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Are Smartphones Enhancing or Displacing Face-to-Face Communication With Close Ties? A Panel Study Among Adults

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Previous research has revealed inconsistent findings regarding enhancement or displacement of face-to-face (FtF) communication due to social media and smartphone use. We argue that the occurrence of enhancement or displacement effects is contingent on the specific type of smartphone use. Specifically, we tested how adults' communicative and noncommunicative smartphone uses influence the quantity of FtF communication and quality of relationships with family and friends. Results of a two-wave panel survey (N_{Time2} = 461) revealed a positive influence of communicative smartphone use on quantity of FtF communication with family and friends, supporting the enhancement hypothesis. Quality of relationships with close ties, however, was not influenced by communicative smartphone use. In line with the displacement hypothesis, we found a negative influence of noncommunicative smartphone use on quantity of FtF communication with close ties, but not on quality of relationships with family and friends.

Keywords: close ties, displacement hypothesis, enhancement hypothesis, face-to-face communication, panel study, smartphone use

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In our daily interactions, both smartphone use and interpersonal face-to-face (FtF) communication are intertwined. In fact, one study revealed that 85% of mobile phone owners used their phone during a social activity with family or friends (Richter, 2018). In this context, smartphones may act as a double-edged sword (T. H. Chan, 2014). On the one hand, smartphones serve as a main social tool for enhancing and maintaining relationships (Ellison, Steinfield, & Lampe, 2007; Ellison, Vitak, Gray, & Lampe, 2014). On the other hand, they can hinder or diminish FtF communication, suggesting the displacement of real-life social interactions (e.g., Kraut et al., 1998; Sbarra, Briskin, & Slatcher, 2019; Verduyn, Schulte-Strathaus, Kross, & Hülsheger, 2020).

Previously, researchers assumed that the time spent engaging with a mass communication medium such as television caused social displacement because of lack of time (Kestnbaum, Robinson, Neustadtl, & Alvarez, 2002). However, with the rise of Internet-enabled mobile devices, both interpersonal and mass communication have merged into one device (Kestnbaum et al., 2002), in this case, the smartphone (Humphreys, Karnowski, & von Pape, 2018).

The displacement effects of new technologies have been studied since the seminal work by Kraut and colleagues (1998). They found negative effects of Internet use on social relationships. The so-called displacement hypothesis has been tested ever since, resulting in inconsistent empirical findings (e.g., Kraut et al., 2002). Despite these mixed results, it is highly relevant to study potential displacement effects because of omnipresent smartphone use. Given that smartphones can be used anytime and anywhere, such a displacing effect of interpersonal communication with close ties could even amplify. In a recent study, researchers assessed daily mobile communication experiences and FtF communication. Results showed that there are within-person displacement effects on a daily level because of smartphone use (Verduyn et al., 2020).

Concurrently, researchers have been arguing for the opposite effect, suggesting the enhancement of FtF communication. The hyperpersonal theory of mediated communication (Walther, 1996) stipulates that media can facilitate communication that exceeds interpersonal levels of FtF communication. Thus, the stimulation hypothesis (Valkenburg & Peter, 2007), as well as reciprocal positive effects of online and interpersonal FtF communication (i.e., the reinforcement hypothesis; Dienlin, Masur, & Trepte, 2017), have been confirmed in previous research studies (e.g., Desjarlais & Willoughby, 2010; Reich, Subrahmanyam, & Espinoza, 2012; Valkenburg & Peter, 2009).

The existing contradictions between displacement and enhancement may be explained by different types of smartphone use, which previous research has not sufficiently considered. In the present study, we argue that the consequences of smartphone use on FtF communication depend on how the smartphone is being used. Not all of the time spent on the smartphone is equally distributed. Among various activities, users can decide whether they will actively engage in communication with others (Burke & Kraut, 2016) or just passively observe the content (Wang, Gaskin, Rost, & Gentile, 2018).

Such a distinction is relevant for understanding the influence of smartphone use on existing social relationships and can account for the inconsistent findings in prior research. Smartphones can serve as a supplementary tool for offline interactions, and mobile communication may lead to more offline encounters as it stimulates connection (e.g., Vriens & van Ingen, 2018). Previous research has established a positive gain

from online communication, mainly in receiving social support (Kim, 2014). In this sense, the stimulation influence can result in positive outcomes for relationship quality (e.g., Valkenburg & Peter, 2007). However, smartphones enable individuals to engage in other unique ways of use, such as noncommunicative activities (e.g., reading, searching for information), which may replace the time reserved for FtF communication. These passive activities rather than communicative activities may lead to a time displacement of real-life social interactions, but they may also negatively affect the quality of offline relationships.

Although existing research has made an important contribution to our knowledge of enhancement and displacement effects on interpersonal communication, there are considerable gaps. First, researchers have examined either Internet online communication (Valkenburg & Peter, 2007) or social networking sites (SNSs) and instant messaging (IM) use (Dienlin et al., 2017), which are both exclusively focused on communication activities. Little attention has been paid to the overall use of smartphones. It is not yet understood how different smartphone activities may influence FtF communication with close ties. We contribute to the literature by testing the enhancement and displacement effects of smartphone use while distinguishing between two usage patterns, that is, communicative/active and noncommunicative/passive smartphone use.

Second, we focus not only on the quantity (frequency), but also the quality of relationships with close ties. Studies have shown that smartphones may disturb offline social interactions and cause *phubbing*, that is, ignoring someone's presence in order to use the smartphone (J. A. Roberts & David, 2016). Thus, it is highly relevant to look beyond the quantity and also assess the impact of smartphone use on the quality of relationships.

Third, there is a lack of panel studies, with only a few testing the displacement effects in the context of social media use among adults (Dienlin et al., 2017; Vriens & van Ingen, 2018). So far, research in this area has been mostly cross-sectional, leaving little space for inferences over time and the temporal order of the relationships. Two-wave panel designs are therefore necessary because they allow us to see the changes in the proposed relationships between online and offline behaviors in the longer term.

With regard to the existing research gaps, we conducted a two-wave panel survey with a sample of smartphone users ranging from adolescence to older adulthood. The main goal of our study was to examine potential long-term enhancing and displacing effects of overall smartphone use on the quantity and quality of FtF communication with family and friends.

Theoretical Background

Face-to-Face and Smartphone Communication With Close Ties

Maintaining relationships with close ties is one of the main goals for individuals. Face-to-face interactions with family and friends ensure feelings of social connectedness and life satisfaction (Chopik, 2017). Nowadays, individuals continue and extend their offline social interactions through their smartphones, which serve as new connectivity tools for bonding (e.g., Ellison et al., 2007). Previous research has shown an amplitude of positive associations between online communication and bonding social capital

(Burke, Kraut, & Marlow, 2011) as well as perceived social support from family and friends (High & Buehler, 2017). However, findings from recent studies point toward negative outcomes. Kushlev and Dunn (2018) found that increased parental smartphone use during the time spent with children diverts their attention and distracts their social and emotional connections with children. Similarly, negative outcomes occurred among friends. Researchers have found that increased digital media use leads to the displacement of social interactions among the same cohort group (Twenge, Spitzburg, & Campbell, 2019). However, these studies focused either on the parents and young children or on adolescents, while neglecting the relationships among adults. In our study, we examine the smartphone influences on FtF communication with family and friends across generations.

Defined as core networks (Vriens & van Ingen, 2018), strong ties constitute the main social circle throughout the lifespan. Family members are oftentimes a given social circle, from an individual's birth onward, whereas friendships are prone to change over time and might be flexible. Procidano and Heller (1983) explain the relative distinction in the relevance of family and friends in individual's life. Friendships may be of shorter duration than family relationships and might as well begin later in life. A change in friendship circles happens because of moving and employment, whereas the change in family circles typically occurs because of the loss of a family member. In the present study, we include both types of close ties with the aim of examining FtF communication with family and friends separately.

Communicative and Noncommunicative Smartphone Use

Because smartphone devices offer numerous affordances to its users (e.g., Humphreys et al., 2018), we distinguish between two main types of use: communicative and noncommunicative (e.g., Elhai, Levine, Dvorak, & Hall, 2017; Frison & Eggermont, 2015; Van Deursen, Bolle, Hegner, & Kommers, 2015; Verduyn et al., 2015). The two usage patterns are not exclusive and can even occur simultaneously while using the smartphone. However, it is important to differentiate between these two types of use because researchers have found different outcomes.

Communicative smartphone use refers to active interaction and engagement through talking, texting, and commenting on social media content (Burke & Kraut, 2016; Frison & Eggermont, 2015). This type of communication can be regarded as a direct one, with a clear social purpose (Burke & Kraut, 2014). Specifically, it involves calling family and friends, communicating over mobile SNSs, and sending and receiving e-mails, as well as sending and posting photos (M. Chan, 2015). Communicative use is considered essential for the enhancement of existing relationships and relationship maintenance (Ellison et al., 2014; Valkenburg & Peter, 2009). It extends and strengthens perceived connection with others (e.g., Lee, 2009), and those positive social experiences may lead to feelings of gratification (Van Deursen et al., 2015). Overall, mobile communication with social media and SNSs has been shown to exert positive influences on individuals' emotion regulation (Hoffner & Lee, 2015), social capital (Cho, 2015), social support (Kim, 2014), and well-being (Burke & Kraut, 2016; M. Chan, 2015; Stevic, Schmuck, Matthes, & Karsay, 2019).

Noncommunicative smartphone use refers to passive activities, such as reading, observing, and following other people's profiles without active social engagement (Elhai et al., 2017; Wang et al., 2018). More precisely, this type of use includes searching for information, reading news, listening to the radio,

watching videos, and scrolling through social media profiles without interaction. All of these activities cause individuals to perpetually rely on their smartphones, resulting in the inevitable exclusion of everyday social interactions (Chotpitayasunondh & Douglas, 2018). Researchers focusing on passive social media use have found positive associations with depressive symptoms (Escobar-Viera et al., 2018) and negative social comparison (Frison & Eggermont, 2016). In addition, this type of use has been found to decrease individuals' well-being (Stevic et al., 2019; Verduyn et al., 2015; Wang et al., 2018). Based on these diverging outcomes, we differentiate between communicative/active and noncommunicative/passive smartphone use and their influence on quantity of FtF communication and quality of relationships with family and friends.

The Enhancement of Face-to-Face Communication

With growing technological advancements, interpersonal FtF communication has also become more mediated than before. Based on the hyperpersonal theory of mediated communication (Walther, 1996), online communication enhances interpersonal relations because of newly added elements. We can expect enhancement of offline social interactions because of the mobility of smartphone devices, which secures permanent access to social contacts.

The main rationale behind the stimulation (Valkenburg & Peter, 2007) and the reinforcement hypothesis (Dienlin et al., 2017) posits that online communication enhances the frequency of existing social interactions. Early research has suggested that "the Internet use may enrich social networks with new or newly resurrected social contacts" (Kestnbaum et al., 2002, p. 36). Valkenburg and Peter (2007) state that if "the reason to use the Internet is primarily to maintain contacts with existing friends, the prerequisite for a displacement effect is not fulfilled" (p. 1170). Instead, frequent communication via smartphones should positively influence the quantity and quality of offline relationships, as shown with increased bridging and bonding social capital (Ellison et al., 2007).

Regarding the enhancement effects on quantity, Lee (2009) found that the time spent with friends was not replaced by computer activities. Carrier, Spradlin, Bunce, and Rosen (2015) found that online activities increase the time spent in FtF communication. Dienlin and colleagues (2017) found a reciprocal reinforcing influence of communication on SNSs that increased frequency of FtF communication with family, friends, and acquaintances in the long term. Individuals who often communicated FtF were more likely to frequently communicate on SNSs and messaging applications.

In terms of the quality of close relationships, Valkenburg and Peter (2007) found that online communication has a positive effect on friendship quality through the increased time spent with friends because partners in online communication are mostly close ties. Desjarlais and Willoughby (2010) showed that communicating over the Internet has a positive influence on the quality of friendships for adolescent girls in the long term. Reich and colleagues (2012) indicated that SNSs strengthen offline friendships, and other researchers have found that communicative mobile use increased friendship satisfaction and social support (M. Chan, 2018) despite the number of close ties (Kim, 2014). In sum, the findings from the studies examining the enhancement effects suggest that online or social media use for communicative purpose may positively influence FtF communication, especially among close ties (Koutamanis, Vossen, Peter, &

Valkenburg, 2013; Spradlin, Cuttler, Bunce, & Carrier, 2017). Building on previous theoretical and empirical findings, we proposed the following hypotheses:

H1: Communicative/active smartphone use will positively influence the quantity of FtF communication with (a) family and (b) friends over time.

H2: Communicative/active smartphone use will positively influence the quality of relationships with (a) family and (b) friends over time.

The Displacement of Face-to-Face Communication

The main rationale of the displacement hypothesis posits that the time spent on one activity cannot be spent on another activity (e.g., Lee, 2009; Nie, Hillygus, & Erbring, 2002). Theoretically, online use displaces the time that would have been spent otherwise, in this case, on offline FtF communication (Valkenburg & Peter, 2007). Early research on Internet use assumed that users' online interaction replaces their offline interaction with family and friends. Specifically, Kraut and colleagues (1998) found that interpersonal communication is the dominant Internet usage pattern. In that sense, they explain displacement effects as a paradox. The Internet, which is a social technology used for communicative purposes with other individuals or groups, in fact, results in a decline of offline social interactions. Their research showed that the more time users spend online, the less they would interact offline with family and friends. Such a process is problematic, as precisely these close offline relationships may provide support for one's life and ensure satisfaction (Kraut et al., 1998). For general Internet and social media use, studies have shown that this pattern exists. As online activity increases, offline interactions with family members decline (Lee, 2009; Nie et al., 2002).

Despite the evidence supporting the displacement hypothesis, Kraut and colleagues (2002) conducted a follow-up study of the original Internet paradox research. This time, findings did not yield support for the displacement hypothesis. Instead, Internet use predicted positive outcomes for extroverted individuals on social involvement and well-being. Similarly, in other studies, researchers did not find support for the displacement effect of Internet use either (Kestnbaum et al., 2002; Valkenburg & Peter, 2007). For example, Tokunaga (2016) tested the displacement hypothesis in a cross-sectional and a panel study among young adults. He examined how different Internet activities (i.e., social, leisure, and information-seeking) affect professional and social difficulties. The results showed no support for the displacement hypothesis. Similarly, Dienlin and colleagues (2017) found no displacement effect of the use of SNSs and IM on FtF communication. However, in a recent study using mobile experience sampling, researchers found displacement effects of smartphone use on a daily base within-persons level, but not on a long-term between-persons level (Verduyn et al., 2020). A recent literature overview suggests that *technoference*, defined as smartphone use that interferes with or intrudes social interactions, undermines interpersonal relationships (Sbarra et al., 2019).

These inconsistent findings suggest that displacement effects might occur under specific conditions only. We argue that displacing effects might be more prevalent when smartphones are used for noncommunicative and isolative purposes instead of communicative purposes. For example, using

computers or smartphones for frequent gaming might be one reason for the displacement of FtF interaction (Shen & Williams, 2010) because the focus is on pastime activities. Existing research has shown that time spent on online (social) gaming reduces offline social interactions (Lemmens, Valkenburg, & Peter, 2011) and creates displacement effects (Kowert, Domahidi, Festl, & Quandt, 2014), especially for women (Carrier et al., 2015). Although not addressing smartphone use but different types of SNS use, Huang (2017) found in a meta-analysis that browsing other people's (strangers) profiles can lead to the displacement of time spent on real-life communication with family and friends. Building on these findings, we suggest that spending more time on the smartphone for pastime activities and other reasons than social interaction could replace the time otherwise spent with close ties.

With regard to the quality of FtF communication with close ties, Campbell (2019) notes that "mobile communication especially complicates claims of a zero-sum game. Rather than time displacement, the trade-offs associated with it may manifest in other ways, such as the quality rather than quantity of time spent engaging with co-present people" (p. 58). Existing research has shown adverse effects of passive use on individuals' quality of life (Verduyn et al., 2015; Wang et al., 2018). J. A. Roberts and David (2016) found evidence that the partners' overall smartphone use (phubbing) leads to more conflict about the mobile phone and decreased relationship satisfaction. Using a field experiment, Dwyer, Kushlev, and Dunn (2018) showed that the presence of mobile phones decreased the enjoyment of real-life social interactions. Especially during FtF communication, participants felt more distracted because of smartphone use. However, there have been no studies that differentiate between communicative and noncommunicative uses. Considering the relevance of social relationships for individuals' life satisfaction, it is necessary to examine whether noncommunicative/passive smartphone use is culpable for lower quality of relationships with close ties in the long term. Therefore, we suggested the following hypotheses:

H3: Noncommunicative/passive smartphone use will negatively influence the quantity of FtF communication with (a) family and (b) friends over time.

H4: Noncommunicative/passive smartphone use will negatively influence the quality of relationships with (a) family and (b) friends over time.

Lastly, we are interested in different intensities of smartphone effects on close ties. Campbell (2019) suggests that smartphones represent an "added layer of connectivity in all realms of social life" (p. 53). In that context, communicating through smartphones enhances bonds among close ties because there are no restrictions to access them (Campbell, 2019). However, literature indicates that displacement of close ties might differ among friends and family (Lee, 2009) in a way that individuals who live with their family members might spend less time with them if they engage in more online communication with friends. Another relevant distinction comes from a longitudinal study among students. Based on the evolutionary theory, S. G. Roberts and Dunbar (2011) demonstrated that there are important differences between kinships and friendships. Their results suggest that the costs of maintaining friendships are higher than the costs of maintaining family relations. Specifically, the emotional intensity of relationships with friends decreased in contact frequency and in the number of activities done together, in comparison with family relations. Thus, we posed the following research question:

RQ: Do enhancement and displacement effects differ among family and friends?

Method

We carried out a two-wave survey with a private research institute, based on a quota sample, including age, gender, and education in Germany. The present study was conducted as part of a larger project on smartphone use and well-being (see Stevic et al., 2019). Relying on a similar panel survey on smartphone and social media use, we included a four-month interval between the two waves (Yao & Zhong, 2014). With this time lag, we could assess possible changes but also keep a low attrition rate. We recruited participants in March/April 2018 (Time 1 = T1) and July/August 2018 (Time 2 = T2). Prior to the survey participation, respondents were asked to sign an informed consent. Main requirements to take part in the survey were age 16 and older, owning a smartphone, and use of at least one social media application on it.

In the first wave, 833 participants completed the survey, and in the second wave, the total number of participants reached 461 (53% women). The attrition rate was 45%. The participants who did not take the survey at T2 scored higher in communicative smartphone use at T1, $F(1, 831) = 15.16$, $p = .000$, $\eta^2 = .01$; passive smartphone use at T1, $F(1, 831) = 30.28$, $p = .000$, $\eta^2 = .03$; and quantity of FtF communication with family at T1, $F(1, 830) = 6.70$, $p = .01$, $\eta^2 = .00$. The participants who did not take part at T2 scored lower in quality of relationships with family, $F(1, 831) = 13.02$, $p = .000$, $\eta^2 = .01$, but did not show any significant difference regarding quality of relationships with friends, $F(1, 831) = 2.06$, $p = .151$, $\eta^2 = .00$, and quantity of FtF communication with friends, $F(1, 819) = 1.40$, $p = .236$, $\eta^2 = .00$.

Measures

Independent Variables

We assessed communicative/active smartphone use with five items from M. Chan (2015). On a 6-point scale ranging from 1 (*never*) to 6 (*several times a day*), participants answered the questions: "How often do you use your smartphone to (1) talk to your family, (2) your friends, (3) read or send e-mails, (4) communicate with others using social media channels (such as Facebook or WhatsApp), (5) post or send photos or videos on social media platforms?" We computed five items in a formative index ($M = 3.46$, $SD = 0.99$ at T1). We entered these items into a principal component analysis with oblique rotation and obtained two factors, one for calling and a second one for other communicative activities. Because all five items denote active communication, in a second step, we added them together and fixed the number of factors to one. The factor explained 47.46% of the variance.

We measured smartphone use for noncommunicative/passive purposes with items from M. Chan (2015).[2] Using a 6-point scale ranging from 1 (*never*) to 6 (*several times a day*), we asked respondents to indicate how often they use their smartphone to (1) search for information on Wikipedia, Google, or blogs; (2) read online news; (3) listen to the radio, podcasts, or music; (4) watch TV, movies, or video clips (on YouTube

[2] As suggested by the two reviewers, the item about gaming activities was excluded from the formative index because of the possibility of being both a communicative and noncommunicative activity.

or Netflix); (5) take photos or videos; and (6) view profiles of family and friends on social media channels (such as Facebook). These six items were added to a formative index (*M* = 2.88, *SD* = 1.11 at T1). We entered these items into a principal component analysis with oblique rotation and obtained one factor, explaining 54.96% of the variance.

Dependent Variables

We assessed individuals' regular FtF communication with family with one item from Jin and Park (2012). Respondents were asked to indicate the average time they spend with their family per day: "How much time do you spend on an average day talking to your family members in person or doing something together (in minutes)?" (*M* = 105.48, *SD* = 136.30, range = 0–1,440 minutes at T1; *M* = 106.31, *SD* = 146.58, range = 0–1,440 minutes at T2).

To assess individuals' FtF communication with friends, we adapted one item from Jin and Park (2012). We asked participants the following question: "How much time do you spend on an average day talking to your friends in person or doing something together (in minutes)?" (*M* = 43.82, *SD* = 75.72, range = 0–800 minutes at T1, with one outlier [10,000 minutes] that we removed; *M* = 47.98, *SD* = 86.38, range = 0–700 minutes at T2).

We measured quality of relationships with family with three items adapted from Mesch (2006) and Mitchell, Finkelhor, and Wolak (2003). Respondents were asked to state their agreement on a 5-point scale ranging from 1 (*completely disagree*) to 5 (*completely agree*) with the following three statements: "My family members are attentive to my problems"; "My family members and I understand each other well"; "My family members and I are emotionally close" (*M* = 3.72, *SD* = 0.79, α = .74 at T1; *M* = 3.78, *SD* = 0.83, α = .80 at T2).

To measure quality of relationships with friends, we adapted the items from Mesch (2006) similar to the study by Mitchell and colleagues (2003). Using a 5-point scale ranging from 1 (*completely disagree*) to 5 (*completely agree*), we asked respondents to indicate their agreement with the following three statements: "My friends are attentive to my problems"; "My friends and I understand each other well"; "My friends and I are emotionally close" (*M* = 3.93, *SD* = 0.73, α = .74 at T1; *M* = 3.98, *SD* = 0.74, α = .77 at T2).

Control Variables

We included age, gender, education, family status, having children, number of family members, and number of friends as control variables. Participants were between 18 and 65 years old, with an average age of 48.38 years (*SD* = 13.01). We grouped education into a binary variable, with a lower category consisting of degrees below high school (67.2%) and higher category consisting of high school degrees and above (32.8%). In our sample, 32.8% of participants indicated being single, 23.0% were in a relationship, 42.5% were married, and 1.7% were widowed. Regarding parenthood, 55.7% indicated having children: The median value for number of family members was five and for friends six.

Data Analysis

To test our hypotheses, we conducted negative binomial and ordinary least squares linear regressions. We tested the effects of all main predictors at T1 on quantity of FtF communication as well as on quality of relationships with family and friends at T2. We controlled for the autoregressive effects of all four dependent variables. In all models, both communicative and noncommunicative smartphone uses were controlled for (to account for the overall smartphone use).

In our data, the two dependent variables measuring quantity of FtF communication represented count data (i.e., minutes per day spent with family or friends) in numerical values that were integer and nonnegative. The variance was greater than the mean in both variables; thus, we needed to account for overdispersion (Cameron & Trivedi, 1998). Moreover, the two dependent variables consisted of unevenly distributed observations, mainly gathered at the bottom of the distribution (Darlington & Hayes, 2016). We ran two negative binomial regressions, which relied on a log-transformation of the dependent variable (Stieglitz & Dang-Xuan, 2013). For the two dependent variables, which were normally distributed (i.e., quality of relationships), we conducted ordinary least squares linear regressions.

Results

Figure 1, Table 1, and Table 2 present our results. Initial correlation analysis showed a high correlation between communicative and noncommunicative smartphone use (r = .74, p < .001), which is not surprising because both activities are essential parts of smartphone use. Despite the high correlation, multicollinearity tests showed no violation (communicative smartphone use variance inflation factor = 2.3; noncommunicative smartphone use variance inflation factor = 2.5). The average time of using smartphones for communicative purposes was higher (M = 3.46) than for noncommunicative use (M = 2.88).

To test the construct validity of our independent variables, we conducted confirmatory factor analysis, which showed an unsatisfactory model fit when all 11 items of communicative and noncommunicative use were included in the model. Thus, we reduced the number of items for both types of use to confirm separate latent variables, which revealed a good model fit: comparative fit index = .95; Tucker–Lewis index = .93, χ^2/df = 3.16, p < .001; root mean square error of approximation = .07, 90% CIs [.06, .08]. All items showed high estimate values in both latent variables. However, our regression models were conducted with observed variables, including all listed items for each type of use.

With regard to our first hypothesis, we found a significant positive association between communicative smartphone use at T1 and quantity of FtF communication with family at T2 (b = .25, SE = .10, p = .015). This result shows that one unit of increase in communicative smartphone use (T1) will change the log of count of quantity of FtF communication with family (T2) by .25 estimate units. Furthermore, the results revealed a significant positive association between communicative smartphone use at T1 and quantity of FtF communication with friends at T2 (b = .37, SE = .11, p = .001). This result shows that one unit of increase in communicative smartphone use (T1) will change the log of count of quantity of FtF communication with friends (T2) by .37 estimate units. Thus, Hypothesis 1a and Hypothesis 1b were supported.

In our second hypothesis, we assumed that communicative/active smartphone use would increase quality of relationships with family (H2a) and friends (H2b) over time. We found no significant association between communicative smartphone use and quality of FtF communication with family (b = .00, SE = .04, p = .925) or with friends (b = −.03, SE = .04, p = .461). Therefore, Hypothesis 2 was not supported.

In our third hypothesis, noncommunicative/passive smartphone use at T1 showed a significant negative association with quantity of FtF communication with family (b = −.20, SE = .09, p = .036) and with friends (b = −.28, SE = .11, p = .009). This result shows that one unit of decrease in noncommunicative/passive smartphone use (T1) will change the log of count of quantity of FtF communication with family (T2) by .20 estimate units and by .28 estimate units with friends (T2). Thus, our Hypothesis 3a and Hypothesis 3b were supported.

Regarding our fourth hypothesis, we tested whether noncommunicative/passive smartphone use would negatively influence individuals' quality of relationships with family (H4a) and friends (H4b) over time. We found no significant association with quality of relationships with family (b = −.01, SE = .03, p = .772) or with friends (b = .01, SE =.04, p = .706). Therefore, our last hypothesis was not supported.

Finally, as an answer to our research question, the results showed that the effects are slightly stronger for friends than for family members, but only when it comes to the enhancement effect of smartphone use on the quantity of FtF communication.

Table 1. Results of the Negative Binomial Regression Models.

Variable	Quantity of face-to-face communication with family (Time 2) *b (SE)*	Quantity of face-to-face communication with friends (Time 2) *b (SE)*
Quantity of face-to-face communication with family (Time 1)	.00*** (.00)	
Quantity of face-to-face communication with friends (Time 1)		.01*** (.00)
Age (Time 1)	−.01* (.01)	−.01 (.01)
Gender (Time 1)	−.10 (.14)	−.00 (.15)
Education (Time 1)	−.14 (.15)	−.19 (.17)
Family status (Time 1)	.38*** (.08)	.01 (.09)
Children (Time 1)	.07 (.16)	−.05 (.17)
Number of family members (Time 1)	.00 (.00)	−.01***(.00)
Number of friends (Time 1)	−.00 (.00)	.00 (.00)
Communicative/active smartphone use (Time 1)	.25* (.10)	.37** (.11)
Noncommunicative/passive smartphone Use (Time 1)	−.20* (.09)	−.28* (.11)
Log likelihood	−2,394.06	−1,952.99

Note. *p < .05. **p < .01. ***p < .001.

Table 2. Results of the Ordinary Least Squares Regression Models.

	Quality of relationships with family (Time 2)	Quality of relationships with friends (Time 2)
Variable	*b* (*SE*)	*b* (*SE*)
Quality of relationships with family (Time 1)	.83*** (.03)	
Quality of relationships with friends (Time 1)		.69*** (.04)
Age (Time 1)	.00 (.00)	.00 (.00)
Gender (Time 1)	−.04 (.05)	−.06 (.05)
Education (Time 1)	.00 (.05)	−.00 (.06)
Family status (Time 1)	.01 (.03)	.00 (.03)
Children (Time 1)	.01 (.06)	.04 (.06)
Number of family members (Time 1)	−.00 (.00)	−.00*** (.00)
Number of friends (Time 1)	−.00* (.00)	.00 (.00)
Communicative/active smartphone use (Time 1)	.00 (.04)	−.03 (.04)
Noncommunicative/passive smartphone Use (Time 1)	−.01 (.03)	.01 (.04)
Observations	445	445
Adjusted R^2	.63	.49

Note. N = 461; 15 cases are system-missing in the variable noncommunicative/passive smartphone use.

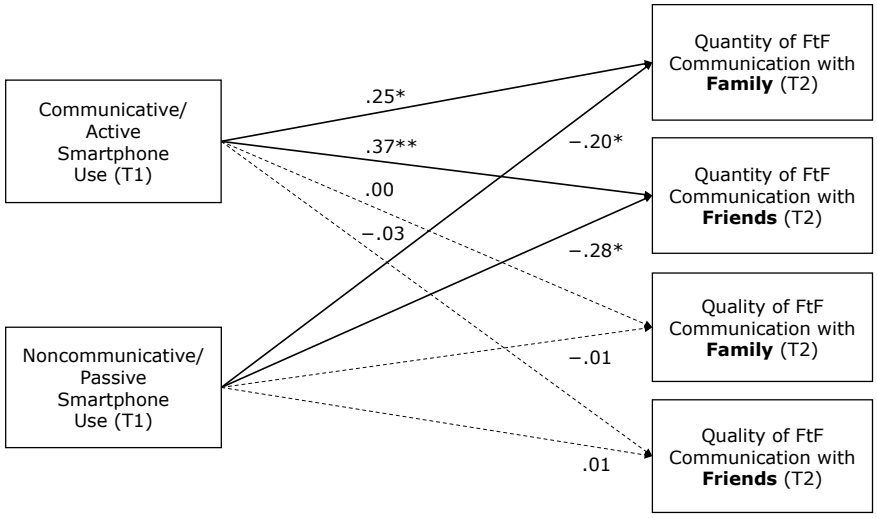

Figure 1. Results of the hypothesized model. FtF = face-to-face; T1 = Time 1; T2 = Time 2.

Additional Analyses

We conducted cohort analyses with age, categorized into different groups: 16–29 years old (12.1%), 30–39 years old (13.9%), 40–49 years old (21.3%), 50–59 years old (23.6%), 60–69 years old (28.9%), 70–79 years old (0.0%), and 80 years old or older (0.2%). We created dummy variables for each group and tested their direct associations with each dependent variable at T2. The results revealed no significant results. We tested direct associations of different age groups on communicative and noncommunicative smartphone use at T2 and found no significant results.

In addition, to test whether communicative and noncommunicative smartphone use exerts an indirect effect on quality of relationships with family and with friends via quantity of FtF communication with family and with friends, we ran mediation analyses in the SPSS PROCESS macro (Model 4; Hayes, 2017). The analyses did not yield significant indirect effects.

Discussion

Against the background of enhancement and displacement hypotheses, our study set out to clarify existing contradictory findings by systematically testing the influence of smartphone use on FtF communication. We argued that the occurrence of enhancement or displacement effects is, in fact, contingent on the type of smartphone use. To examine the influences of communicative and noncommunicative smartphone use on the quantity of FtF communication and quality of relationships with close ties, we conducted a longitudinal survey among adults, which is a significant contribution given the prevalence of correlational studies in this research area.

Our findings are twofold. First, we found partial support for the enhancement assumption. Communicative/active smartphone use positively predicted quantity of FtF communication with family and friends over time. These results also provided an answer to our research question. The larger effect size between communicative smartphone use and quantity of FtF communication was found for friends. Different communication frequencies between family and friends may be the reason for these effects. Individuals indicated spending more minutes per day with their family (M = 106.3) than with their friends (M = 47.98); thus, the enhancement effect through smartphones was stronger for friends.

To compensate for the reduced time spent with friends, individuals may expand their interpersonal communication activities virtually with smartphone devices, which can bring people who are more distant closer together (Rotondi, Stanca, & Tomasuolo, 2017). Therefore, communicative/active smartphone use may complement existing friendships. Thus, our finding corroborates earlier research showing that Facebook is associated with increased time spent on FtF communication (Spradlin et al., 2017). Our result partly confirms the main postulate of hyperpersonal theory of computer-mediated communication (Walther, 1996), stating that the technological opportunity for interpersonal interaction exchange accompanies relationship development.

To that end, communicating over smartphones is essential for the continuation of social interactions among friends. Our finding is also in line with the longitudinal study by Dienlin and associates (2017) that showed positive influences of SNSs and IM on the frequency of FtF communication with family, friends, and

acquaintances. To extend those findings, we tested the influence of overall smartphone use on the quality of relationships with close ties. However, our results revealed no association between communicative smartphone use and quality of relationships with family and friends. Thus, our findings suggest that the quality of real-life social communication and interaction between close ties cannot be augmented with smartphone devices.

Second, noncommunicative/passive smartphone use negatively predicted quantity of FtF communication, confirming previous findings (Lee, 2009; Verduyn et al., 2020). We found evidence for the displacement hypothesis with regard to the quantity of FtF communication, but not the quality of relationships with close ties. After all, the main premise of the displacement hypothesis is based on the time spent on the technology that replaces offline social interactions, which was confirmed in our study.

Nevertheless, in the smartphone context, it is relevant to empirically demonstrate that there is no influence of noncommunicative/passive smartphone use on quality of relationships over time. These null findings are in line with the majority of studies exploring displacement effects (e.g., Dienlin et al., 2017; Hall, Kearney, & Xing, 2018; Tokunaga, 2016; Valkenburg & Peter, 2007). Thus, showing that the displacement effect on quality of relationships with close ties does not occur over time makes a valid contribution. Cortina and Folger (1998) state that "establishing the boundary conditions of an effect are often just as important as finding the effect itself" (p. 338). Showing nonoccurrence of the proposed negative association between noncommunicative smartphone use and quality of relationships with close ties is in fact better news than providing an alternative hypothesis, which would in this case result in a negative outcome (Cortina & Folger, 1998).

Previous research has shown detrimental effects following passive use of social media and SNSs for individuals' life satisfaction (e.g., Frison & Eggermont, 2016; Wang et al., 2018). Therefore, finding no influence on the quality of relationships with close ties sheds more optimistic light than what the displacement hypothesis proposes. Moreover, these null findings might be interpreted in the light of increasing smartphone pervasiveness. As Hall and colleagues (2018) suggest, early research on displacement effects has focused on the computer and Internet uses at home or at work (e.g., Kraut et al., 1998; Lee, 2009; Nie et al., 2002), leaving little possibility for examining simultaneous technological use and FtF communication with close ties in other contexts. Since smartphones became embedded in our social lives, with more and more people using them during social encounters, perhaps the displacement effect is not that easily detectable anymore. Instead, scholars are focusing on the effects of phubbing (J. A. Roberts & David, 2016) and FtF communication disturbance due to simultaneous smartphone use, as well as on daily within-person effects of smartphone use and displacement of FtF communication (Verduyn et al., 2020).

Overall, our study points to positive and negative outcomes of smartphone use and confirms stability of quality of relationships. Individuals who use smartphones for communicative purposes do not replace their social interactions and actually benefit from their use. However, engaging in pastime activities poses risks for the amount of FtF communication with close ties. Understanding the optimal way of using smartphones might be essential for offline relationships.

Finding partial support for the enhancement and the displacement hypotheses only strengthens the premise of FtF communication being the richest communication form (Vriens & van Ingen, 2018), which

cannot be easily disrupted because of smartphones. In line with the hyperpersonal model of online communication (Walther, 1996) and Campbell's (2019) theoretical directions in mobile communications, we can conclude that mobile communication, with an emphasis on smartphones, moves away from a "zero-sum perspective and toward an added layer of social connection" (Campbell, 2019, p. 46).

Limitations and Future Research

There are several limitations to our study. First, the collected data relied on self-reported measures reflecting participants' subjective perceptions that might be influenced by social desirability (Van Deursen et al., 2015) and recall biases (Tokunaga, 2016). Further studies can partially avert this drawback by employing mobile tracking measures or mobile experience dairy methods (Naab, Karnowski, & Schlütz, 2019; Schnauber-Stockmann & Karnowski, 2020).

Second, our results demonstrate rather weak effects. However, we demonstrated these effects in a longitudinal analysis controlling for autoregressive effects, which accounts for the robustness of our findings.

Third, we tested only direct associations of the postulated concepts. Although the main goal of our study was to examine online influence on offline communicative behaviors, several underlying mechanisms could be further assessed. Future research could examine the influence of important mediators, such as online self-disclosure or quality of smartphone communications with family and friends, or further investigate the moderating influences of personality traits on the proposed associations (e.g., Spradlin et al., 2017). In relation to a recent study by M. Chan and Li (2020), different smartphone uses may exert effects on well-being via social support or relationship satisfaction. Thus, using these variables as mediators might provide greater insight into the relationship dynamics.

Future research should account for the time individuals spend on their smartphones and in FtF communication during weekends (e.g., Frison & Eggermont, 2016). It might show different outcomes because there is more time available to spend with family and friends, but also to use the smartphone.

Moreover, specific lifestyle differences between younger and older smartphone users could have an impact on the quantity and quality of FtF communication because of work hours, free time, and age-related social connections (younger people might have more social contacts than older people). In addition, looking at the equivalence between family and friends might be relevant. The next research phase could examine whether close ties actually compete for FtF communication. The question is whether there are differences between how smartphone engagement with family influences FtF communication with friends and the other way around.

Conclusion

The present study contributes to our knowledge of longitudinal smartphone influences on FtF communication and relationships with close ties. For the first time, we tested the enhancement and the displacement hypotheses in the context of communicative and noncommunicative smartphone use. We

showed that smartphone use needs to be studied not as a single entity, but rather as an overall combination of different types of use, which might lead to different outcomes.

Our research provides evidence that using smartphones in a certain way (i.e., for communicative purposes) increases time spent with family and friends offline, whereas noncommunicative activities decrease time spent with friends and family. Thus, we confirmed main postulates of enhancement and displacement hypotheses. Against our expectations, we found no associations with quality of relationships with family and friends. Finding null results in this context is a valuable contribution, which not only confirms previous findings on the displacement hypothesis, but also contradicts assumed adverse effects of passive smartphone use on interpersonal relationships. Our findings shed a new light on the (dis)advantages of smartphone use and further illustrate their interplay with FtF communication.

References

Burke, M., & Kraut, R. (2014). Growing closer on Facebook: Changes in tie strength through social network site use. In *Conference Paper CHI 2014, One of a CHInd* (pp. 4187–4196). New York, NY: Association for Computing Machinery. doi:10.1145/2556288.2557094

Burke, M., & Kraut, R. (2016). The relationship between Facebook use and well-being depends on communication type and tie strength. *Journal of Computer-Mediated Communication*, *21*(4), 265–281. doi:10.1111/jcc4.12162

Burke, M., Kraut, R., & Marlow, C. (2011). Social capital on Facebook: Differentiating uses and users. In *Proceedings of the 2011 Annual Conference on Human Factors in Computing Systems—CHI 11* (pp. 571–580). New York, NY: Association for Computing Machinery. doi:10.1145/1978942.1979023

Cameron, A. C., & Trivedi, P. K. (1998). *Regression analysis of count data*. Cambridge, UK: Cambridge University Press.

Campbell, S. W. (2019). From frontier to field: Old and new theoretical directions in mobile communication studies. *Communication Theory*, *29*(1), 46–65. doi:10.1093/ct/qty021

Carrier, L. M., Spradlin, A., Bunce, J. P., & Rosen, L. D. (2015). Virtual empathy: Positive and negative impacts of going online upon empathy in young adults. *Computers in Human Behavior*, *52*, 39–48. doi:10.1016/j.chb.2015.05.026

Chan, M. (2015). Mobile phones and the good life: Examining the relationships among mobile use, social capital, and subjective well-being. *New Media & Society*, *17*(1), 96–113. doi:10.1177/1461444813516836

Chan, M. (2018). Mobile-mediated multimodal communications, relationship quality and subjective well-being: An analysis of smartphone use from a life course perspective. *Computers in Human Behavior*, *87*, 254–262. doi:10.1016/j.chb.2018.05.027

Chan, M., & Li, X. (2020). Smartphones and psychological well-being in China: Examining direct and indirect relationships through social support and relationship satisfaction. *Telematics and Informatics*, *54*, 1–11. doi:10.1016/j.tele.2020.101469

Chan, T. H. (2014). Facebook and its effects on users' empathic social skills and life satisfaction: A double-edged sword effect. *Cyberpsychology, Behavior, and Social Networking*, *17*(5), 276–280. doi:10.1089/cyber.2013.0466

Cho, J. (2015). Roles of smartphone app use in improving social capital and reducing social isolation. *Cyberpsychology, Behavior, and Social Networking*, *18*(6), 350–355. doi:10.1089/cyber.2014.0657

Chopik, W. J. (2017). Associations among relational values, support, health, and well-being across the adult lifespan. *Personal Relationships*, *24*(2), 408–422. doi:10.1111/pere.12187

Chotpitayasunondh, V., & Douglas, K. M. (2018). The effects of "phubbing" on social interaction. *Journal of Applied Social Psychology*, *48*(6), 304–316. doi:10.1111/jasp.12506

Cortina, J. M., & Folger, R. G. (1998). When is it acceptable to accept a null hypothesis: No way, Jose? *Organizational Research Methods*, *1*(3), 334–350. doi:10.1177/109442819813004

Darlington, R. B., & Hayes, A. F. (2016). *Regression analysis and linear models concepts, applications, and implementation*. New York, NY: Guilford Press.

Desjarlais, M., & Willoughby, T. (2010). A longitudinal study of the relation between adolescent boys and girls' computer use with friends and friendship quality: Support for the social compensation or the rich-get-richer hypothesis? *Computers in Human Behavior*, *26*, 896–905. doi:10.1016/j.chb.2010.02.004

Dienlin, T., Masur, P. K., & Trepte, S. (2017). Reinforcement or displacement? The reciprocity of FtF, IM, and SNS communication and their effects on loneliness and life satisfaction. *Journal of Computer-Mediated Communication*, *22*(2), 71–87. doi:10.1111/jcc4.12183

Dwyer, R. J., Kushlev, K., & Dunn, E. W. (2018). Smartphone use undermines enjoyment of face-to-face social interactions. *Journal of Experimental Social Psychology*, *78*, 233–239. doi:10.1016/j.jesp.2017.10.007

Elhai, J. D., Levine, J. C., Dvorak, R. D., & Hall, B. J. (2017). Non-social features of smartphone use are most related to depression, anxiety and problematic smartphone use. *Computers in Human Behavior*, *69*, 75–82. doi:10.1016/j.chb.2016.12.023

Ellison, N. B., Steinfield, C., & Lampe, C. (2007). The benefits of Facebook "friends": Social capital and college students' use of online social network sites. *Journal of Computer-Mediated Communication*, *12*(4), 1143–1168. doi:10.1111/j.1083-6101.2007.00367.x

Ellison, N. B., Vitak, J., Gray, R., & Lampe, C. (2014). Cultivating social resources on social network sites: Facebook relationship maintenance behaviors and their role in social capital processes. *Journal of Computer-Mediated Communication*, *19*(4), 855–870. doi:10.1111/jcc4.12078

Escobar-Viera, C., Shensa, A., Bowman, N., Sidani, J., Knight, J., James, E., & Primack, B. (2018). Passive and active social media use and depressive symptoms among United States adults. *Cyberpsychology, Behavior, and Social Networking*, *21*(7), 437–443. doi:10.1089/cyber.2017.0668

Frison, E., & Eggermont, S. (2015). Toward an integrated and differential approach to the relationships between loneliness, different types of Facebook use, and adolescents' depressed mood. *Communication Research*, *47*(5), 701–728. doi:10.1177/0093650215617506

Frison, E., & Eggermont, S. (2016). "Harder, better, faster, stronger": Negative comparison on Facebook and adolescents' life satisfaction are reciprocally related. *Cyberpsychology, Behavior, and Social Networking*, *19*(3), 158–164. doi:10.1089/cyber.2015.0296

Hall, J. A., Kearney, M. W., & Xing, C. (2018). Two tests of social displacement through social media use. *Information, Communication & Society*, *22*(10), 1396–1413. doi:10.1080/1369118X.2018.1430162

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach.* New York, NY: Guilford Press.

High, A. C., & Buehler, E. M. (2017). Receiving supportive communication from Facebook friends: A model of social ties and supportive communication in social network sites. *Journal of Social and Personal Relationships*, *36*(3), 719–740. doi:10.1177/0265407517742978

Hoffner, C. A., & Lee, S. (2015). Mobile phone use, emotion regulation, and well-being. *Cyberpsychology, Behavior, and Social Networking*, *18*(7), 411–416. doi:10.1089/cyber.2014.0487

Huang, C. (2017). Time spent on social network sites and psychological well-being. *Cyberpsychology, Behavior, and Social Networking*, *20*(6), 346–354. doi:10.1089/cyber.2016.0758

Humphreys, L., Karnowski, V., & von Pape, T. (2018). Smartphones as metamedia: A framework for identifying the niches structuring smartphone use. *International Journal of Communication*, *12*, 2793–2809.

Jin, B., & Park, N. (2012). Mobile voice communication and loneliness: Cell phone use and the social skills deficit hypothesis. *New Media & Society*, *15*(7), 1094–1111. doi:10.1177/1461444812466715

Kestnbaum, M., Robinson, J. P., Neustadtl, A., & Alvarez, A. (2002). Information technology and social time displacement. *IT & Society*, *1*(1), 21–37.

Kim, H. (2014). Enacted social support on social media and subjective well-being. *International Journal of Communication*, *8*, 2201–2221.

Koutamanis, M., Vossen, H. G. M., Peter, J., & Valkenburg, P. M. (2013). Practice makes perfect: The longitudinal effect of adolescents' instant messaging on their ability to initiate offline friendships. *Computers in Human Behavior*, *29*, 2265–2272. doi:10.1016/j.chb.2013.04.033

Kowert, R., Domahidi, E., Festl, R., & Quandt, T. (2014). Social gaming, lonely life? The impact of digital game play on adolescents' social circles. *Computers in Human Behavior*, *36*, 385–390. doi:10.1016/j.chb.2014.04.003

Kraut, R., Kiesler, S., Boneva, B., Cummings, J., Helgeson, V., & Crawford, A. (2002). Internet paradox revisited. *Journal of Social Issues*, *58*(1), 49–74. doi:10.1111/1540-4560.00248

Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukopadhyay, T., & Scherlis, W. (1998). Internet paradox: A social technology that reduces social involvement and psychological well-being. *American Psychologist*, *53*(9), 1017–1031. doi:10.1016/j.porgcoat.2016.05.014

Kushlev, K., & Dunn, E. W. (2018). Smartphones distract parents from cultivating feelings of connection when spending time with their children. *Journal of Social and Personal Relationships*, *36*(6), 1619–1639. doi:10.1177/0265407518769387

Lee, S. J. (2009). Online communication and adolescent social ties: Who benefits more from Internet use? *Journal of Computer-Mediated Communication*, *14*(3), 509–531. doi:10.1111/j.1083-6101.2009.01451.x

Lemmens, J. S., Valkenburg, P. M., & Peter, J. (2011). Psychosocial causes and consequences of pathological gaming. *Computers in Human Behavior*, *27*, 144–152. doi:10.1016/j.chb.2010.07.015

Mesch, G. S. (2006). Family relations and the Internet: Exploring a family boundaries approach. *Journal of Family Communication*, *6*(2), 119–138. doi:10.1207/s15327698jfc0602

Mitchell, K. J., Finkelhor, D., & Wolak, J. (2003). The exposure of youth to unwanted sexual material on the Internet: A national survey of risk, impact, and prevention. *Youth & Society*, *34*(3), 330–358. doi:10.1177/0044118X02250123

Naab, T. K., Karnowski, V., & Schlütz, D. (2019). Reporting mobile social media use: How survey and experience sampling measures differ. *Communication Methods and Measures*, *13*(2), 126–147. doi:10.1080/19312458.2018.1555799

Nie, N. H., Hillygus, D. S., & Erbring, L. (2002). Internet use, interpersonal relations, and sociability: A time diary study. In B. Wellman & C. Haythornthwaite (Eds.), *The Internet in everyday life* (pp. 215–243). Malden, MA: Blackwell.

Procidano, M. E., & Heller, K. (1983). Measures of perceived social support from friends and from family: Three validation studies. *American Journal of Community Psychology*, *11*(1), 1–24. doi:10.1007/bf00898416

Reich, S. M., Subrahmanyam, K., & Espinoza, G. (2012). Friending, IMing, and hanging out face-to-face: Overlap in adolescents' online and offline social networks. *Developmental Psychology*, *48*(2), 356–368. doi:10.1037/a0026980

Richter, F. (2018). *America's smartphone addiction*. Retrieved from https://www.statista.com/chart/12403/smartphone-addiction/

Roberts, J. A., & David, M. E. (2016). My life has become a major distraction from my cell phone: Partner phubbing and relationship satisfaction among romantic partners. *Computers in Human Behavior*, *54*, 134–141. doi:10.1016/j.chb.2015.07.058

Roberts, S. G., & Dunbar, R. I. (2011). The costs of family and friends: An 18-month longitudinal study of relationship maintenance and decay. *Evolution and Human Behavior*, *32*(3), 186–197. doi:10.1016/j.evolhumbehav.2010.08.005

Rotondi, V., Stanca, L., & Tomasuolo, M. (2017). Connecting alone: Smartphone use, quality of social interactions, and well-being. *Journal of Economic Psychology*, *63*, 17–26. doi:10.1016/j.joep.2017.09.001

Sbarra, D. A., Briskin, J. L., & Slatcher, R. B. (2019). Smartphones and close relationships: The case for an evolutionary mismatch. *Perspectives on Psychological Science*, *14*(4), 596–618. doi:10.1177/1745691619826535

Schnauber-Stockmann, A., & Karnowski, V. (2020). Mobile devices as tools for media and communication research: A scoping review on collecting self-report data in repeated measurement designs. *Communication Methods and Measures*, *14*(3), 145–164. doi:10.1080/19312458.2020.1784402

Shen, C., & Williams, D. (2010). Unpacking time online: Connecting Internet and massively multiplayer online game use with psychosocial well-being. *Communication Research*, *38*(1), 123–149. doi:10.1177/0093650210377196

Spradlin, A., Cuttler, C., Bunce, J. P., & Carrier, L. M. (2017). #Connected: Facebook may facilitate face-to-face relationships for introverts. *Psychology of Popular Media Culture*, *8*(1), 1–9. doi:10.1037/ppm0000162

Stevic, A., Schmuck, D., Matthes, J., & Karsay, K. (2019). "Age matters": A panel study investigating the influence of communicative and passive smartphone use on well-being. *Behaviour & Information Technology*. doi:10.1080/0144929X.2019.1680732

Stieglitz, S., & Dang-Xuan, L. (2013). Emotions and information diffusion in social media: Sentiment of microblogs and sharing behavior. *Journal of Management Information Systems*, *29*(4), 217–248. doi:10.2753/MIS0742-1222290408

Tokunaga, R. S. (2016). An examination of functional difficulties from Internet use: Media habit and displacement theory explanations. *Human Communication Research*, *42*(3), 339–370. doi:10.1111/hcre.12081

Twenge, J. M., Spitzburg, B. H., & Campbell, W. K. (2019). Less in-person social interaction with peers among U.S. adolescents in the 21st century and links to loneliness. *Journal of Social and Personal Relationships*, *36*(6), 1892–1913. doi:10.1177/0265407519836170

Valkenburg, P. M., & Peter, J. (2007). Online communication and adolescent well-being: Testing the stimulation versus the displacement hypothesis. *Journal of Computer-Mediated Communication*, *12*(4), 1169–1182. doi:10.1111/j.1083-6101.2007.00368.x

Valkenburg, P. M., & Peter, J. (2009). The effects of instant messaging on the quality of adolescents' existing friendships: A longitudinal study. *Journal of Communication*, *59*(1), 79–97. doi:10.1111/j.1460-2466.2008.01405.x

Van Deursen, A. J. A. M., Bolle, C. L., Hegner, S. M., & Kommers, P. A. M. (2015). Modeling habitual and addictive smartphone behavior: The role of smartphone usage types, emotional intelligence, social stress, self-regulation, age, and gender. *Computers in Human Behavior*, *45*, 411–420. doi:10.1016/j.chb.2014.12.039

Verduyn, P., Lee, D. S., Park, J., Shablack, H., Orvell, A., Bayer, J., . . . & Kross, E. (2015). Passive Facebook usage undermines affective well-being: Experimental and longitudinal evidence. *Journal of Experimental Psychology: General*, *144*(2), 480–488. doi:10.1037/xge0000057

Verduyn, P., Schulte-Strathaus, J., Kross, E., & Hülsheger, U. (2020). When do smartphones displace face-to-face interactions and what to do about it? *Computers in Human Behavior*, *114*, 106550. doi:10.1016/j.chb.2020.106550

Vriens, E., & van Ingen, E. (2018). Does the rise of the Internet bring erosion of strong ties? Analyses of social media use and changes in core discussion networks. *New Media & Society*, *20*(7), 2432–2449. doi:10.1177/1461444817724169

Walther, J. B. (1996). Computer-mediated communication: Impersonal, interpersonal, and hyperpersonal interaction. *Communication Research*, *23*(1), 3–43. doi:10.1177/009365096023001001

Wang, J. L., Gaskin, J., Rost, D. H., & Gentile, D. A. (2018). The reciprocal relationship between passive social networking site (SNS) usage and users' subjective well-being. *Social Science Computer Review*, *36*(5), 511–522. doi:10.1177/0894439317721981

Yao, M. Z., & Zhong, Z. (2014). Loneliness, social contacts and Internet addiction: A cross-lagged panel study. *Computers in Human Behavior*, *30*, 164–170. doi:10.1016/j.chb.2013.08.007