

Smartphones distract parents from cultivating feelings of connection when spending time with their children

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Abstract

In the U.S., 95% of smartphone users admit to having used their smartphones during their latest social gathering. Although smartphones are designed to connect us with others, such smartphone use may create a source of distraction that disconnects us from the people in our immediate social environment. Focusing on one fundamental social relationship—between parents and their children—we examined whether smartphones made parents feel distracted, thereby undermining key benefits parents reap when spending time with their children. In a field experiment at a science museum (Study 1), we randomly assigned parents to use their phones frequently or infrequently. Frequent phone use led parents to feel more distracted, which in turn impaired feelings of social connection and the meaning that parents derived when spending time with their children. In an additional weeklong diary study (Study 2), we found further evidence that smartphones can distract parents from reaping a sense of social connection when spending time with their children. These studies suggest that being constantly connected to the Internet may carry subtle costs for the fabric of social life.

Keywords

Human–computer interaction, mobile computing, parenthood, psychological need satisfaction, smartphones, social interaction, subjective well-being, ubiquitous computing

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Smartphones have penetrated society with unprecedented speed: In the 20 s that it took to type this sentence, about 1,000 smartphones were shipped to their future users (The Economist, 2015). This trend toward ever more powerful and portable computing devices has all the trappings of a new technological era, revolutionizing when, where, and how people work, socialize, and play (Slade, 2012; Thompson, 2013; Turkle, 2011). But even as these pocket computers remotely connect us with others anytime and anywhere, might they sometimes disconnect us from the people right by our side?

Sociologists (Tomlinson, 2007; Turkle, 2011), media theorists (Rushkoff, 2013), and technology experts (Lindley, 2015) have all argued that the ubiquity of connected digital technology is fracturing our attention, with adverse social and emotional consequences. In contrast to this abundant speculation, experimental research examining how phones affect social and emotional life is relatively scant. Previous research has examined the psychological consequences of specific digital activities—from Facebook (Kross et al., 2013; Montag et al., 2017) to text messaging (Guillory, Hancock, Woodruff, & Keilman, 2015) and e-mail (Kushlev & Dunn, 2015). In the present research, we go beyond this past work to explore how today's ubiquitous engagement with smartphones—and all of the functions they provide—affects the psychological benefits people reap from concurrent nondigital activities. We focus on perhaps the most fundamental social relationship: between parents and their children (Kenrick, Griskevicius, Neuberg, & Schaller, 2010).

Theoretical perspective

Our work starts from the assumption that smartphones are distinct from their closest predecessors—desktops and laptop computers—because of their *pervasiveness* in our daily lives (cf., Klopfer, Squire, & Jenkins, 2002; Sweet, 2016). With a smartphone in our pocket, we can message a friend while we are at work or check our work e-mail while we are spending time with our family. Of course, other information tools—from books and magazines to mechanical watches—are as portable as smartphones. Unlike smartphones, however, these tools do not afford *connectivity* (Sweet, 2016) to a limitless set of people, places, and activities. It is this combination of pervasiveness and connectivity that sets smartphones apart from the preceding forms of information technology.

This pervasive connectivity necessitates an understanding of how phones, in particular, might affect the psychological benefits people derive from concurrent nondigital activities. While psychological theory on the rapidly expanding intersection between digital and nondigital activities is scant (cf., Okdie et al., 2014), classic theorizing by James J. Gibson offers a starting point with the concept of *affordances* (Gibson, 1977). According to Gibson, “The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill” (Gibson, 1979, p. 127). Previous research has documented the psychological consequences of specific digital affordances, such as staying in touch with remote others (Guillory et al., 2015; Verduyn et al., 2015) and finding information (Kushlev & Proulx, 2016; Sparrow, Liu, & Wegner, 2011), but this work has largely neglected the concurrent affordances offered by the *nondigital* environment.

We theorize that the psychological consequences of using digital technology should depend on the interplay between the affordances of the digital and nondigital environments (cf., Kushlev, 2018). When people use smartphones to support their nondigital activities (e.g., reading reviews on Yelp to help a friend select a meal at a restaurant), they may reap greater benefits from those nondigital activities as a result. That is, engaging in digital activities that are relevant to the concurrent nondigital activity should enhance the rewards of that activity. In contrast to this *complementarity* process, an *interference* process may also be at play (Kushlev, 2018): When people use smartphones to access content that is irrelevant to their current nondigital activity (e.g., scrolling through Facebook posts while out with a friend at a restaurant), they may miss out on the benefits from their nondigital activity due to diminished attention. The magnitude of such interference should further depend on the affordances of the nondigital environment. When this environment offers relatively limited opportunities for the satisfaction of psychological needs, people have little to lose by devoting attention to digital activities. However, when the nondigital environment offers rewarding activities, people may fail to reap the potential benefits of these activities if they devote attention to their phones.

Existing research offers support for some of the proposed processes. Providing evidence for the complementarity process, Kushlev, Proulx, and Dunn (2017) demonstrated that people experience more positive moods when they are able to use digital technology to support their nondigital activities by finding directions to an unfamiliar place. Consistent with the interference process, Dwyer, Kushlev, and Dunn (2018) showed that people enjoyed a meal with friends significantly less when they were able to use their phones during the meal (compared to when phones were put away; see also: Kushlev & Heintzelman, 2018; Przybylski & Weinstein, 2013). In line with our theorizing and classic research showing that attention is a limited resource (e.g., Navon & Gopher, 1979), this effect was explained in part by the elevated levels of distraction people experienced when phones were present. Although this study was not designed to disentangle relevant from irrelevant types of phone use, the negative effects of phone use should only occur when phone use is irrelevant to nondigital activities.

Phone use and parenting

In the present research, we test the interference hypothesis in the context of one of the most fundamental social activities: spending time with one's children. Interactions with close others offer a critical source of social connection in daily life (Reis, Sheldon, Gable, Roscoe, & Ryan, 2000). Although spending time with children has sometimes been portrayed as an unpleasant experience (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004), more recent evidence points to the conclusion that parenting provides psychological need satisfaction and happiness in daily life (Nelson, Kushlev, English, Dunn, & Lyubomirsky, 2013; Nelson, Kushlev, & Lyubomirsky, 2014). According to our theorizing, phone use may interfere with deriving these psychological benefits of parenting.

While there is a growing interest in the effects of technology on parent-child interactions, research has primarily focused on the consequences of parents' digital

distraction for children's developmental processes (e.g., Radesky et al., 2014; Stupica, 2016). Research on the effects of digital distraction on parents' own experience with their children is much scarcer, with only a few qualitative and ethnographic studies shedding some light on this topic (e.g., Blackwell, Gardiner, & Schoenebeck, 2016; Mazmanian & Lanette, 2017). When researchers interviewed parents at Seattle-area playgrounds, for example, parents acknowledged that their phone use might reduce their attention to the world around them but also reported being able to easily reengage with their children when needed. The researchers' observations, however, conflicted with parents' optimistic perceptions: Parents who were using their phones frequently missed their children's bids for attention (Hiniker et al., 2015). These observations provide initial support for the idea that phone use may increase distraction in the context of parent-child interactions.

The present research

In the present research, we recruited parents attending a science museum with their children to participate in a field experiment, in which we randomly assigned parents to use their phones as much or as little as possible (Study 1). Based on our theorizing, we expected that phone use would reduce the psychological rewards parents derived from spending time with their children in this enjoyable context. Although we assumed that parents would use their phones primarily to engage in digital activities irrelevant to the science museum, we also asked participants to report *how* they used their phones. This enabled us to explore whether any negative effects of phones were reversed when parents used them to access material relevant to their museum experience. Because our experimental design introduced possible demand characteristics, we also conducted a daily diary study to examine phone use more unobtrusively (Study 2). Across both studies, we hypothesized that phone use would make parents feel more distracted, which in turn would interfere with their ability to cultivate feelings of social connection and emotional well-being.¹

Study 1: The Museum

Preregistered hypotheses

Based on our theorizing and the results of a pilot study, we preregistered three central hypotheses on the Open Science Framework at <https://tinyurl.com/KushlevDunnJSPPR-Study1Reg> (all subsequent preregistrations and materials are provided as footnotes). Specifically, we hypothesized that participants in the *high-use* (vs. *low-use*) condition would experience (1) lower attention quality, (2) lower social connectedness, and (3) lower emotional well-being. We also proposed a mediational model whereby parents in the high-use (vs. low-use) condition would be less attentive, thereby compromising their feelings of social connectedness, which would in turn predict lower emotional well-being.

Method

Participants

We recruited 200 parents (median age = 38; 56% women) who were spending time with their children at Science World, a science museum in Vancouver, Canada, that offers a variety of highly engaging educational displays and indoor playgrounds (for images and further details, see www.scienceworld.ca). Participants were entered in a draw to win a 1-year membership to the museum. We initially preregistered to recruit a sample of 260 parents to give us 80% power to detect an effect size of $d = .35$.² However, because of logistical constraints, we decided to amend our target sample size to 200, giving us 80% power to detect a similar effect size of $d = .40$; this decision was made without looking at the data.

Procedure

Parents were invited to take part in a brief study about their experiences at the museum. Prior to condition assignment, we informed parents that they might be asked to modify their phone use by either using their phones a lot or limiting their phone use. We thus ensured that everyone was willing to participate regardless of their condition assignment; random assignment was thus not compromised by people selectively opting out of the study after receiving the experimental instructions. After agreeing to participate, parents were randomly assigned either to use their phones as much as they safely could during their time at the museum (*high-use* condition) or to refrain from using their phones as much as possible (*low-use* condition).

After receiving the phone use instructions, parents were handed the survey in a pre-stamped and pre-addressed envelope, which they could mail or hand to a research assistant. We asked parents to wait at least 30 min before completing the questionnaire (thus ensuring that the manipulation could have an effect). Because we were interested in capturing parents' current feelings (rather than their recollections of how they felt), we instructed participants to complete the questionnaire before they left the science museum. Parents indicated where and when (i.e., the time and date) they completed the survey; only 10% of participants completed the survey outside this time window, and we kept all participants in the analyses to preserve random assignment. At the top of the survey, participants were instructed that all questions referred to how they felt and what they did at the museum after agreeing to participate in the study. To minimize participant burden and ensure the recruitment of a broad sample in this field experiment, we selected brief measures of each outcome.³

Subjective attention quality

To assess participants' subjective quality of attention, we adapted 2 items ($r = .56$) from the Attention subscale of the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R; Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007). Participants were asked to indicate how easily distracted they felt (reverse-scored) and how easy it was for them to concentrate on what they were doing, from 0 = *not at all* to 6 = *very much* ($M = 3.78$, $SD = 1.46$).

Social connectedness

To assess social connectedness, we adapted 2 items ($r = .46$) from the Social Connectedness Scale (Lee, Draper, & Lee, 2001). In particular, we selected the item with the highest loading on the main factor of the scale—I *felt distant from people* (reverse-scored)—and one other face-valid item—I *felt close to people*. Items were anchored on a scale from 0 = *not at all* to 6 = *very much* ($M = 3.93$, $SD = 1.52$).

Emotional well-being

To capture emotional well-being, we assessed mood by asking participants to report how they were feeling at the museum (Killingsworth & Gilbert, 2010), from 0 = *very bad* to 6 = *very good* ($M = 4.69$, $SD = .96$).

Meaning in life

Because a sense of meaning is among the most commonly documented well-being benefits of parenting (for a review, see Nelson et al., 2014), we also included an exploratory measure of how much meaning and purpose in life parents felt during the event: “To what extent have you experienced a sense of meaning and purpose in your life?” (0 = *not at all*; 6 = *very much*; $M = 3.67$, $SD = 1.67$). This single-item measure of meaning was developed in previous research with parents and correlates highly with a longer validated measure of meaning (Ashton-James, Kushlev, & Dunn, 2013).

Manipulation check

As a manipulation check, participants were asked how much they had used their phones, from 0 = *not at all* to 6 = *constantly* ($M = 2.20$, $SD = 2.11$). Parents reported using their phones more in the *high-use* condition ($M = 3.88$, $SD = 1.59$) than in the *low-use* condition ($M = .69$, $SD = 1.15$), $t(198) = 16.38$, $p < .001$. We also asked parents to report how much they had used their phones at Science World compared to how much they would have normally used their phones in that context: $-3 = \text{much less}$; $0 = \text{the same}$; $+3 = \text{much more}$ ($M = -.09$, $SD = 1.89$). Using a test value = 0 as an indicator for normal use in this context, one-sample t tests within each condition further indicated that parents in the *high-use* condition ($M = 1.17$, $SD = 1.64$) used their phones more than they normally would, $t(92) = 6.89$, $p < .001$, whereas those in the *low-use* condition ($M = -1.23$, $SD = 1.28$) used their phones less than they normally would, $t(102) = -9.80$, $p < .001$. To minimize demand characteristics, these questions about phone use came after our dependent measures.

Exploratory measures of phone use

In addition to testing our primary preregistered hypotheses of interference, we wanted to explore whether phone use relevant to the museum visit may be positively associated with well-being. Thus, we asked parents to indicate how much they had used their phones for both relevant and irrelevant purposes as follows: (1) to enhance your own experience at

Science World by accessing relevant content (e.g., apps and information); (2) to enhance your child's experience at Science World by accessing relevant content (e.g., apps and information); (3) to take photos; (4) to share photos or post about the experience on social media; (5) to use social media for purposes unrelated to Science World (e.g., browsing Facebook); (6) to socialize with other people (e.g., texting, calling, messaging); (7) to entertain yourself in other ways not related to Science World (e.g., playing games, reading news); (8) to access work-related content (e.g., work e-mail, etc.). All scales ranged from 0 = *not at all* to 6 = *constantly* (see Table 1 for means and standard deviations).

Results

Contextual descriptives

On average, the parents in our study had two children (median age = 5 years) who were both with them at the museum. In addition to being accompanied by their children, 44% of the participants were also with their partner, 16% were with friends, 15% were with other people's children, and 8% were with relatives.

Main effects

Confirming our first hypothesis, parents who were asked to maximize their phone use reported lower subjective attention quality than parents asked to minimize their phone use, $t(197) = -4.43, p < .001$ (see Table 2). Supporting our second hypothesis, parents in the *high-use* condition felt less socially connected than parents in the *low-use* condition, $t(197) = -5.11, p < .001$. We did not find support for our third hypothesis: Parents in the *high-use* and *low-use* conditions did not significantly differ in emotional well-being, $t(190) = -.64, p > .250$. We did, however, find that phone use negatively affected our exploratory measure of parental well-being: sense of meaning and purpose in life. Parents in the *high-use* condition experienced lower meaning than parents in the *low-use* condition, $t(195) = -2.12, p = .035$.

Mediation

Because our manipulation did not significantly affect emotional well-being, we only tested whether subjective attention quality mediated the negative effect of high phone use on social connection (for a test of the original model including emotional well-being, see Supplementary Online Material—SOM). We used Hayes's (2013a) PROCESS 2.10 for SPSS 24 (Model 4), applying bootstrapping with 50,000 resamples. As shown in Figure 1, we found a significant indirect effect of condition on feelings of social connection through subjective attention quality, $b = -.45$, 95% confidence interval (CI) $[-.71, -.24]$. By impairing quality of attention, higher phone use made parents feel less socially connected. We also found evidence for a remaining direct effect, $b = -.59$, 95% CI $[-.95, -.23]$, $p < .001$, such that higher phone use made parents feel less socially connected above and beyond its effects on attention. Thus, high phone use impairs feelings of social connection, at least in part by fracturing attention.

Table 1. Types of phone use and social connectedness (Study 1).

	Relevant content (self)	Relevant content (child)	Take photos	Share photos	Social media	Text/call	Entertain self	Work
<i>M (SD)</i>	.44 (1.08)	.50 (1.23)	2.50 (2.25)	.93 (1.69)	1.19 (1.82)	1.69 (1.96)	1.08 (1.86)	.83 (1.58)
% Reporting	18.8	17.8	65.5	28	37.8	56.1	31.3	28.7
Social connection (<i>r</i>)	.11	.15*	-.05	-.05	-.13 [†]	-.15*	-.12 [†]	-.18*

Note. The Pearson correlations represent the relationship between each type of phone use (0 = not at all; 6 = constantly) and social connectedness. *M* = mean; *SD* = standard deviation.

[†]*p* < .10; **p* < .05; ****p* < .001.

Table 2. Effects of phone use condition (Study 1).

	High-phone use, M (SD)	Low-phone use, M (SD)	Cohen's <i>d</i>
Attention quality	3.32 (1.52)	4.20 (1.27)	−.63*** [−.91, −.35]
Social connection	3.39 (1.66)	4.43 (1.19)	−.73*** [−1.02, −.44]
Emotional well-being	4.64 (1.01)	4.73 (.92)	−.09 [−.37, .19]
Meaning in life	3.40 (1.69)	3.90 (1.62)	−.30* [−.52, −.02]

Note. Numbers in square brackets indicate 95% confidence interval of the Cohen's *d* effects. *M* = mean; *SD* = standard deviation.
****p* < .001; ***p* < .01; **p* < .05.

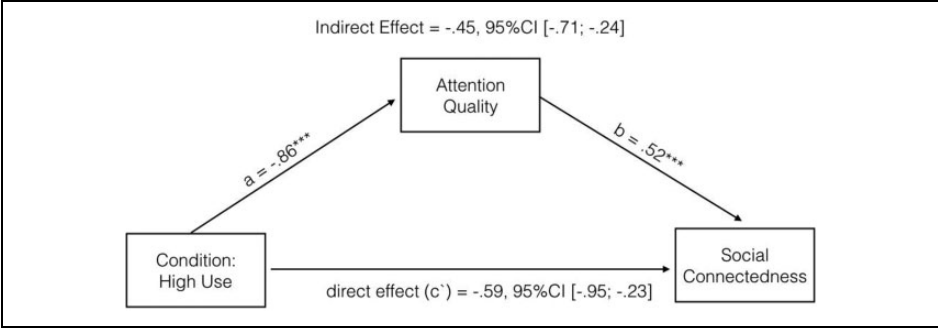


Figure 1. Attention quality mediates the effect of phone use on social connectedness.
Note. All values represent unstandardized regression coefficients. ***p* < .01; ****p* < .001.

Exploratory analyses

Combining across the two conditions, we explored the relationships between social connectedness and self-reported use of various phone functions (e.g., e-mail, social media, texting). From our theoretical perspective, any type of phone use that distracts people from their immediate social environment should detract from the sense of social connection they derive from spending time with close others. Consistent with this possibility, a series of exploratory Pearson correlations indicated that the negative effects of phone use on social connectedness emerged for diverse activities, ranging from using social media to accessing work-related content (Table 1). Our theorizing also predicts, however, that phones should not interfere with, and may even boost, social connectedness if phones are used to support people’s nondigital activities. Indeed, we found that parents who used phones to access content relevant to Science World in order to enhance the child’s experience tended to report higher—rather than lower—social connectedness. As shown in Table 1, however, parents reported fairly low levels of phone use within each category. Thus, while the overall pattern of relationships is consistent with our theorizing, these exploratory results need to be interpreted with caution.

Discussion

Study 1 provides initial experimental evidence that parents feel less attentive and, as a result, less socially connected when they use their smartphones frequently while spending time with their children. Of course, because we did not include a control group in which participants received no instructions regarding phone use, we cannot determine whether increased phone use led to costs or whether decreased phone use led to benefits. This strategy reflects our assumption that there is no meaningful or stable “neutral” level of phone use; rather, we would expect phone usage to fluctuate widely depending on the specific context, time of day, and so forth, limiting the value of a no-instruction control group.

An important limitation of Study 1 is that we may have created demand characteristics by informing parents that they could be asked to increase or decrease their phone use. We decided to provide this information upfront in order to preserve the soundness of random assignment (by preventing differential attrition between conditions) as well as for ethical reasons: After agreeing to our initial request to participate in the study, some parents might have felt compelled to go along with whatever set of instructions we subsequently provided (Cialdini & Goldstein, 2004), even if they felt uncomfortable using their phones while watching their children. The downside of this approach is that if parents believed that using smartphones would adversely affect them, they might have altered their survey responses to reflect this belief.

Another limitation of Study 1 is that we measured parents’ sense of social connection in general rather than specifically with their children. We chose this approach in order to capture the social connectedness that parents derived not only from their children but also from other sources (e.g., texting with friends). This approach also enabled us to avoid revealing that we were interested in parents’ experiences with their children, which could amplify impression management concerns, that is, parents might be reluctant to say they felt disconnected from their own kids.

Addressing these limitations, we designed a second study in which we measured people’s phone use in their daily life over 1 week. To reduce demand characteristics, we took care to obscure the purpose of this daily diary to examine the effects of phone use by intentionally embedding the question about phone use among several other common activities. Additionally, we used TurkPrime to collect data from Mechanical Turk, allowing us to preselect participants who owned a smartphone without explicitly asking about smartphone ownership. In this study, we measured both parents’ feelings of social connection in general and with their children specifically.

Study 2: A week in the life of a parent

Overview

We preselected participants who were parents and who owned a smartphone and invited them to take part in a study seeking to obtain “a snapshot of people’s experiences over 1 week.” The description was intentionally broad to avoid revealing that we were interested in smartphones or parenting at the initial recruitment phase. Once a day, for six consecutive days, we asked parents to report what they had been doing and feeling during the preceding 30 min. We also asked parents who they were with during those

episodes (including an option to select “my children”); we only examined episodes in which parents reported being with their children; as shorthand, we refer to these as “episodes with children,” to encompass the wide range of situations in which parents were with their children. We tested the relationship between phone use, subjective attention quality, and social connectedness during episodes with children. To minimize participant burden, we did not ask about emotional well-being, which was not significantly affected by phone use in Study 1.

Preregistration

We initially preregistered a sample of 100 parents and oversampled slightly to ensure enough usable participants. After examining the data (which were consistent with our hypotheses but statistically weak), we tripled our planned sample size to confirm whether the effects we initially observed were reliable,⁴ again oversampling slightly to ensure adequate usable participants. We predicted that during episodes with children, parents would report lower subjective quality of attention if they used their phones, which in turn would lead to lower social connectedness. We predicted only an indirect effect of phone use on social connectedness (via attention) because we anticipated that many other variables would influence feelings of social connection in the uncontrolled and highly varied settings of day-to-day life (compared to the relatively controlled experimental context of Study 1, in which all participants were in one museum, engaging in similar activities). Put in terms of our theoretical model, we expected that parents may stand to miss out on fewer psychological rewards in the context of mundane daily activities compared to the highly rewarding environment of a science museum.

Method

Participants

Participants were recruited through TurkPrime from the pool of Mechanical Turk participants in the U.S. who owned a smartphone and had at least one child aged 19 years or younger. We first recruited 114 participants, all of whom reported at least one episode with their children. In total, these participants reported their phone use during 467 episodes when they were with their children. As described above, we then recruited an additional 202 participants, of whom 178 reported an episode with their children. Thus, the expanded sample included 292 parents (median age = 35; 68% women), with 1,228 episodes with children in which participants answered our question about phone use. Participants were paid US\$0.50 per survey.

Procedure and measures

On a Saturday, participants signed the consent form online and enrolled in the study. On each of the next 6 days (from Sunday to Friday), participants sent a survey via e-mail containing the focal measures: phone use, attention, and social connectedness in general and with their children. To maximize the likelihood of capturing episodes when parents

were spending time with their children, we asked parents to complete the surveys between 6 p.m. and 9 p.m.

On each daily survey, parents were asked to report how they had been feeling and what they had been doing in the past 30 min, thus capturing one half-hour episode of their day. Because we were interested only in episodes when parents were spending time with their children, we asked participants to report who they were with during the past 30 min; “my children” was included among other options (i.e., *friends, significant other, other people not listed*).

We asked participants to report how much they had been using their smartphones (0 = *not at all*; 6 = *very much*) among several other common evening activities: socializing, preparing food, relaxing, and eating. Parents also completed the same measures used in Study 1 assessing subjective attention quality ($M = 4.26$; $SD = 1.58$) and general social connectedness ($M = 4.53$; $SD = 1.52$) on a scale from 0 = *not at all* to 6 = *very much*. Additionally, we modified the social connectedness items to capture social connectedness with their children specifically (i.e., *In the past 30 min, I felt distant from my children* and *In the past 30 min, I felt close to my children*; $M = 5.05$; $SD = 1.25$). As we had assumed in Study 1, the two measures of social connectedness were highly related, $r = .63$, $p < .001$.⁵

Results

Episode descriptives

Of the 1,228 episodes with children, about two-thirds ($n = 835$) included phone use and one-third ($n = 393$) did not include phone use. The majority of the episodes with children also contained other typical evening activities, such as preparing food (52.5%), eating (58.8%), relaxing (79.6%), and socializing (86.1%). Similarly, in 61% of the 1,228 episodes with children, participants reported also being with their partner; episodes including other social partners were fairly uncommon (e.g., being with friends: 5.9%). Thus, as intended, our surveys captured an array of typical family evening activities.

Analytic strategy

During episodes when parents were with their children, we examined the relationship between smartphone use and attention, as well as social connectedness. As preregistered, we analyzed how parents felt during episodes with no phone use as compared to episodes with phone use. Because each parent had multiple episodes, we employed multilevel modeling, thus accounting for the nonindependence in observations. The models included the intercept, random intercept, and the fixed effects of phone use. To use the most parsimonious models, the random effects of phone use were not included in the models as they did not substantively influence the fixed effects, which are of primary interest. To estimate total effects, we used SPSS 21 with restricted maximum likelihood estimation. To estimate indirect effects, we used Hayes's (2013b) macro for Mplus 7.1.4.⁶ We present the total and indirect effects of phone use in the full sample

Table 3. Main and indirect effects of phone use on episodes with children (Study 2).

	Initial sample (<i>n</i> = 114)	Full sample (<i>N</i> = 292)	<i>p</i> _{augmented}
Total effect			
Attention	−.39**	−.27**	.050, .053
Indirect effects			
Social connectedness (general)	−.03 [†]	−.08*	.050, .062
Social connectedness (with children)	−.05	−.06*	.056, .062

Note. The main effects on attention represent the fixed effects of phone use from the described multilevel model; these fixed effects can be interpreted as the mean difference in attention between episodes with children when parents were using their phones and episodes with children when parents were not using their phones. *p*-Augmented (Sagarin et al., 2014) is a measure of the Type I error inflation rate in the full sample due to the sample size augmentation. The lower-bound value represents the inflation rate under the best case scenario when the sample would not have been augmented with any *p* value larger than the one actually obtained in the initial sample; the upper-bound value represents the inflation rate when the sample would have been augmented even under *p* = 1 in the initial sample, providing the most liberal estimate of Type I error inflation. Note that, by definition, *p*-augmented cannot be smaller than the critical $\alpha = .05$.

(*N* = 292). For full transparency, we also present evidence for the hypothesized effects from the initial sample (*n* = 114) in Table 3. Because collecting an additional batch of data can inflate Type I error, we also calculate *p*_{augmented} statistics to quantify the extent of this potential inflation due to data augmentation (see Table 3). In a recent influential paper, Sagarin, Ambler, and Lee (2014) show that *p*_{augmented} “allows researchers to augment a dataset in a fully ethical manner” (p. 300). As they note, *p*_{augmented} will always be greater than .05, but values close to .05 indicate that any inflation of the Type I error rate is fairly minimal.

Attention

As predicted, during episodes with children, parents experienced lower subjective quality of attention when they used their phones than when they did not use their phones, *b* = −.27, *p* = .005. Additional tests for Type I error inflation due to augmenting the sample size suggested negligible effects of augmentation (see Table 3). Moreover, the effect of phone use on attention held when controlling for age, gender, and personality traits (see SOM, for details).

Social connectedness

During episodes with children, phone use was not significantly associated with feelings of social connectedness in general, *b* = −.15, *p* = .103, or social connectedness with children, *b* = −.06, *p* > .250. Consistent with our preregistered hypothesis, however, we found significant indirect effects of phone use through attention on both general social connectedness, *b* = −.08, *p* = .017, and social connectedness with children, *b* = −.06, *p* = .017 (Table 3); thus, to the extent that phone use compromised parents’ quality of attention, parents experienced lower feelings of connection (both in general and with children specifically).

Robustness tests

When parents were with their children, the majority were also with other people (primarily their partners). It is thus possible that phone use would have little to no effect on feelings of attention when parents were simply alone with their children. As a robustness test, therefore, we reran the analyses using only the episodes ($n = 388$) in which parents were with their children only. We found that the use of phones was an even stronger predictor of reduced attention when parents were solely with their children, $b = -.61$, $p < .001$, suggesting that the presence of others is a suppressor rather a confounder in the relationship between phone use and attention.

Discussion

Study 2 provided further support for our theorizing that phone use can interfere with the benefits of spending time with one's children by compromising attention quality. To the extent that phone use was associated with lower subjective quality of attention, parents experienced lower sense of social connection during episodes when they were with children. Although correlational, these findings addressed several alternative explanations for the effects observed in Study 1. First, while in Study 1 we focused on preserving random assignment, in Study 2 we took care to decrease demand characteristics by concealing that the purpose of the research was to examine the effects of smartphones. Second, going beyond general feelings of social connectedness assessed in Study 1, we observed the effects of phone use on how connected parents felt specifically with their children. Taken together, the two studies provide evidence for the interference hypothesis, whereby phone use reduces attention, which undercuts the psychological rewards of spending time with one's children.

General discussion

Across a field experiment and a weeklong diary study, frequent smartphone usage distracted parents from cultivating feelings of social connection while spending time with their children. At a science museum (Study 1), parents assigned to use their smartphones frequently reported feeling more distracted and less socially connected than parents who were assigned to minimize their phone use. Tracking almost 300 parents' phone use in daily life (Study 2), we found that parents who reported having used their smartphones while spending time with their children felt more distracted, which in turn was associated with lower feelings of social connection—both in general and with children specifically.

From our theoretical perspective, the psychological consequences of smartphones should depend on whether this technology directs attention toward or away from our concurrent nondigital activities. Consistent with this idea, we found exploratory evidence in Study 1 that the negative effects of phone use were reversed when parents used their phones to access content that was relevant to their children's experience at the science museum. And, in Study 2, we found that phone use only undermined parents' social connection with their children when phone use made them feel distracted.

Consistent with our theorizing, then, the costs of using smartphones appear to emerge when this technology distracts us from the nondigital environment.

Moreover, consistent with our theorizing, the psychological consequences of phone use appear to depend on the rewards offered by the nondigital environment. In our field experiment, we intentionally chose to study an environment in which parents engaged in potentially rewarding activities with their children. In this context, the negative effects of phone use on attention and social connectedness were statistically large. In comparison, the effects of phone use were substantially smaller in our daily diary study and the effect on social connectedness only emerged as an indirect effect through distraction. When parents are spending time with their children in environments that afford relatively few opportunities for social connection (e.g., watching a kid's soccer practice alone), phone use should have less to interfere with, producing smaller detrimental effects (see Kushlev & Heintzelman, 2018; Przybylski & Weinstein, 2013). Thus, in contrast to popular media portrayals of phone use as wreaking devastation on family life (e.g., Restom, 2015; Shapiro, 2014; Stafford, 2015), the effects of phones appear to be relatively subtle in daily life.

It is also worth noting that we found no direct effects of phone use on mood in Study 1 or on social connectedness in Study 2. The null effects we observed may have been due to two competing effects that canceled each other out: a negative effect through reduced attention and a positive effect through engagement in entertaining digital activities. In the science museum (Study 1), for example, parents using their phones might have enjoyed games, funny videos, or an interesting article, which could have boosted their mood. In daily life (Study 2), phone use might improve parents' well-being by serving as a reprieve from the potential tedium of childcare. Parents today spend more time with their children than did parents of preceding generations (Dotti Sani & Treas, 2016), and social media, texting, or related activities may provide parents with a link to adult social life or serve as a source of social support (Duggan, Lenhart, Lampe, & Ellison, 2015). Consistent with this possibility, parents use Facebook more than adults without children (Duggan et al., 2015). Future research should explore these potential positive effects of phone use by measuring whether phone use can increase people's sense of interest and enjoyment.

Despite their subtlety, the negative effects of phone use we observed in Study 2 were quite robust, emerging even when we controlled for personality and demographic variables. Moreover, we were able to observe the same psychological processes—whereby phone use was linked to lower subjective attention quality, which in turn was linked to lower feelings of social connection—in both our naturalistic field experiment in Canada and our daily diary study in the U.S.

Limitations

Each of our two studies had notable limitations. In Study 1, participants knew that we were interested in manipulating their phone use, potentially creating demand characteristics. In Study 2, we tried to minimize demand characteristics as much as possible by embedding the question about phone use in a battery of questions about other common daily activities. Another potential limitation of Study 1 was the absence of a no-

instruction control condition; we chose this strategy intentionally because the relative effects of a no-instruction control condition might be difficult to replicate in other contexts, given that the baseline levels of phone use are likely to vary as a function of the social setting. In contrast, we would expect the differences we observed between the low- and high-phone use conditions to replicate across a wide variety of contexts in which parents are spending time with their children. Notably, Study 2 revealed a very similar pattern of results when we simply examined participants' own naturalistic phone use over the course of a regular week. The primary limitation of Study 2 is that it relied on correlational methods, precluding strong causal conclusions. Taken together, however, our studies provide initial converging evidence for our central argument that phone use impairs subjective attention, thereby compromising feelings of social connection when parents are spending time with their children.

A shared limitation of both studies is that we relied on self-report measures of phone use. Because of this important limitation, we did not attempt to conduct fine-grained analyses of phone use. Instead, our self-report measure in Study 1 simply served as a manipulation check, and we did not exclude participants on the basis of their responses to this question. In Study 2, we used a dichotomous approach, comparing episodes in which people had not been using their phones at all to episodes in which at least some phone use had occurred (rather than analyzing degree of phone use, which might have been a noisier measure). That said, as reliable trackers of phone use become increasingly available, it would be worthwhile for future research to employ objective measures of phone use in order to conduct more fine-grained analyses.

It is also important to acknowledge that smartphones are far from the only source of distraction in daily life (e.g., Daly, 2001; Lee & Chae, 2007; Mazmanian & Erickson, 2014). Indeed, even before the advent of the smartphone, Gergen (2002) argued that each major advance in communication technology—from the printing press to the standard telephone—has facilitated a state of “absent presence;” that is, when our minds are drawn into a novel, a phone call with a distant relative, or a Facebook conversation, we become less present in our own physical environment. That said, smartphones appear to offer a particularly pervasive source of distraction due to their combination of portability and connectivity. In the U.S., 95% of smartphone users admit to having used their smartphones during their latest social gathering (Rainie & Zickuhr, 2015)—a proportion that seems unlikely to extend to traditional media, such as newspapers and novels. And when researchers observed parents at Seattle playgrounds, they found that the majority used their smartphones (Hiniker et al., 2015). Although most used their phones fairly briefly, all of the parents who were interviewed had thoughts or concerns about phone use while spending time with their children, underscoring the need for rigorous research specifically on the effects of smartphones. That said, the interference hypothesis could and should hold true for the use of other media—from books to TV—during times spent with others (Kushlev, 2018).

Conclusion

On a broader theoretical level, our results provide support for our central premise that the new technological era of pervasive connectivity—in which people are constantly

connected to the Internet—may foster feelings of distraction that make it harder to reap rewards from the immediate social environment (cf., Montag & Diefenbach, 2018). It would be worthwhile to test our proposed complementarity and interference processes in other social contexts, from first dates to family vacations. Our theorizing suggests that the very devices intended to connect us with others can, ironically, undermine our feelings of connection while spending time with the most important people in our lives.

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Supplemental material

Supplemental material for this article is available online.

Notes

1. Data for both studies are available at <https://tinyurl.com/KushlevDunnJSPRData>. All data and project materials provided in this report are licensed under Creative Commons (CC)-By Attribution 4.0 International; for details, see <https://creativecommons.org/licenses/by/4.0/>.
2. Preregistered power analysis, Study 1: <https://tinyurl.com/KushlevDunnJSPR-Study1Pow>.
3. The full questionnaire was preregistered and is available at <https://tinyurl.com/KushlevDunnJSPR-Study1Q>.
4. Preregistered sample size, hypotheses, and analyses, Study 2: <https://tinyurl.com/KushlevDunnJSPR-Study2Reg>.
5. The questionnaire is available at <https://tinyurl.com/KushlevDunnJSPR-Study2Q>.
6. We modified our original preregistered mediation analysis plan, which required that participants have episodes both when they were using their phones and when they were not. Of the 292 participants, only 139 participants had both types of episodes. Using multilevel modeling mediation analyses, we were able to use all available data.

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