.g., access to social media), not the device itself. Hence, in principle, this account would predict that the same "addictive" needs could be satisfied by any device offering similar functionalities—whether it be a laptop, tablet, or smartphone—and regardless of whether one owns the device or it belongs to someone else.

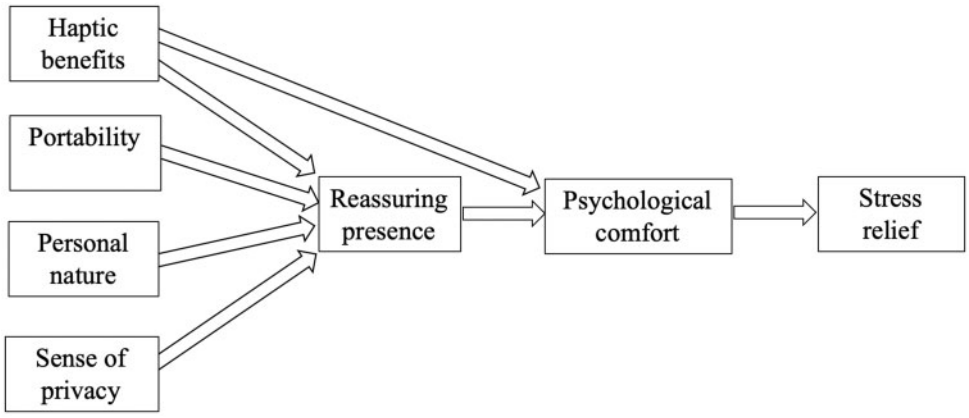
While functionalities undoubtedly play an important role in explaining why consumers form attachments to their smartphone, in this research we argue that there is a deeper psychological explanation for this special relationship. We propose that consumers are drawn to their phone because it offers a unique combination of functional, haptic, and personal ownership benefits that allow the device to serve as a source of psychological comfort. Thus, while the very notion of "smartphone addiction" frames the relationship that people have with their phone in an exclusively negative light, here we argue that consumers also derive emotional and psychological benefits from use of their device.

### Smartphones as a Source of Psychological Comfort

The idea that individuals can develop deep emotional bonds with material objects has a long tradition in both consumer research and psychology (Ball and Tasaki 1992;

**FIGURE 1**

CONCEPTUAL MODEL: SMARTPHONES AS A SOURCE OF PSYCHOLOGICAL COMFORT




Belk 1988; Nedelisky and Steele 2009; Schifferstein and Zwartkruis-Pelgrim 2008). For example, young children often develop ties to transitional or attachment objects, such as blankets and teddy bears, that give them comfort in moments of stress and produce separation anxiety when unavailable (Passman 1977; Winnicott 1953). For children, these ties are presumed to have a developmental function, allowing the child to transition away from the comfort and security of the primary caregiver (Bowlby 1969; Winnicott 1953). While the developmental drivers that give rise to childhood attachment objects are typically outgrown by early adolescence, adults too can develop emotional attachments to material objects that have similar behavioral earmarks as children's attachments to transitional objects (Bachar et al. 1998; Keefer, Landau, and Sullivan 2014). For example, prior work shows that most adults report having "special possessions" that are both highly cared for and provide feelings of warmth and security (Schultz, Kleine, and Kernan 1989; Wallendorf and Arnould 1988).

Notably, even if the analogy is only paramorphic (see, e.g., Hoffman 1960, for a discussion of the distinction between isomorphic and paramorphic representations of psychological processes), consumers' smartphones possess properties that are parallel to those that characterize attachment objects for children. For one, much like a child's attachment object is small and lightweight enough to be carried around for use across various contexts (Lehman et al. 1992; Winnicott 1953), a smartphone is highly portable, enabling the owner to access its benefits virtually always. Attachment objects also tend to have a tactile quality, with their benefits primarily derived through physical touch—such as a child self-soothing by gripping and stroking a teddy bear (Busch et al. 1973; Lehman et al. 1992). Similarly, most smartphones are ergonomically designed to enhance and facilitate the user's tactile experience with the device (Aquino 2016), and consumers must physically interact with their device through its touchscreen interface to access its benefits. In combination with the item exhibiting the key physical traits of an attachment object, the child must *expect* it to provide certain positive outcomes—a learned association that develops for fixed or constant objects that consistently or reliably provide a particular set of positive outcomes (Cairns 1966). Consumers likewise come to expect their smartphone to deliver a specific combination of positive outcomes, such as social interaction with loved ones or informational updates, in an immediate and consistent fashion (Aoki and Downes 2003; Oulasvirta et al. 2012). Finally, similar to the highly personal nature of attachment objects (e.g., children have their own security blanket, pacifier, or stuffed animal that is not to be shared with others), smartphones are also highly personal objects; for example, one's phone is rarely shared with anyone else and is often highly customized (e.g., personalized case; unique set of apps).

The central thesis of this article is that smartphones are endowed with a unique combination of properties that lead them to be viewed not just as pragmatic tools, but also as sources of comfort for owners—not unlike pacifiers for children. This thesis, in turn, makes specific predictions about downstream consequences of using the device. For example, owners will show a heightened tendency to seek out and engage with the device in moments of stress; and, once engaged with, the device will provide relief from stress. This proposition is compatible with other phenomena documented with the device, such as the anxiety (Cheever et al. 2014) and cognitive load (Ward et al. 2017) that users experience when separated from their smartphone.

Figure 1 illustrates the hypothesized mechanisms by which smartphones come to provide psychological comfort

to their owners. In particular, we argue that as a result of four particular properties of the device—its portability, associated sense of privacy, personal nature, and haptic benefits—smartphones provide a reassuring presence for their owners, which leads the device to serve as a source of psychological comfort. We review these properties in turn:

1. *Smartphones are portable*. An essential property of smartphones that allows them to be a reassuring presence for owners is their portability. Their inherently compact nature enables these devices to be carried around by owners practically everywhere and at all times. As a result, the vast array of functionalities available on the device—such as communication features, social media, entertainment, and news updates—can be accessed at virtually any time and place, making one's device dependable and readily available.
2. *Smartphones afford a sense of privacy*. A second critical property of smartphones is the sense of privacy that users experience while engaging with the device. One's smartphone creates a private space in which users can immerse themselves in activities of their choosing—not unlike a teenager retreating to her room to listen to music or an adult retreating to his "man cave" to play video games. This sense of privacy is reinforced by the small screen of these devices, which encourages users to immerse themselves in their device and away from their external environment. In addition, the relatively small screen of a smartphone makes users feel as though their activities are less observable to others around them. The idea that use of a smartphone provides a heightened sense of privacy is consistent with some authors' conceptualization of mobile phones as a form of "refuge" (Trub and Barbot 2016). It is also consistent with research showing that computer-mediated environments facilitate the disclosure of personal information by enhancing users' sense of privacy (Joinson 2001).
3. *Smartphones are highly personal possessions*. Smartphones have properties that make them highly personal objects for owners. For example, as mentioned above, today's smartphones involve a great deal of customization (e.g., selected apps, organization of content, personalized cases) and are in many ways connected to a person's identity: unlike landline numbers, cellphone numbers are typically linked to a single person, and the device typically contains highly personal content such as personal messages, cherished photos, and favorite songs. Further, many owners tend to use the device for very personal reasons such as communicating with family, checking private messages, and interacting with friends on social media. Moreover, its portability implies that owners carry the device around on their person throughout most of the day, and many even keep it close to their bedside at night—features that further enhance the personal nature of the device relative to other personal objects (Fullwood et al. 2017).
4. *Smartphones provide haptic benefits*. Another defining feature is the ergonomic design that makes smartphones easy and pleasant to hold in one's hands. Moreover, most interactions with the device occur through physically touching and swiping its touchscreen interface. Importantly, such haptic qualities have been shown to generate hedonic benefits in the form of comfort and pleasure (Peck and Childers 2003; Shu and Peck 2011; Vaucelle, Bonanni, and Ishii 2009).

## PREDICTIONS AND EMPIRICAL OVERVIEW

We propose that this unique combination of properties—the knowledge that, whenever and wherever they want, consumers can retreat to a "private space" that is highly personal and functional and even provides haptic pleasure—enables the device to serve as a reassuring presence for owners. The reassuring presence provided by one's phone, in turn, leads the device to play a special role for owners: that of providing feelings of psychological comfort when needed. The goal of the empirical work that follows is to substantiate this general thesis, which yields three specific empirical predictions:

**P1:** The psychological comfort that consumers derive from their smartphone arises from a combination of four properties that render it a reassuring presence in their lives: (a) its highly personal nature, (b) its portability, (c) the sense of privacy it provides, and (d) its rich haptic qualities.

**P2:** In moments of stress, consumers show an increased tendency to seek out and engage with their smartphone as a means of coping with their discomfort (even when other objects are at their disposal).

**P3:** Because of the psychological comfort that smartphones provide, even brief engagement with one's phone can afford relief from a stressful situation.

**P3A:** This effect is greater when using one's smartphone than when using another personal device with comparable functionality: one's laptop.

**P3B:** This effect is greater when using one's smartphone than when using an otherwise similar smartphone belonging to someone else.

We test these predictions across four studies. In the first study we obtain correlational evidence for the hypothesized drivers of the enhanced psychological comfort associated with smartphones as well as its downstream consequences (figure 1). We then report the results of three controlled experiments that demonstrate the palliative

effects of using one's smartphone, showing that the device is sought out in moments of stress (study 2) and that, once engaged with, the device indeed provides greater relief than comparable devices (studies 3 and 4). In web appendix 1 we additionally report the results of a fifth study that lend further support for our hypotheses in a real-world context of stress, showing that consumers who recently quit smoking rely more heavily on their smartphone as a substitute for the palliative effects afforded by cigarettes.

## STUDY 1

The purpose of this first study was twofold: (a) to test the mechanisms hypothesized to underlie the role of smartphones as sources of psychological comfort, and (b) to assess some downstream consequences of this psychological comfort. As explained earlier, we theorize that smartphones come to serve as a key source of psychological comfort for consumers as a result of four specific properties: smartphones (a) tend to be highly personal, (b) are very portable, (c) can provide a heightened sense of privacy, and (d) have rich haptic qualities. These properties combine to make smartphones a reassuring presence for owners, ultimately enabling the device to enhance feelings of psychological comfort when the consumer engages with it (prediction 1).

We also examined whether the extent to which smartphones provide psychological comfort varies across consumers. For example, consistent with our conceptualization (see prediction 2), the more external stress people experience in their lives, the more we expect them to rely on their phone as a source of stress relief. Demographic traits may also play a role: older consumers, for instance, may be less dependent on their phone as a source of comfort than younger consumers, since older individuals are more likely to have developed alternate means of coping with stress (prior to the introduction of the smartphone). Likewise, consumers who have fewer positive associations with their smartphone—such as those who primarily use the device for work—may derive less psychological comfort from it.

### Method

To test these predictions, 885 participants from the Amazon Mechanical Turk (MTurk) panel (46% female) were surveyed about their use of and attitudes toward their smartphone. In addition, to obtain a comparison baseline, a separate sample of 470 MTurk participants responded to the same survey but with the questions rephrased to refer to their primary PC (e.g., laptop). These different sample sizes were based on *a priori* power calculations that reflected the different types of analyses planned for the two samples: given that participants' responses about their smartphone were the primary focus of interest (e.g., examining the relationship between smartphone usage and levels of daily stress), we sought a sample size that would be large enough to detect small effects ($d = .2$ with 80% power at $\alpha = .05$). In contrast, given that the PC sample was collected solely as a basis for simple contrasts with the smartphone sample, we anticipated larger effect sizes (e.g., $d = .3$–$.5$) for which a smaller sample size was required to achieve the same power.

The survey, reproduced in web appendix 2, was composed of four sections designed to measure the theorized psychological constructs depicted in figure 1, their downstream consequences, as well as possible correlates of the effects. Each set of measures will be reviewed in turn.

*Main Dependent Measure.* The degree to which smartphones provide psychological comfort to their owners was measured through five seven-point items such as "Using my smartphone provides a source of comfort" and "When using my smartphone I feel safe and secure" (1 = "Not at all" to 7 = "Very much so"; $\alpha = .94$).

*Antecedents of Psychological Comfort.* The first proposed antecedent of psychological comfort—the reassuring presence afforded by one's phone—was measured on a four-item scale with items such as "Whenever I need my phone I know it will be there for me" and "I think of my phone as a reliable companion" (on a scale of 1 = "Not at all" to 7 = "Very much so"; $\alpha = .88$). This construct was expected to arise from four hypothesized properties of the device: its perceived portability, sense of privacy, personal nature, and haptic pleasure (all of which were measured on the same seven-point scale). The perceived portability of the device was measured as a five-item scale with items such as "It is easy to reach for my phone whenever I need it" and "Wherever I go, my phone goes" ($\alpha = .88$). The sense of privacy afforded by the device was measured as a four-item scale with items such as "My phone enables me to retreat to my private space" and "When I use my phone I feel like I am in my own safe space" ($\alpha = .94$). The extent to which the device has a personal nature was measured as a five-item scale with items such as "I think of my smartphone as a very personal object" and "I would feel uncomfortable if someone used my smartphone" ($\alpha = .85$). Finally, the haptic pleasure derived from interacting with the device was measured as a four-item scale with items such as "I enjoy the physical feeling of touching or holding my phone" and "Touching or swiping my phone's screen/keypad feels pleasant" ($\alpha = .95$).

*Downstream Consequence: Use of Phone as Relief from Stress.* To examine a potential downstream consequence of the psychological comfort expected to arise from smartphones, participants were asked to answer four items assessing the degree to which they used their phone as a means of coping with different exogenous sources of stress on a scale of 1 = "Not at all" to 7 = "Very much so": "Using my phone helps me escape my daily pressures,"

"I often turn to my phone in a moment of stress or anxiety," "If I am in an uncomfortable social situation I turn to my phone," and "I use my phone as a way of comforting myself when I feel stressed" ("stress relief" index; $\alpha = .91$).

*Individual Differences.* To measure the extent to which usage contexts predicted the degree of comfort associated with one's phone, participants were asked to indicate the degree to which they relied on their phone for social, entertainment, and work-related purposes. We theorized that consumers who use their phones more for "hedonic" purposes, such as communicating with friends/family and entertainment, would generally derive greater comfort from their smartphone than those who use it for more "utilitarian" reasons—namely, work-related purposes. We were also interested in whether the extent to which one's phone is used to alleviate stress differs across different types of stress—specifically personal stresses (e.g., breakups, loneliness) and stress from work-related problems (e.g., meeting a late-night deadline). We therefore asked participants to rate the extent to which they were subject to different types of external stresses including health, financial, family, and work-related stress. Items related to the first three domains were averaged to form an index of "personal stress" ($\alpha = .82$), and items related to the latter domain were averaged into an index of "work-related stress" ($\alpha = .65$). Finally, participants were asked a number of demographic questions including their age and gender, as well as general device usage questions such as length of ownership and estimated hours of use per day.

## Results and Discussion

We report and discuss this study's findings in three stages. We begin by offering model-free evidence of the degree to which participants perceive their phone as a source of comfort, and the extent to which they report using it as a means of relieving stress. We then report the results of two structural equation models that test our theoretical predictions. The first tests our central hypothesis about the antecedents of the psychological comfort provided by smartphones as well as a key downstream consequence: the use of one's phone for stress relief. The second model examines how the degree of comfort derived from one's phone and its use for stress relief covaries with individual-difference factors, such as the degree of daily stress faced by owners and contexts in which the device is used (work vs. personal). A correlation matrix of all variables used in the analysis is reported in web appendix 3.

*Model-Free Evidence: Do Consumers Derive Comfort from Their Smartphone?.* As theorized, participants indicated that their smartphone serves as a source of psychological comfort for them, rating it significantly above the scale midpoint ($M = 4.51$; $t(884) = 9.53$, $p < .001$). Moreover, participants assessing their smartphone rated the device as a stronger source of psychological comfort than did participants assessing their PC ($M_{PC} = 3.62$; $F(1, 1353) = 88.63$; $\eta^2 = .06$; $p < .001$).

Similar support was observed for the predicted antecedents of psychological comfort. First, participants evaluating their smartphone rated it as significantly above the scale midpoint in terms of providing a reassuring presence ($M_{Reassurance} = 5.18$; $t(884) = 25.11$, $p < .001$), haptic pleasure ($M_{Haptic} = 4.65$; $t(884) = 12.59$, $p < .001$), feelings of privacy ($M_{Private} = 4.69$; $t(884) = 12.33$, $p < .001$), being a particularly personal object ($M_{Personal} = 5.25$; $t(884) = 26.39$, $p < .001$), and being highly portable ($M_{Portable} = 6.21$; $t(884) = 67.16$, $p < .001$). Smartphones were also rated as exhibiting most of these properties to a greater extent than PCs. Compared to PCs, smartphones were seen as providing more of a reassuring presence ($M_{PC} = 4.50$; $F(1, 1353) = 66.26$; $\eta^2 = .05$; $p < .001$), conveying greater haptic pleasure ($M_{PC} = 4.42$; $F(1, 1353) = 6.05$; $\eta^2 = .004$; $p = .014$), being more portable ($M_{PC} = 4.09$; $F(1, 1353) = 875.88$; $\eta^2 = .39$; $p < .001$), and being a more personal object ($M_{PC} = 4.86$; $F(1, 1353) = 20.93$; $\eta^2 = .02$; $p < .001$). The only dimension on which participants reported no difference was in the degree to which the devices provide a sense of privacy ($M_{PC} = 4.72$; $F < 1$), suggesting that while users indeed derive a sense of privacy from using their phone, this may be a benefit afforded by one's PC as well.

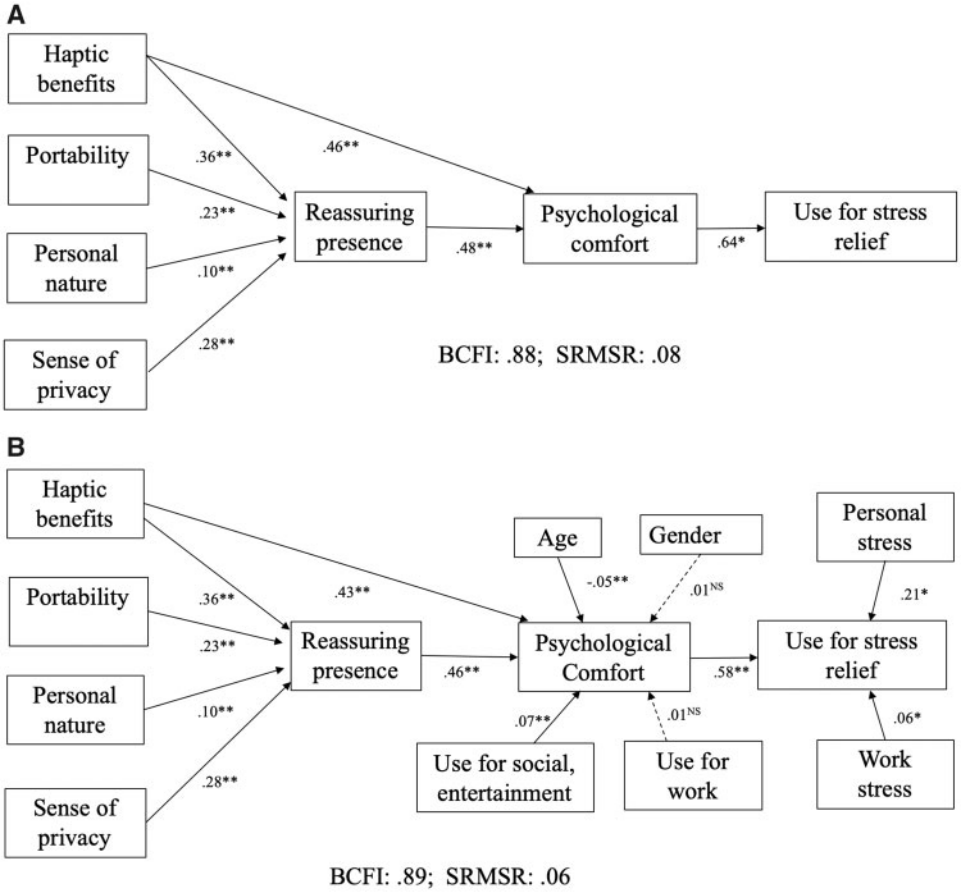
Participants also reported experiencing the hypothesized downstream consequence of psychological comfort. Participants rated the extent to which they used their smartphone as a means of relieving stress as significantly higher than the midpoint on average ($M_{Stress\ relief} = 4.61$; $t(884) = 31.86$, $p < .001$), and additionally, they reported exhibiting this behavior more with their smartphone than with their PC ($M_{PC} = 4.12$; $F(1, 1353) = 27.60$; $\eta^2 = .02$; $p < .001$).

*Testing the Theoretical Model.* As depicted in figure 1, we hypothesize that four distinctive properties of smartphones—their portability, personal nature, haptic benefits, and capacity to provide a sense of privacy—make them a reassuring presence in the lives of consumers, which results in enhanced feelings of psychological comfort when using the device. This enhanced psychological comfort, in turn, allows the device to serve as a source of relief from stress. To test this account, we submitted the measures of the various theoretical constructs to a structural path model of the hypothesized process (using SAS's Proc CALIS). Standardized maximum-likelihood estimates of the parameters of the model are reported in figure 2A.

The estimated model provides a good fit to the data (Bentler Comparative Fit Index [BCFI] = .88; standardized root mean squared residual [SRMSR] = .08), with estimates of the parameters supporting the hypothesized path structure. As predicted, the model supports the proposition that the reassuring presence afforded by one's smartphone

**FIGURE 2**

(A) STUDY 1: PARAMETERS OF HYPOTHESIZED STRUCTURAL MODEL OF DRIVERS OF PSYCHOLOGICAL COMFORT FROM SMARTPHONE USE AND ITS DOWNSTREAM CONSEQUENCE. (B) STUDY 1: PARAMETERS OF THE EFFECTS OF INDIVIDUAL DIFFERENCES ON COMFORT AND STRESS RELIEF.




** DENOTES $p(t) < .01$; * $p(t) < .05$

leads to enhanced psychological comfort from the device ($r_{\text{Reassurance}\rightarrow\text{Comfort}} = .48$, $t = 21.61$, $p < .001$). This reassuring presence, in turn, is driven by perceptions of the portability of the device ($b_{\text{Portable}\rightarrow\text{Reassurance}} = .23$, $t = 9.60$, $p < .001$), perceptions of the phone as a personal object ($b_{\text{Personal}\rightarrow\text{Reassurance}} = .10$, $t = 3.77$, $p < .001$), perceptions of privacy when using a phone ($b_{\text{Privacy}\rightarrow\text{Reassurance}} = .28$, $t = 9.28$, $p < .001$), and the perceived haptic benefits it affords ($b_{\text{Haptic}\rightarrow\text{Reassurance}} = .36$, $t = 12.82$, $p < .001$). The analysis shows that these perceived haptic benefits do not just contribute to the reassuring presence afforded by the device but also directly affect the psychological comfort it provides ($b_{\text{Haptic}\rightarrow\text{Comfort}} = .46$, $t = 12.82$, $p < .001$). Finally, the analysis supports the proposition that the more comfort derived from the device, the more it serves as a source of relief from stress ($b_{\text{Comfort}\rightarrow\text{Stress relief}} = .64$, $t = 32.81$, $p < .001$).

*Examining Individual Differences.* To examine whether the degree of comfort and stress relief afforded by one's phone varies across different individual factors, we estimated an expanded form of the proposed process model that included two sets of additional paths. One set of paths estimated how much the degree of psychological comfort derived from a smartphone depends on the person's age, gender, use for work, and use for social or entertainment purposes. A second set of paths estimated how much the tendency to rely on a smartphone for stress relief depends on personal sources of stress (family, health, financial) and on work-related stress.

The resulting model, depicted in figure 2B, again provides a good fit to the data (BCFI = .89; SRMS = .06). As expected, the more participants relied on their smartphone for "hedonic" purposes (e.g., entertainment), the more comfort they reported deriving from the device ($b_{\text{Hedonic use}\rightarrow\text{Comfort}} = .07$, $t = 3.30$, $p < .001$). In contrast, the use of one's smartphone for work purposes was unrelated to the psychological comfort derived from the device ($b_{\text{Work use}\rightarrow\text{Comfort}} = .01$, $t = .45$, NS). These results suggest that the psychological comfort that many consumers derive from their smartphone is not driven by its form factor alone: it is also driven by the types of activities that users tend to engage in on the device. Participants' age had a negative correlation with psychological comfort ($b_{\text{Age}\rightarrow\text{Comfort}} = -.05$, $t = -2.86$, $p = .004$), indicating that younger consumers are more prone to associate their smartphones with psychological comfort than older consumers. There was no relation between gender and degree of comfort derived from the device ($b_{\text{Gender}\rightarrow\text{Comfort}} = -.00$, NS), suggesting that men and women are similarly likely to derive psychological comfort from their smartphone.

Consistent with our general conceptualization, participants who reported relying most on their phone as a means of coping with stress tended to be those under the greatest level of personal stress (e.g., health, family) ($b_{\text{Personal stress}\rightarrow\text{Stress relief}} = .21$, $t = 7.61$, $p < .001$). While work-related stress showed a similar relationship, this effect was not as pronounced as it was for personal stress ($b_{\text{Work stress}\rightarrow\text{Stress relief}} = .06$, $t = 2.08$, $p = .038$), suggesting that the psychological comfort afforded by one's phone might better alleviate stress arising from personal issues than from work-related problems.

## STUDY 2

An obvious limitation of the first study is that the findings are correlational in nature, limiting our ability to draw causal conclusions. The purpose of the second study was therefore to test our general thesis—that an important role of smartphones is to provide psychological comfort when needed—in a controlled experimental setting. Specifically, we test the prediction that in moments of stress, consumers will show an increased tendency to seek out and engage with their smartphone (prediction 2). To examine this, in study 2 we manipulated participants' level of stress and then unobtrusively filmed their behavior while they waited for the next part of the study. To the extent that smartphones indeed serve as a source of comfort for their owners, we predicted that compared to those under low stress, participants under high stress would be more likely to reach for and engage with their smartphones over other objects available in their vicinity as a means of coping with their discomfort.

### Method

*Design.* Seventy-eight students from a large US East Coast university (69% women) were randomly assigned to one of two conditions of a single-factor (high stress vs. low stress), between-subjects design. The study was conducted in a controlled lab setting, with one participant per session, in sessions lasting 40 minutes. Participants were each paid $12.

*Procedure.* The lab room was split into two separate areas: a waiting area containing a single chair alongside a small table with newspapers, and a survey area containing a single desk and chair. Upon arrival, all participants were asked to place their belongings, including their "smartphone and anything else that could be distracting," in the waiting area. They were then led to the survey area, where they were asked to complete a series of paper-and-pencil tasks.

First, they were asked to rate their momentary feelings (with pencil and paper), including their level of felt comfort (measures described below). Next, depending on their assigned condition, participants completed a task designed to either increase their level of stress (in the high-stress condition) or not (in the low-stress condition). After the stress manipulation, participants were instructed to return to the waiting area and sit until the experimenter returned. All participants then sat alone in the waiting area for a predetermined amount of time while, unbeknownst to them, their behavior was surreptitiously filmed by a hidden camera located in a wall clock facing their chair. Upon the experimenter's return, participants were led back to the survey area, where they were asked to complete another paper-and-pencil questionnaire in which they reported their felt comfort for a second time and answered a series of control and demographic questions. They were then debriefed, asked for permission to use their data, and paid.

*Stress Manipulation.* The stress manipulation was adapted from the classic Trier Social Stress Test (Kassam, Koslov, and Mendes 2009; Kirschbaum, Pirke, and Hellhammer 1993) and was administered on paper. Participants were randomly assigned to either a high-stress or low-stress condition. In the high-stress condition, participants were given five minutes to prepare in writing a speech about why they are the perfect candidate for a particular job, under the cover of a "Job Interview Preparation Study." They were led to believe that they would subsequently have to recite this speech from memory on camera so that a video analysis of their speech could be conducted at a later time. To boost the cover story, a video camera was placed in the survey area, facing participants as they prepared their speech. In contrast, in the low-stress condition, the task was positioned as a "Job Preparation Study." Participants in this condition were given five minutes to write about advice they would give to someone who was

**TABLE 1**

STUDY 2: FREQUENCIES, MEANS, AND INTERRATER RELIABILITIES FOR ALL BEHAVIORS DURING THE WAITING PERIOD

| | | All participants ($N = 71$) | | | Used smartphone at some point ($N = 47$) | | |
|---|---|---|---|---|---|---|---|
| | Interrater reliability | Low stress ($n = 35$) | High stress ($n = 36$) | $p$-value | Low stress ($n = 21$) | High stress ($n = 26$) | $p$-value |
| Used smartphone at some point | $\alpha = .98$* | 60% | 72.2% | $p = .28$ | | | |
| Likelihood of reaching for phone first | $\alpha = .93$* | 34.3% | 63.9% | $p = .023$ | 57.1% | 88.5% | $p = .014$ |
| Time until first reached for smartphone | $\alpha = .99$ | | | | 89.69 sec | 23.9 sec | $p < .001$ |
| Proportion of time spent on phone | $\alpha = .97$ | 31.3% | 51.3% | $p = .054$ | 52.1% | 71% | $p = .105$ |
| Average time per interaction with phone | $\alpha = .96$ | 165.54 sec | 299.32 sec | $p < .001$ | 275.91 sec | 414.44 sec | $p < .001$ |
| Number of interactions with phone | $\alpha = .89$* | 0.89 | 0.92 | $p = .88$ | 1.48 | 1.27 | $p = .3$ |

*Means reported were calculated after two coders (blind to both condition and hypothesis) reconciled the measures they had originally disagreed on. Cronbach's alphas reported in the table reflect the interrater reliability *prior* to reconciliation of measures.

starting the same position as described in the high-stress condition. Unlike in the high-stress condition, participants in this condition were *not* led to believe that they would need to present their writing on camera, and correspondingly there was no visible camera in the survey area. The exact instructions used in the stress manipulations are reproduced in web appendix 4.

*Unobtrusive Measurement of Behavior.* After participants completed their assigned job-preparation task, the experimenter asked them to sit in the waiting area for "about 10 minutes." In the high-stress condition, the alleged rationale for this waiting period was that a PhD student needed to review their speech to generate follow-up questions for them to answer on camera. In the low-stress condition, the alleged rationale was that the research assistant simply needed to transcribe their writing. In reality, during this 10-minute period, participants were unobtrusively filmed as they waited alone for the next part of the study.

During this time, participants had access to their personal belongings, including their smartphone and any other items that they had brought with them to the study (e.g., backpacks, books, laptop). In addition, two newspapers (the *New York Times* and *Wall Street Journal*) were intentionally placed on the small table beside the chair, providing participants the option of engaging with alternative stimuli. Newspapers were chosen because they are commonly available in waiting areas and therefore serve as a natural, externally valid object with which participants could potentially engage.

*Behavioral Dependent Measures.* The video footage of participants' behavior during the waiting period was subsequently coded by two independent judges who were blind to the study's hypothesis and to participants' conditions. The judges were instructed to code the footage for a set of objective aspects of the participant's behavior (e.g., what time the participant reached for the first object during the waiting period; what the first object was). From these observable indicators we calculated a battery of behavioral measures designed to capture participants' propensity to preferentially seek out and engage with their smartphone (e.g., the time elapsed before the participant first reached for his or her phone, if at all; the proportion of waiting time spent on the phone). Table 1 provides summary statistics of the key measured variables with respect to smartphone behavior across the two conditions.

*Felt Comfort and Other Measures.* Participants' level of felt comfort was assessed at two points in time: once upon arrival (time 1) and a second time after the waiting period (time 2). Specifically, participants were asked to rate their agreement with 13 statements about their momentary feelings (see web appendix 5), five of which focused on their felt comfort: "I feel relaxed," "I feel calm," "I feel at ease," "I feel a sense of comfort," and "I feel anxious" (reverse-coded) on a scale of 1 = "Not at all" to 7 = "Very much so" (Kolcaba and Kolcaba 1991; Marteau and Bekker 1992). Responses to these five items were averaged to create a felt-comfort measure for times 1 and 2. The change in felt comfort from time 1 ($\alpha = .86$) to time 2 ($\alpha = .90$) provided a check of the stress manipulation (albeit an imperfect one).

As control measures, participants additionally reported how frequently they use their phone per day, how long they have owned their current smartphone, specific behaviors surrounding the device (e.g., how much they paid for their phone case), and how emotionally connected they are to their phone (four items, $\alpha = .70$). Participants were also asked to indicate the last time they used their smartphone and to describe what they did on their phone while in the waiting area (see web appendix 6). This latter measure was gathered to address the alternative explanation that it is *solely* the social functionality afforded by phones—rather than the phones themselves—that engenders usage under stress.

## Results

*Preliminary Analyses.* Upon debriefing, two participants (one in the high-stress condition) refused to have

their data included in the study, and another five (two in the high-stress condition) were excluded for not having their smartphone with them at the study, thus leaving 71 participants for analysis. Participants did not differ across conditions in terms of their momentary feelings upon arrival to the study, the number of daily hours spent on the device, the length of time they owned the device, emotional connection to their smartphone, reported behaviors involving their device, or demographics (all $F$-values $< 1$). This suggests that randomization across conditions was effective. As a tentative check of the stress manipulation, while participants in the two conditions reported similar levels of felt comfort at time 1 ($M_{\text{High-Stress}} = 4.19$ vs. $M_{\text{Low-Stress}} = 4.29$; $F < 1$), at time 2 high-stress participants reported significantly lower levels of comfort ($M = 3.44$) than did low-stress participants ($M = 4.71$; $F(1, 69) = 21.68$; $\eta^2 = .24$; $p < .001$), suggesting that the manipulation was effective.

*Main Analyses.* Based on prediction 2, we predicted that high-stress (vs. low-stress) participants would be more likely to seek out their smartphones over other available objects, and to exhibit greater engagement with the device. Consistent with this prediction, the results showed that high-stress participants were indeed more likely to engage with their smartphone first—that is, before other available objects (63.9%)—than were low-stress participants (34.3%; $x^2(1) = 5.09$, $p = .024$; see table 1). In addition, among participants who did reach for their phone at some point during the waiting period (72.2% in the high-stress condition and 60.0% in the low-stress condition), high-stress participants reached for their phone much *sooner* than did low-stress participants (Poisson regression $\beta = -1.37$, $p < .001$). Specifically, on average, high-stress participants reached for their phones only 23.9 sec after first sitting down, whereas low-stress participants waited 89.7 sec before first reaching for their phone.

With respect to the degree of sustained attention on the device, we first tested for differences in the average time spent per interaction with one's smartphone during the waiting period. As predicted, high-stress participants spent significantly more time per interaction with their device ($M = 299.32$ seconds per interaction) than did low-stress participants on average ($M = 165.54$ seconds; Poisson regression $\beta = .37$, $p < .001$). Relatedly, high-stress participants also showed greater engagement with their smartphone, spending a greater proportion of the total waiting time on their device ($M = 51.3\%$) than low-stress participants ($M = 31.3\%$; $t = 1.96$, $p = .054$).

An additional analysis shows that high-stress participants were much more likely to reach for their smartphone first than for any of their other personal belongings (e.g., laptop, book) available during the waiting period ($M = 13.9\%$; $z = 3.56$, $p < .001$), suggesting that smartphones have special status as an object of comfort relative to other personal belongings.

*Social Contact as an Alternative Explanation.* One possible alternative explanation is that high-stress (vs. low-stress) participants sought out and engaged with their smartphones not for their comforting effects per se, but because they were in search of social contact—one of the many functions available on the device (e.g., writing a text message to a friend). Inconsistent with this account, high-stress participants were no more likely to make social contact on their phone during the waiting period (30.8%) than were low-stress participants who used their device (23.8%; $x^2(1) = 0.04$, NS).

## Discussion

The findings of the first lab experiment support the prediction that moments of greater stress make consumers more likely to seek out and engage with their smartphone as a means of coping with their discomfort (prediction 2). Specifically, we found that compared to low-stress participants, high-stress participants were quicker to reach for their smartphone first, and they engaged with the device more intensely. In addition, high-stress participants preferentially sought out their phone over other personal objects they brought with them, such as items in their backpack (e.g., their laptop), as well as newspapers made available to them in the waiting area. This suggests that the palliative effect provided by one's smartphone is not equally afforded by *any* potential source of distraction (e.g., one's laptop, newspapers). The results also show that the tendency for participants to seek out their phones under greater stress cannot be accounted for by preexisting differences in participants' situational feelings upon arrival, general emotional connection to their smartphones, or demographic factors, nor did it appear to be driven by differences in the desire to engage in social contact.

# STUDY 3

The results of the first lab experiment confirmed that in moments of stress, consumers show an enhanced tendency to seek out and engage with their smartphone, even when other objects are at their disposal (prediction 2). The purpose of the next two studies was to examine in a controlled lab experimental setting whether engagement with one's smartphone does indeed provide psychological comfort when needed. Specifically, in study 3 we test the prediction that even brief engagement with one's smartphone can provide relief from a stressful situation—more so than engaging with another personal device with comparable functionality: one's laptop (prediction 3A). Laptops provide a meaningful comparison as a control condition for several methodological, theoretical, and substantive

reasons. From a methodological standpoint, laptops and smartphones can be used to perform many of the same activities, which allows us to hold constant the task and information consumed across conditions. In addition, laptops and smartphones have similar ownership and usage rates among US consumers, which helps address possible alternative explanations related to device familiarity. (Tablets such as iPads, which exhibit lower ownership and usage rates among US consumers, were not selected for this reason.) From a theoretical standpoint, laptops and smartphones share many functionalities (e.g., browsing, social media, email), which is helpful in testing the idea that the special relationship that consumers form with their smartphone cannot be solely explained by its functionalities. At the same time, laptops differ from smartphones in several ways that are theoretically meaningful with respect to our conceptualization; namely, they are less portable, less haptic, and potentially less personal than smartphones (prediction 1). Finally, from a substantive standpoint, the comparison with laptops is a natural one, often discussed by marketers and firms as part of the "mobile revolution."

In this study, all participants first underwent a stress induction and were then instructed to browse the same web page either on their smartphone in one condition, or on their laptop in the other condition. Participants' momentary feelings were measured at three points during the study session: (1) prior to the stress induction, (2) after the stress induction but before participants used their assigned device, and (3) after participants used their assigned device.

We predicted that participants who used their smartphone would show greater recovery from discomfort due to stress than participants who performed the same task on their laptop. We additionally predicted that smartphone usage would be uniquely associated with enhanced feelings of comfort as opposed to other emotions. In other words, we expected smartphone use to enhance feelings of psychological comfort in particular rather than positive emotions in general (e.g., satisfaction).

## Method

Fifty students from the same university participant pool as in study 2 were randomly assigned to the conditions of a 2 (device: smartphone vs. laptop) × 3 (time: time 1 vs. time 2 vs. time 3) mixed design, with device as a between-subjects factor and time as a within-subject factor. We note here that, given that participants needed to be run one at a time per session, the sample size of study 3 was constrained by available lab resources; nevertheless, the within-subject nature of the mixed design lent reasonable power to the analysis. Specifically, an *a priori* power analysis using SAS PROC GLMPOWER concluded that the design study had an 85% chance of correctly rejecting a false null hypothesis of no time-by-device interaction at $p = .05$ (assuming a standard deviation and serial correlation of measures of .6, and an expected post-stress difference between devices of .5).

All participants were required to bring both their smartphone and their laptop with them to the session. To control for potential distractions posed by the presence of other participants, the study was administered one participant at a time. To ensure that the presence of the devices would not impact participants' feelings prior to the device manipulation, upon arrival participants were asked to put their smartphone and laptop in the adjacent cubicle. They each received $8 for 30 minutes of participation.

*Felt Comfort Measure (Time 1).* At the beginning of the study, participants were told that they would be participating in two (allegedly) unrelated studies that were combined for greater efficiency. Before beginning the "first" study, participants were asked to rate their agreement with the same 13 statements about their momentary feelings as in study 2 (see web appendix 5), including the five statements focusing on participants' felt comfort ("I feel relaxed," "I feel calm," "I feel at ease," "I feel a sense of comfort," and "I feel anxious" [reverse-coded]). Responses to these five items were averaged to create a measure of felt comfort at time 1 ($\alpha = .88$) as part of the main dependent variable. To test the prediction that it is felt comfort in particular that is enhanced by smartphone (vs. laptop) use rather than other types of feelings in general, the remaining nine statements were included to assess a variety of other momentary emotions.

*Stress Induction.* Next, all participants completed "study 1," which was cast as a task performance study but actually served as a stress induction. To induce stress among participants, we used a standard stress procedure in the literature, which consists of administering a series of cognitive tasks under time constraints (Boyes and French 2010). Based on two pretests, one of them with students from the same pool as the main study, we selected three sets of cognitive tasks for the stress induction: (a) 15 GMAT math problems, (b) 18 Remote Associates Test (RAT) items (Mednick and Mednick 1967), and (c) 18 anagrams. The three sets of tasks were presented in increasing order of task difficulty, as were the individual items within each set. Participants in the main study carried out the tasks on paper and were given three minutes to complete each task, which pretests had shown was greatly insufficient. To intensify the stressful aspects of the overall procedure, the experimenter set a timer to ring loudly every minute. Pretest results indicated that the overall procedure was effective in inducing stress among participants. The problem sets are reproduced in web appendix 7.

*Felt Comfort Measure (Time 2).* After completing the stress induction, participants were again asked to report their momentary feelings on the same items as at time 1, with responses to the five comfort-related items averaged

into an index of felt comfort at time 2 ($\alpha = .85$). Changes in felt comfort from time 1 to time 2 served as a check of the stress induction.

*Device Manipulation.* Next, participants completed "study 2," which was ostensibly about social media but in fact administered the device manipulation. Participants were randomly assigned to browse a specific social media site either on their smartphone in the experimental condition, or on their laptop in the control condition. To minimize the possibility that any effects observed might be driven by differences in the content consumed across conditions, all participants were asked to browse a page called "Things Fitting Perfectly into Other Things" on Tumblr. This specific web page was chosen for two reasons. First, Tumblr has comparable interfaces across its mobile and web-based formats, and second, this particular Tumblr blog displays simple images with minimal or no text, making the content similarly amenable to browsing on both laptop and smartphone devices. As a check, at the end of the study participants across conditions were asked to rate how user-friendly they found the browsing experience to be. All participants were given five minutes to browse the site "Things Fitting Perfectly into Other Things," allegedly in order to search for images that they particularly liked on the page.

*Felt Comfort Measure (Time 3).* After five minutes had passed, the experimenter instructed participants to stop browsing and handed out the final set of questions that measured participants' felt comfort after using their assigned device. Participants responded to the same questions presented at times 2 and 3, yielding a third five-item index of felt comfort ($\alpha = .78$). Increases in felt comfort from time 2 to time 3 were interpreted as relief from stress following device usage, which was the primary focus of the study.

Finally, participants were asked to indicate their preexisting familiarity with the Tumblr site (whether they had a Tumblr account prior to the study) and how user-friendly they found the Tumblr application or website to be on a scale of 1 ("Not user-friendly at all") to 5 ("Very user-friendly"). They also answered a series of control questions about demographics, frequency of smartphone use (i.e., average number of hours spent on the device per day), as well as the perceived difficulty of the stress-induction tasks (i.e., how difficult they found each of the three problem sets to be, and how much more time they would have liked to complete the tasks) (see web appendix 8).

## Results

*Preliminary Analyses.* The results confirmed no differences between device conditions in terms of participants' demographics, smartphone usage frequency, and preexisting familiarity with Tumblr. Of the 13 items assessing momentary feelings at time 1 (prior to the stress induction), only one—felt frustration—indicated an unexpected initial difference between conditions, with participants in the smartphone condition reporting a marginally higher level of frustration upon arrival ($M = 2.60$) than those in the laptop condition ($M_{PC} = 1.88$; $F(1, 48) = 3.96$, $p = .051$; see web appendix 9 for all means). However, none of the five items assessing the dependent measure of interest—felt comfort—showed any initial difference.

A check of the stress induction confirmed a significant decrease in participants' felt comfort from time 1 (upon arrival; $M = 4.87$) to time 2 (immediately following the stress induction; $M = 3.54$; $F(1, 48) = 93.08$; $\eta^2 = .66$; $p < .001$). Importantly, between time 1 and time 2, there was no time × device interaction ($F < 1$), confirming that the stress induction had parallel effects across conditions. There were no significant differences across conditions in the reported difficulty of each stress-induction task (largest $F(1, 48) = 2.16$, NS), the additional amount of time participants would have liked in order to complete the tasks ($F(1, 48) = 2.84$, NS), or in the number of questions attempted in each task (all $F$-values $< 1$). These latter findings suggest that the randomization was largely effective in equating participants across conditions prior to the device-usage manipulation.

*Stress Relief Due to Device Usage.* To test the prediction that using one's smartphone provides greater relief from stress than using another personal device with comparable functionality (one's laptop), measures of participants' felt comfort at times 1, 2, and 3 were submitted to a mixed ANOVA with time as a within-subject factor and device as a between-subjects factor. A significant main effect of time ($F(2, 96) = 64.80$; $\eta^2 = .57$; $p < .001$) showed a decrease in participants' felt comfort from time 1 ($M = 4.87$) to time 2 ($M = 3.55$), as reported earlier ($F(1, 48) = 83.40$; $\eta^2 = .63$; $p < .001$), followed by an increase in felt comfort from time 2 to time 3 ($M = 5.11$; $F(1, 48) = 98.64$; $\eta^2 = .64$; $p < .001$).

More importantly, this effect was qualified by a significant time × device interaction ($F(2, 96) = 4.16$; $\eta^2 = .04$; $p = .018$). Focusing on changes in comfort between time 2 and time 3, a planned interaction contrast reveals, as predicted, a greater increase in felt comfort from time 2 to time 3 among participants who used their smartphone ($M_{\text{Time 2}} = 3.37$ vs. $M_{\text{Time 3}} = 5.33$; $F(1, 24) = 68.32$; $\eta^2 = .74$; $p < .001$) than among participants who browsed the same content on their laptop $M_{\text{Time 2}} = 3.73$ vs. $M_{\text{Time 3}} = 4.88$; $F(1, 24) = 31.67$; $\eta^2 = .57$; $p < .001$; interaction contrast: $F(1, 48) = 6.55$; $\eta^2 = .04$; $p = .014$).

In fact, participants in the smartphone condition reported even greater comfort at time 3 ($M = 5.33$) than they did at time 1 ($M = 4.77$; $F(1, 24) = 7.97$; $\eta^2 = .25$; $p = .013$), whereas participants in the laptop condition only returned to the same level of felt comfort at time 3 ($M = 4.89$) as

they reported at time 1 ($M = 4.97$; $F < 1$; interaction contrast: $F(1,48) = 5.23$; $\eta^2 = .09$; $p = .027$). Therefore, not only did the use of their smartphone help participants recover from stress better than did the use of their laptop, it actually raised participants' overall sense of comfort over and above the initial state they were in prior to the stress induction.

Mixed ANOVAs of *other* feelings measured at times 1, 2, and 3 show main effects of time on feelings of confidence, satisfaction, focus, frustration, happiness, and sadness (largest $F(2, 96) = 52.04$, $p < .001$; see web appendix 6 for all means). However, none of these effects was moderated by the type of device (largest $F(2, 96) = 1.40$, NS), suggesting that it is feelings of comfort (and stress alleviation) in particular that smartphones enhance, rather than positive affect in general.

## Discussion

The results of study 3 support the proposition that consumers not only preferentially seek out their smartphone in moments of stress (as shown in study 2), but also derive psychological comfort from their device when needed. Specifically, the study shows that compared to the use of another personal device with comparable functionality, the mere use of one's smartphone to perform the same brief task is sufficiently comforting to provide relief from a recent stressful experience. The results of this experiment are noteworthy in three respects. First, methodologically, the fact that the task and associated content (the web page) were held constant across conditions means that any observed difference in comfort and stress relief cannot be attributed to mere differences in information consumed across devices. Second, from a more theoretical perspective, the fact that the effects cannot be attributed to differences in content means that the observed sense of comfort arises from the device itself. Third, the fact that the sense of comfort and stress relief provided by the use of one's smartphone exceeds that afforded by the use of one's laptop—a device with comparable functionalities—is consistent with a general view that the relationship that consumers have with their smartphone is a special one that cannot be strictly reduced to the device's functional value.

# STUDY 4

Although personal laptops provide a natural point of comparison for testing whether smartphones serve as distinct sources of comfort for owners, a limitation of study 3 is that laptops may have been less stress-relieving for reasons that are unrelated to our theorizing. For example, while laptops differ in terms of two of the theorized drivers of psychological comfort—their portability and haptic nature (prediction 1)—it is possible, for example, that consumers may use their laptop more for work and less for leisure than their smartphone, or that the effects are driven in part by differences in their physical form that are not accounted for by our theory. Thus, a more stringent test of our theorizing would hold the type of device constant.

The purpose of the final lab experiment is to show that the use of one's own smartphone to engage in a given activity helps alleviate stress to a greater extent than the use of an otherwise similar smartphone belonging to someone else (prediction 3B). Such a finding would lend support to our theorizing in several ways. First, it would provide further evidence that the comfort that people derive from interacting with their smartphone does not strictly arise from the sheer functionalities available on the device. Second, it would provide support for our proposition that the psychological comfort derived from smartphones is driven in part by the highly personal nature of the device (prediction 1).

The general design of this study was similar to that of study 3. All participants first underwent a stress induction and then were asked to browse the same content on a smartphone. In one condition, it was their own smartphone; in the other condition, it was an otherwise similar phone belonging to the lab. We predicted that compared to participants engaging in the task on the lab's smartphone, participants engaging in the same task on their own smartphone would derive greater psychological comfort and thus exhibit greater recovery from stress.

## Method

Seventy-five participants from a different university than in studies 2 and 3 (71% women) were randomly assigned to the conditions of a 2 (ownership: own smartphone vs. lab smartphone) × 3 (time: time 1 vs. time 2 vs. time 3) mixed design, with ownership as a between-subjects factor and time as a within-subject factor. The effect sizes observed in study 3 provided guidance for determining the sample size for study 4, which was planned using SAS's PROC GLMPOWER. Assuming means and standard deviations similar to those observed in study 3 as well as the same mixed design, we sought a sample size that would have a 90% probability of correctly rejecting the null hypothesis of no interaction between device and time 2-to-3 at $\alpha = .05$. The final sample size of 75 had an *a priori* power of .93.

The study was again conducted in a controlled lab setting, one participant at a time, in sessions lasting 30 minutes for which participants were paid $10. All participants were required to bring their smartphone to the lab. They were led to believe that they were completing two separate surveys combined for greater efficiency. As part of "study 1," which was cast as a task performance study, participants were first asked to report their momentary feelings along the same 13 items as in studies 2 and 3 (see web appendix 5), plus an additional item measuring felt

stress ("I feel stressed"). The five comfort-related items from the prior studies and the additional stress-related item (reverse-coded) were combined to form a six-item index of felt comfort at time 1 ($\alpha = .90$).

All participants were then administered the same stress induction as were the high-stress participants in study 2. That is, under the cover of a "Job Interview Preparation Study," all participants were given five minutes to prepare in writing a speech about why they are the perfect candidate for a particular job, and were led to believe that they would have to recite this speech on camera. After completing the stress induction, participants were again asked to report their momentary feelings on the same items as at time 1, which was used to construct the six-item index of felt comfort at time 2 ($\alpha = .91$). Changes in felt comfort from time 1 to time 2 served as a check of the stress induction.

Next, participants completed "study 2," ostensibly about the user experience of different devices, which actually served as the ownership manipulation. Participants were led to believe that the experimenters were interested in "how users' reactions to the use of the lab's devices compare to their reactions to their own personal devices." Participants in the own-phone condition were asked to take out their smartphone to browse the "Things Fitting Perfectly" Tumblr page for five minutes (as in study 3), whereas participants in the lab-phone condition were asked to complete the same browsing task on the lab's smartphone—either on an iPhone 6 or Samsung Galaxy S5 (an exploratory survey revealed that these two smartphone models were the two most commonly owned models among the lab participant pool). To ensure that participants in the lab-phone condition did not need to search through an unfamiliar interface to locate the content, the Tumblr page was already open on the device in this condition.

After five minutes had elapsed, participants' momentary feelings were measured for a third time, providing an index of felt comfort at time 3 ($\alpha = .88$). Again, an increase in felt comfort from time 2 to time 3 was interpreted as relief from stress following device usage, which was the primary focus of the study. Participants then responded to the same control questions about demographics and frequency of smartphone use (i.e., average number of hours spent on the device per day) as in study 3. Finally, lab-phone participants were additionally asked to rate how similar the lab's phone was to their own device along the following dimensions (on a scale of 1: "Completely different" to 7: "Exactly the same"): physical comfort, ease of use, brightness, and vividness/clarity (see web appendix 10). These four measures were combined to form a lab-phone similarity index ($\alpha = .84$).

## Results

*Preliminary Analyses.* As in study 3 there were no differences across conditions in terms of participants' demographics or smartphone usage frequency. In addition, there were no initial differences along any of the 14 items assessing momentary feelings at time 1 prior to the stress induction. Participants in the lab-phone condition reported perceiving the lab's device as similar to their own, with the mean perceived similarity significantly above the midpoint of the seven-point scale ($M = 5.92$; $t(28) = 8.02$, $p < .001$). Finally, a check of the stress induction confirmed a significant decrease in participants' felt comfort from time 1 (upon arrival; $M = 4.54$) to time 2 (immediately following the stress induction; $M = 3.33$; $F(1, 73) = 91.43$; $\eta^2 = .52$; $p < .001$; see web appendix 11 for all means).

*Stress Relief Due to Device Usage.* To test the central prediction that using one's smartphone provides greater relief from stress than an otherwise similar phone belonging to someone else, measures of participants' felt comfort at times 1, 2, and 3 were submitted to a mixed ANOVA with time as a within-subject factor and device as a between-subjects factor. A significant main effect of time ($F(2, 146) = 98.33$; $\eta^2 = .55$; $p < .001$) showed that the decrease reported above in participants' felt comfort from time 1 ($M = 4.54$) to time 2 ($M = 3.33$) was followed by an increase in felt comfort from time 2 to time 3 ($M_{\text{Time 2}} = 3.33$ vs. $M_{\text{Time 3}} = 5.25$; $F(1, 73) = 137.50$; $\eta^2 = .65$; $p < .001$).

More importantly, as in study 3, this effect was qualified by a significant time × device interaction ($F(2, 146) = 8.15$; $\eta^2 = .05$; $p < .001$). Examining the interaction contrast for time 2 to time 3 ($F(1, 73) = 12.24$; $\eta^2 = .05$; $p < .001$), we see that the results reveal a significantly greater increase in felt comfort among participants who used their own smartphone ($M_{\text{Time 2}} = 2.90$ vs. $M_{\text{Time 3}} = 5.36$; $F(1, 37) = 94.20$; $\eta^2 = .72$; $p < .001$) than among those who browsed the same content on the lab's smartphone ($M_{\text{Time 2}} = 3.76$ vs. $M_{\text{Time 3}} = 5.14$; $F(1, 36) = 64.65$; $\eta^2 = .64$; $p < .001$). These results thus provide a conceptual replication of those observed in study 3. In addition, on average, the degree of comfort reported immediately after use of the device was greater than that reported at the onset of the study ($M_{\text{Time 3}} = 5.25$ vs. $M_{\text{Time 1}} = 4.54$; $F(1, 73) = 28.09$; $\eta^2 = .27$; $p < .001$), although here the time-by-device interaction was not significant (own-phone: $M_{\text{Time 3}} = 5.36$ vs. $M_{\text{Time 1}} = 4.51$; lab-phone: $M_{\text{Time 3}} = 5.14$ vs. $M_{\text{Time 1}} = 4.57$; interaction: $F(1, 73) = 1.07$; $\eta^2 = .01$; NS).

One factor that potentially complicates this analysis, however, is that the effect of the stress manipulation was somewhat stronger for those in the own-phone condition compared to the lab-phone condition, such that participants in the own-phone condition reported lower comfort after the manipulation than those in the lab-phone condition (time 2: $M_{\text{own}} = 2.90$ vs. $M_{\text{lab}} = 3.76$; $F(1, 73) = 8.50$; $\eta^2 = .10$; $p = .005$). While this difference would presumably make it *more* difficult to observe greater stress relief in the

own-phone condition, to ensure that the effects were not influenced by the difference in the strength of the manipulation we reanalyzed the data in a mixed-model analysis using SAS Proc Mixed that controlled for differences in felt comfort at time 2, treating participants as a nested random effect. The analysis confirmed the original findings, again revealing a significant time-by-ownership interaction after controlling for time 2 differences ($F(1, 73) = 15.75$; $\eta^2 = .04$; $p < .001$). Specifically, participants who used their own smartphone still experienced a greater rate of recovery from stress from time 2 to time 3 ($LSM_{\text{Time 2}} = 3.18$ vs. $LSM_{\text{Time 3}} = 5.63$; $F(1, 37) = 133.43$; $\eta^2 = .89$; $p < .001$) relative to participants who engaged with the lab's smartphone ($LSM_{\text{Time 2}} = 3.47$ vs. $LSM_{\text{Time 3}} = 4.86$; $F(1, 36) = 82.32$; $\eta^2 = .27$; $p < .001$).

## Discussion

The results of this study conceptually replicate those of study 3 and extend them in an important way. They again show that the mere use of one's smartphone to perform a simple task for a few minutes is sufficiently emotionally comforting to provide relief from a recent stressful experience, replicating the results of study 3 within the smartphone (vs. laptop) condition. More importantly, the results additionally seem to suggest that the comforting effects of using a smartphone are stronger for one's own smartphone than for an otherwise similar smartphone belonging to someone else. This finding is consistent with our theory that the psychological comfort afforded by one's phone is partly driven by the personal nature of the device, which enables it to serve as a reassuring presence for owners and thus increase their sense of comfort (prediction 1). Studies 3 and 4 tested all the proposed components of our theoretical model.

# GENERAL DISCUSSION

The purpose of this research was to develop a better understanding of the nature of the relationship that many consumers form with their smartphone—a device that in the span of only a few years has become one of the most ubiquitous and frequently used products among consumers, as well as the primary device through which online consumption activities take place. While in recent years a descriptive literature has emerged on people's self-reported smartphone use (Bianchi and Phillips 2005; De-Sola Gutiérrez et al. 2016), theoretical and experimental investigations into this relationship have been limited. In this work we provide one of the first theoretical accounts of many consumers' relationship with their smartphone, including the antecedents that underlie it as well as downstream consequences. Our central thesis is that, for many consumers, smartphones serve as more than just practical tools: consumers also experience enhanced psychological comfort from engaging with their device, which allows it to serve as a palliative aid for owners during moments of stress—not unlike how pacifiers (and other attachment objects) provide psychological comfort to young children.

Also central to our theory is the proposition that a smartphone affords feelings of comfort not just because of its functionalities, but rather because of a unique *combination* of properties: its role as a reassuring presence in the daily lives of consumers, which arises from its portability, highly personal nature, the sense of privacy it invokes when engaged, and the haptic pleasure users derive from handling their device. The role of the device as a reassuring presence, in turn, allows the device to enhance feelings of psychological comfort when consumers engage with it.

In this article we report the results of four studies, including a large-scale field study and three controlled laboratory experiments, that lend support to these ideas. The first field study offered evidence for the proposed theoretical model about how the various properties of one's smartphone lead it to represent a source of psychological comfort, as well as the downstream consequences of this comfort. Next, a lab experiment showed that participants who underwent greater stress were more likely to seek out their phone and to show greater engagement with the device (even with other objects at their disposal), presumably as a means of coping with stress. The final two controlled lab experiments then provided direct evidence for the role of smartphones as a source of psychological comfort, showing that participants who engaged with their smartphone reported a greater enhancement in comfort after stress relative to those using the same feature on their personal laptop (study 3) and even those using an otherwise similar smartphone belonging to someone else (study 4). An additional study reported in web appendix 1 (study 5) provides further support for our general thesis.

## Might Other Conceptualizations Better Describe Consumers' Relationship to Their Smartphone?

As discussed at the outset of this article, the majority of work on the topic of consumers' relationship to their phone has argued that it resembles a behavioral addiction (Alter 2017; De-Sola Gutiérrez et al. 2016; Hostetler and Ryabinin 2012). We believe, however, that "addiction" is an inadequate conceptualization of consumers' relationship to the device. While the term can be used to label a certain set of behaviors with the device, it is a strictly negativist framing of consumers' relationship to their phone and, more importantly, does not provide insight into the psychological mechanisms that give rise to this relationship. In this work we offer evidence that there is a positive emotional side to individuals' relationship with their phone: namely, its ability to serve as a source of comfort for many consumers. We posit that these associations of comfort apply to a broader segment of consumers than "addiction,"

which can be understood as a narrower behavioral phenomenon. Moreover, we propose and test a theory that explains the origins of this proposed relationship.

One question that might arise is whether the use of one's phone as a source of comfort results from its ability to serve as a means of distraction—something that could be similarly satisfied by a number of objects or substances (e.g., smoking or eating, as shown in study 5, web appendix 1). Consistent with this, participants in study 1 indicated that they often used their phone to distract themselves when they felt bored ($M = 5.42$ on a seven-point scale; significantly above the midpoint: $t(884) = 25.60$, $p < .001$). That said, our findings suggest that distraction is only *one* part of the story. In study 2, for example, participants who felt greater stress were more likely to seek out their smartphone over other objects at their disposal that could serve as a means of distraction (e.g., their laptop, newspapers). Likewise, in studies 3 and 4 we found, for example, that browsing the *same* distracting content (a particular Tumblr page) after a stress induction indeed helped participants recover from their discomfort, but that the rate of recovery was greater when participants browsed the content on their smartphone than on other devices. Taken together, these results suggest that distraction alone cannot fully account for the palliative benefits afforded by the device.

More generally, another possible conceptualization of the nature of consumers' relationship with their smartphone is that they view the device not as a source of comfort per se, but rather as an extension of themselves (Belk 1988; Schifferstein and Zwartkruis-Pelgrim 2008). To examine this possibility, in study 1 we asked participants to indicate (on a seven-point scale) the degree to which they thought of their smartphone or PC as an extension of themselves. We used a modified version of Ball and Tasaki's (1992) self-extension scale, which included the items: "My phone (PC) reminds me of who I am," "If my phone (PC) was praised by others I would feel as if I were praised," "If someone ridiculed my phone (PC) I would feel attacked," and "If I lost my phone (PC) I would feel like I lost a little of myself" ($\alpha = .87$). The results are inconsistent with a self-extension account of consumers' relationship to their device. First, participants tended to disagree when asked if they saw their smartphone as an extension of themselves ($M_{\text{Smartphone}} = 3.42$ out of 7; significantly below the scale midpoint; $t(884) = -10.44$, $p < .001$). Second, to the degree that they did view their phones as self-extension, it was to a lesser extent than their PC ($M_{\text{PC}} = 3.70$; contrast $F(1, 1353) = 8.12$; $p = .004$).

## Implications for Consumer Welfare and Practitioners

Our findings show that, in addition to deriving functional benefits from the device, phone owners seem to also derive emotional benefits that even Steve Jobs may have failed to foresee: a device with the capacity to provide comfort and relief in times of stress. In a field study reported in web appendix 1 (study 5), we provide real-world evidence that consumers particularly susceptible to stress—those who recently quit smoking—were more likely to show emotional and behavioral attachment to their phone, suggesting that the device may serve as a means of compensating for the stress relief previously afforded by cigarettes. The finding that people who recently quit smoking made greater use of their smartphone suggests that such behavior might actually be encouraged by health professionals as a means to reduce stress across a variety of contexts. While our results imply that adults can derive emotional benefits from engaging with their smartphone, as noted above, much of the extant research on people's relationship to the device has focused on the potential dark side to this attachment—the possibility that, for some, an emotional connection to their phone might develop into an apparent addiction to the device, with negative social and emotional consequences (Hostetler and Ryabinin 2012). An important area for future research, therefore, would be to better understand the conditions under which the comforting benefits of smartphone ownership might transform into an unhealthy dependence on the device and, just as critically, the kinds of design interventions that might be taken to diminish—rather than enhance—attachment in such cases.

Our results also have important practical implications for firms and marketers, who over the past few years have been responding to the "mobile revolution" by diverting more of their budgets to mobile advertising (eMarketer 2016) and attempting to pursue "mobile-first" digital strategies (Kepes 2015). The findings shed light on the unique emotional mind-set that consumers experience while on the device. For one, whereas mobile phone companies focus their persuasive messaging almost exclusively on features available on the device (e.g., battery life, display resolution), our findings suggest that marketers might additionally emphasize the psychological feeling of comfort and reassurance that comes with having one's smartphone in hand. To the extent that people are more open to processing information when in a relaxed state (Pham, Hung, and Gorn 2011), retailers could leverage this insight by investing more aggressively in beacons and other technology that enable them to reach customers on their smartphone in-store.

Finally, our theoretical model provides insights for smartphone brands that, for example, might be interested in understanding why consumers would be eager to upgrade their current phone even though the device serves as a source of comfort for them. Within our model, feelings of comfort are theorized to flow not just from mere ownership but also from the portability, customizability, and haptic nature of the device—attributes that tend to improve

with each new generation of smartphone models. Thus, if a newer model offers more opportunities for personalization and a more ergonomic and haptic interface, for example, then our model would predict that consumers may be willing to abandon their current smartphone for a potentially more comforting one.

## Limitations and Future Research

As one of the first theoretically driven attempts to understand the psychology that underlies consumers' relationship to their smartphone, our research was intentionally limited in scope. For example, study 1 showed that one of the antecedents of consumers' relationship to their phone is the haptic pleasure that arises from its use, which was further substantiated by the results of study 3 wherein participants derived more comfort from engaging with their smartphone than their PC, a less haptic personal device. An interesting avenue of future research would be to further explore the role of haptics in the effect—for example, whether similar psychological effects arise for other electronic devices that consumers have constant tactile contact with, such as "wearable tech" (e.g., Fitbits, Apple watches).

Future work could also investigate the relation of our findings to the literature on adult attachment theory, which has focused on people's style of attachments to close others. Notably, prior work has shown that people with insecure attachment (anxious or avoidant) tend to be more likely to rely on childhood attachment objects (such as a teddy bear) in adulthood (Nedelisky and Steele 2009). While a full empirical examination of this issue is outside the scope of the current investigation, as an initial exploration of this issue in study 1 we examined the degree to which participants' attachment styles correlated with the extent to which they viewed their phone as a source of psychological comfort (using the six-item scale described in study 2). We thus asked participants in study 1 to respond to Hazan and Shaver's (1987) adult attachment style scale (using rewording suggested by Collins and Read 1990), which measures the degree to which individuals exhibit three styles of interpersonal attachments: secure attachment, characterized by trust and friendship; anxious attachment, characterized by fear of being abandoned or unloved; and avoidant attachment, characterized fear of closeness. The results supported the expected associations. Participants who exhibited more of an avoidant attachment style were most likely to rely on their phone as a source of comfort ($r = .18$, $p < .001$), followed by those exhibiting greater anxious attachment ($r = .10$, $p = .003$). In contrast, there was only a weak association between secure attachment and degree of comfort derived from the device ($r = .06$, $p = .077$). These preliminary results suggest that people may rely on their smartphone as a surrogate for the comfort derived from interpersonal relationships, which is generally consistent with our broader conceptualization of smartphones as exhibiting similar properties as attachment objects. We see a more complete investigation of the relationship between people's attachment styles and the comfort they derive from their smartphone as a fruitful avenue for future research.

Moreover, we show that smartphones yield greater comfort by having all participants browse the same, relatively neutral content across devices (a particular page on Tumblr). We do not suggest, however, that this effect would hold across all types of content or activities. For example, in study 1 we show that people tend to derive greater comfort from their phone if they tend to use the device for more positive purposes such as social/entertainment, but derive relatively less comfort if they rely on it primarily for work. Future research could more directly test the boundaries of the effect, for example, by varying the valence of the content presented to participants across devices. Future work could also test for additional downstream consequences of the effects documented in this article—for example, whether the increased feeling of comfort associated with smartphone use will lead certain persuasive messaging (e.g., messages with more comforting language or ads for comfort-related products) to be particularly effective when targeted to users on their smartphones. Finally, if consumers are indeed more easily persuaded by certain messaging on their smartphone, as previous work suggests (Pham et al. 2011), this can be seen as a potential threat to more vulnerable populations—most notably young people for whom the problem of "smartphone addiction" is seen as quite real (Walsh et al. 2011). Another area for future research might thus be to investigate whether the factors that drive attachment for younger segments of the population differ from those driving attachment among older consumers.

## DATA COLLECTION INFORMATION

The first author supervised the collection of and analyzed all of the data. Study 1 was an MTurk survey conducted in March 2019. Lab studies 2 and 3 were conducted in the behavioral lab of Columbia Business School. Study 2 was conducted in February through April 2017, and study 3 was conducted in June 2015, and then continued running in January through March 2016. Study 4 was conducted in the behavioral lab of the Wharton School of the University of Pennsylvania in June 2018. Study 5 (reported in the web appendix) is an MTurk survey that was conducted in May 2016. All data can be accessed on the Open Science Framework at https://osf.io/z36ru/? view_only=03e059d0e7064bde89bc5bf01242bf73.

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