Adolescents' Daily Face-to-Face and Computer-Mediated Communication: Associations with

Autonomy and Closeness to Parents and Friends

Abstract

The amount of time adolescents spend communicating via digital technologies such as smartphones has led to concerns that computer-mediated communication (CMC) is displacing face-to-face (FtF) interactions and disrupting social development. Although many studies have examined CMC in adolescents' relationships with friends, few studies have examined the role of CMC in adolescents' renegotiation of closeness and autonomy with parents. To examine this issue, we administered an online daily diary with 169 U.S. adolescents to estimate the time they spend in CMC and FtF interactions and the number of texts they exchange with friends and parents. On the last day of the survey we asked adolescents about their emotional closeness to friends and parents, and their balance of closeness and volition with parents. Overall, we found more evidence for social stimulation than displacement effects of CMC. Texts and CMC time with friends predicted friend closeness after accounting for FtF time with friends; texts with parents predicted parent closeness after accounting for FtF time with parents. We also found support for our hypothesis that CMC would be associated with greater adolescent volition. CMC time with parents predicted greater volitional dependence (volition plus closeness) whereas texts with friends predicted greater independent decision-making (volition plus distance). We discuss how communication technologies are integrated into U.S. adolescents' relationships with friends and parents and how CMC can facilitate, rather than stifle, adolescents' adjustment of autonomy-relatedness with parents and their construction of emotional closeness with friends.

Keywords: Adolescent Social Development, Autonomy-Relatedness, Computer-Mediated Communication, Face-to-Face Interactions

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Information Communication Technologies have become an integral component of

adolescents' daily lives, as evidenced by recent estimates that U.S. teenagers are engaged in

media use on average 6-9 hours a day, depending on whether multitasking is taken into

account (Rideout, Pai, Saphir, Pritchett, & Rudd, 2015). The sheer amount of time adolescents

spend with communication technologies has raised concerns about the activities being

displaced and the social or self-regulatory developmental processes that could be interrupted

(George, Russell, Piontak, & Odgers, 2017). Although Valkenburg and Peter (2011)

concluded from their review of the literature that there is more evidence for social stimulation

than displacement effects of online communication in adolescent development, the studies

they reviewed were conducted before the widespread use of smartphones among adolescents,

which have likely intensified the presence of electronic communication in daily life.

Importantly, research on stimulation versus displacement effects of communication

technologies has tended to focus on adolescents' peer relationships and has not considered the

interplay between friends and parents in learning how to balance closeness and personal

boundaries during the transition to adulthood.

To update and extend this field of inquiry, we conducted a daily-diary study asking

adolescents to report the time they spent in computer-mediated communication (CMC) and

face-to-face (FtF) interactions, and the number of texts they exchanged with friends and

parents. On the last day of the survey, we asked adolescents about their emotional closeness to

friends and parents, and their autonomy vis-á-vis parents. Our goals were to document how

CMC is integrated into adolescents' daily FtF interactions with close others and to explore

potential consequences for two intertwining tasks during adolescence: the development of

attachment with friends and the renegotiation of autonomy-relatedness in attachments with parents.

Adolescents' Relationships with Friends

In the West, adolescence has long been understood to be an important period of the lifespan for learning how to build intimacy within symmetrical peer relationships, as opposed to the asymmetry of parent-child relationships (Erikson, 1950; Youniss, 1980). Attachment schemas and social skills learned with parents are thought to cascade into attachments with friends, and then, romantic relationships (De Goede, Branje, Delsing, Meeus, 2009; Oudekerk, Allen, Hessel, & Molloy, 2015) as adolescents increasingly look beyond parents to peers for support, companionship, and validation (Larson & Richards 1991; Steinberg & Silverberg, 1986). Close friendships represent highly significant contexts for adolescent social development because they furnish learning experiences for an assortment of interpersonal skills essential for functioning in adulthood, including building interpersonal trust, empathy, and commitment, as well as negotiating boundaries, regulating emotions, and co-constructing a valued sense of self (Buhrmester & Furman, 1987; Collins & Sroufe, 1999).

In the early days of the Internet in the U.S. there was evidence that close relationships would be displaced by electronic communication (Kraut et al., 1998; Sanders, Field, Diego, & Kaplan, 2000). However, as the Internet became ingrained in daily life, empirical findings began to accumulate demonstrating that, in fact, the Internet tends to be used to facilitate and augment, rather than replace, FtF relationships (Kraut et al., 2002; Rainie & Wellman, 2012). There are now a host of studies showing that adolescents' online and offline social contacts tend to overlap, and that CMC is associated with greater friendship closeness (Davis, 2012; Valkenburg & Peter, 2007). For example, in an online survey with Dutch adolescents, Valkenburg and Peter (2007) found that private messaging with existing friends was far more

common than communicating online with strangers, and messaging predicted more overall

time with friends, higher quality friendships, and greater well-being.

These correlational findings could simply indicate that friends who are already close

are more likely to engage in multiple modes of communication with one another. In her media

multiplexity theory, Haythornthwaite (2005) posits that the introduction of a communication

medium creates possibilities for developing new latent ties but actually has little impact on

close relationships because they would be strongly connected regardless; however, strong

social ties are more likely to adopt new communication modalities to aid in their frequent

communication. This perspective is consonant with a media uses and gratification perspective

(Katz, Gurevitch, & Haas, 1973), which views media use as an outcome of individuals'

motivations, proclivities, competencies, and relationships. Indeed, data show that social

adjustment in childhood and early adolescence predicts characteristics of online

communication and quality of friendships later in adolescence (Lee; 2009; Mikami, Szwedo,

Allen, Evans, & Hare, 2010). In addition, support for "rich-get-richer" hypotheses, such as

extraverts being more likely than introverts to gain social benefits from the Internet (Forest &

Wood, 2012; Khan, Gagné, Yang, & Shapka, 2016), also indicate that it is not technology that

drives social consequences, but psychological characteristics and FtF relationships that drive

technology use.

It is also possible that the affordances of CMC enhance relationship closeness in ways

that transcend the contributions of FtF connectivity or individual characteristics. For example,

some studies have provided support for the "social compensation" hypothesis, suggesting that

the Internet can be used to compensate for a lack of resources offline and thus boost social

connection for those who are socially isolated or anxious (Bessiere, Kiesler, Kraut, & Boneva,

2008; Teppers, Luyckx, Klimstra, & Goossens, 2014). Technological affordances are defined

as opportunities for action that enable or constrain (but do not determine) particular human

capacities (Hutchby, 2001). Along these lines, Walther (1996) describes how affordances of CMC facilitate a form of "hyperpersonal" interaction in communication processes relative to the receiver, the sender, the characteristics of the channel, and feedback loops. The CMC channel enhances the convenience of communication and message optimization to highlight socially desirable aspects of the self, which generates more confidence and comfort in disclosure, and in turn, greater positivity and increased intimacy between communication partners.

The hyperpersonal model was developed at a time when multimedia aspects of internet communication were limited and has therefore been applied primarily to text-based communication. Indeed, experimental studies show greater uncertainty reduction communication strategies in text-based communication compared to FtF interactions, which explains greater feelings of affection in CMC compared to FtF interactions (Tidwell & Walther, 2002; Antheunis, Schouten, Valkenburg, & Peter, 2012). Longitudinal research on adolescent relationships has also shown that text-based communication can facilitate self-disclosure (Koutamanis, Vossen, Peter, & Valkenburg, 2013; Valkenburg & Peter, 2009) and also empathy (Vossen & Valkenburg, 2016). In one study, Dutch adolescents who were more engaged in instant messaging with friends had higher quality friendships six months later, and the effect was explained by greater levels of online self-disclosure (Valkenburg & Peter, 2009).

Although one study showed that there were no differences between text-based and visual-based CMC in self-disclosure and intimacy (Antheunis et al., 2012), research is only beginning to unpack how diverse features and affordances of adolescents' polymedia landscapes have varying consequences for their social development (Nesi, Choukas-Bradley, & Prinstein, 2018). Therefore, we examined CMC hours and number of texts separately in our analyses because mobile texting has a number of unique features that could make it distinct

from other kinds of technology-mediated interactions. For example, previous research has found that texting provides affordances for perpetual accessibility, mobility, and cue absence, which may actually foster a unique interplay of synchrony (almost conversation-level exchanges) and asynchrony (time for composition and reflection) conducive to closeness (Reid & Reid, 2004). We predicted that, although there may be tradeoffs between FtF and CMC on a day-to-day basis, adolescents who are typically more engaged in CMC with friends, especially texting, will be those with greater FtF time and emotional closeness with friends. Following the hyperpersonal model, we hypothesized that CMC, especially texting, would amplify emotional closeness to friends above and beyond the effects of FtF time with friends.

Adolescents' Relationships with Parents

Fewer studies have examined adolescents' CMC with parents. Applying media multiplexity theory and the hyperpersonal model to adolescents' relationships with parents, we would expect that although there may be daily trade-offs between CMC and FtF time, adolescents who typically have more FtF time with parents should also have more CMC with them and CMC should uniquely contribute to adolescents' feelings of closeness to parents. Previous correlational studies do show that adolescents who more frequently text (Padilla-Walker, Coyne, & Fraser, 2012) and use social media (Coyne, Padilla-Walker, Day, Harper, & Stockdale, 2013; Yang, 2016) with parents have greater feelings of closeness with parents.

Yet, the role that CMC plays in adolescents' relationships with parents may be more complex in that adolescents and parents are recalibrating the balance between autonomy and relatedness (Hill & Holmbeck, 1986). Autonomy and relatedness are two fundamental human drives (Ryan & Deci, 2000) which transform during the transition from child to adult social status as adolescents and parents adjust asymmetrical authority relations (Collins & Laursen, 2004; Smetana, Crean, & Campione-Barr, 2005). Early psychological theories confounded

increased autonomy on the part of the adolescent with distance, suggesting the necessity of emotional separation from parents for the development of adult self-reliance (Blos, 1979). Contemporary developmentalists define autonomy more precisely in terms of volition (the experience of self-determined action without coercion), and as compatible with family closeness and interdependence (Kagitçibasi, 2005; Ryan & Lynch, 1989). In fact, because of the importance of secure attachment to caregivers for psychological well-being, many developmentalists argue that a fundamental social task of adolescence is not to detach from parents in order to achieve independence but rather, to attenuate hierarchical relations with parents while remaining emotionally close to them (Allen, Hauser, Bell, & O'Connor, 1994; Soenens et al., 2007).

Notwithstanding recent theoretical distinctions, volition and emotional distance are often confounded in scales of adolescent autonomy. To disentangle these two dimensions, Van Petegem, Vansteenkiste, & Beyers (2013) tested the relative positions of commonly used scales with adolescents on two orthogonal dimensions: pressure-volition and proximity-distance. They found that a widely used scale of autonomy in the West, independent decision-making (Dornbusch, Ritter, Mont-Reynaud, & Chen, 1990), fell in the quadrant of volition plus distance from parents. In contrast, the "volitional dependence" measure they created loaded high on feelings of volition and proximity to parents. Volitional dependence is about feeling a sense of personal choice while remaining emotionally interdependent with parents; thus, it is similar to the construct of the "autonomous-related" self that has emerged with urbanization and economic development in cultures where values for individual choice are rising while values for family closeness are also maintained (Kagitçibasi, 2005).

CMC, especially texting, with parents could amplify opportunities for volition in combination with closeness to parents. According to Walther's (1996) hyperpersonal model, CMC creates rewarding feelings of agency, control, mastery, and convenience in presenting

and regulating the self, the interaction, and the relationship, which then drives greater

closeness. Indeed, Pettigrew (2009) has documented how people gain agency and harmony in

their relationships by using texts to evade confrontations, to disguise feelings, to consider a

response before reacting, or to simply bypass small talk and exchange information efficiently.

In her interviews with Israeli adolescents, Ribak (2009) found that they experienced a greater

sense of freedom in combination with security when they began using a cell phone, partly

because their parents gave them a longer leash to go out with friends, knowing they were just

a text or phone call away. Boyd (2014) has also argued that communication technologies in

general provide adolescents with more choices for social engagement and identity expression,

and can also enable greater physical range and leverage to negotiate parental authority.

Building on this work, we predicted that adolescent CMC with parents, especially texting,

would be specifically associated with volition in combination with emotional closeness, as

indexed by the volitional dependence scale.

In contrast, adolescents' CMC with friends could facilitate greater volition plus

emotional distance from parents. The ubiquitous presence of peers, especially with the recent

proliferation of smartphones, could detract from social processes in the family such as FtF

conversations that re-establish closeness in a less hierarchical fashion. Indeed, some

researchers have found that mobile devices interrupt family communication and rituals such

as dinnertime (Rosen, 2007; Ling & Yttri, 2006), which are important contexts facilitating

conversation, trust, and bonding (Fulkerson et al., 2006). Accordingly, some studies have

found that adolescents who frequently engage in CMC with friends strengthen their peer

relationships at the expense of their relationships with parents (Lei & Wu, 2007; Mesch,

2006; Richards, McGee, Williams, Welch, & Hancox, 2010). Lee (2009) found that for every

one minute U.S. adolescents reported using the Internet for social purposes, their FtF time

with parents decreased by .4 minutes. In Israel, Mesch (2006) found that adolescents' social

use of the Internet was not only inversely correlated with parent FtF time, it also predicted greater family conflict. Mesch speculated that adolescents' social connections outside the family weaken in-group family boundaries and cohesiveness. Based on these studies, we predicted that greater CMC with friends would correspond with less FtF time with parents and greater volition plus emotional distance from parents, as indexed by independent decision-making.

Current Study

Our first three research questions deal with interactions between different forms of adolescents' daily communication: their FtF hours, CMC hours, and number of texts exchanged with friends and parents. We examine daily level fluctuations within individuals and also averages across five days to measure individual differences in typical communication. Our last research question focuses on associations between typical communication patterns and the qualities of adolescents' relationships with friends and parents. We examined texting frequency and CMC hours separately to begin to understand how variations in specific technological affordances might influence relationship development differently.

The first question focuses on associations between adolescents' CMC and FtF interactions with friends.

Research Question 1a: Are daily changes in adolescents' CMC hours/texts with friends associated with daily changes in their FtF hours with friends?

Research Question 1b: Do adolescents who report more CMC hours/texts with friends also report more FtF hours with friends?

The second question focuses on associations between adolescents' CMC and FtF interactions with parents.

Research Question 2a: Are daily changes in adolescents' CMC hours/texts with parents associated with daily changes in their FtF hours with parents?

Research Question 2b: Do adolescents who report more CMC hours/texts with parents also report more FtF hours with parents?

Our third research question focuses on whether adolescents' CMC with friends displaces their FtF time with parents.

Research Question 3a: Are daily changes in adolescents' CMC hours/texts with friends associated with daily changes in their FtF hours with parents?

Research Question 3b: Do adolescents who report more CMC hours/texts with friends report less FtF hours with parents?

Our final research question focuses on whether average CMC hours and texts across days account for variability in qualities of adolescents' relationships with friends and parents, as reported on the last day of the survey.

Research Question 4a: Are adolescent-friend CMC hours and texts associated with closeness to friends, after accounting for friend FtF hours?

Research Question 4b: Are adolescent-parent CMC hours and texts associated with closeness to parents, after accounting for parent FtF hours?

Research Question 4c: Are adolescent-parent CMC hours and texts associated with volition plus emotional closeness to parents (volitional dependence)?

Research Question 4d: Are adolescent-friend CMC hours/texts associated with volition plus emotional distance from parents (independent decision-making)?

Methods

Participants

The Institutional Review Board at XXX University approved the protocol entitled

"Adolescents' Use of Communication Technologies" (#15-004) for the current study. Two

hundred adolescents were originally recruited based on recommendations by Green (1991)

that at least 104 participants are needed to detect medium effect sizes in a correlational study

and we expected some attrition due to the longitudinal nature of our study. Thirty-one

participants were removed for having incomplete data (50% or more of survey questions

unanswered across all days of the survey). The final sample was 169 high school adolescents

(54% female) in Washington state between the ages of 14 years and 4 months and 18 years

and 11 months ($M = 16.70$, $SD = 1.01$)[1]. Overall, 37% of the sample was European-American,

30% Latino, 20% Asian, and 12% other. Half of the sample (47%) lived in more rural areas

and small towns in the state; half (53%) lived in and around metropolitan areas. The majority

of the sample (84.5%) reported having a personal smartphone with Internet. More than half of

adolescents' mothers (61%) and fathers (62%) had greater than a high school education, with

14% of mothers and 16% of fathers having earned advanced degrees. However, adolescents

tended to report that mothers (69%) and fathers (51%) were *less* knowledgeable about

communication technologies such as computers and mobile devices compared to themselves.

Procedures

Our goal was to recruit a diverse sample of adolescents, so we reached out to

counselors and teachers in nine different rural, suburban, and urban area high schools and

asked them to encourage students to participate in an online study about communication

technologies and social relations. A proportion of the initial sample of participants (12%)

were also recruited via word of mouth by student participants and research assistants.

Potential participants were informed that they would earn a $20 Amazon gift certificate if

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[1] In the remaining sample one participant did not respond to the questions about Friend and Parent FtF and CMC on days 1 and 3. Two participants did not respond to these questions on day 1. One participant did not respond to these questions on day 3 and another participant missed these questions on day 4. Other participants did not respond to one or two communication questions about CMC and FtF with parents and friends on certain days, but no question was missed by more than 10 participants on any given day of the study in the sample used for analysis.

they completed an online daily diary of their social interactions plus an additional survey about their relationships with parents and friends. They were also told that the information they provided would be confidential and anonymous. Because most of the participants were minors, parental consent was obtained either through emails or paper consent forms mailed by high schools to the principal investigator. Once consent was obtained, participants received an email link to a Qualtrics survey. Qualtrics is an online data collection platform.

The instructions and questions were identical across all diary surveys. Adolescents were told to complete the daily diary survey every evening before they went to sleep for six consecutive days. Researchers monitored the time stamps in Qualtrics to make sure that adolescents were completing the surveys in the evening. On the seventh day, participants completed a survey about their relationship with their parents and friends and sociodemographic background information. Participants who completed all seven surveys were emailed the Amazon gift card.

Data files were downloaded from Qualtrics into SPSS and scanned for incomplete data. Due to a technical error in Qualtrics, day two of the diary was deleted and thus analyses were based on five daily diary communication reports.

Measures

Sociodemographics. Participants completed a sociodemographic questionnaire at the end of the surveys. Participants indicated their age in years and months (e.g. 15 years and 6 months), their gender, their ethnic background, immigrant status, and where they have spent the most time growing up (*farming community*, *small town*, *suburb just outside city*, or *city)*. They also reported whether or not they own a smartphone (mobile phone with Internet) or a cell phone (mobile phone without Internet) that they consider to be theirs only. Adolescents reported their parents' marital status, mother's and father's education using a 7-item scale from (1) *Elementary School only or less* to (7) *Graduate/Law/Medical/MBA degree*, and

ranked how knowledgeable they believed their mothers and fathers to be about technology as (1) *less knowledgeable than I am* (2) *as knowledgeable as I am* (3) *more knowledgeable than I am.*

Communication Patterns. Participants recorded their FtF and technology-mediated communication with their friends and parents. Daily totals and five-day averages were calculated separately for friends and parents.

FtF Hours Friend/Parent. Participants reported how much time they spent engaged in FtF interactions with a friend/parent that day using a drop-down list of hours and a drop-down list of minutes presented in 5-minute intervals. Participants were specifically instructed *not* to include time when they were together with a friend/parent but not paying attention to each other (e.g., watching a movie together, sitting in class together).

CMC Hours Friend/Parent. Participants reported how much time they spent engaged in CMC with a friend/parent that day using a drop-down list of hours and a drop-down list of minutes presented in 5-minute intervals. Participants estimated the time they spent interacting via CMC in three ways: 1) talking on the phone, 2) chatting or sending messaging over the Internet, and 3) skyping or face-timing.

Texts Friend/Parent. Participants reported how many text messages they sent to friends/parents each day and how many text messages they received from friends/parents each day using a mobile device. Text messages sent and received were combined and averaged.

Adolescents' Relationships. Participants responded to a series of questions at the end of the surveys, measuring their perceptions of their relationships with parents and friends.

Friend/Parent Closeness. We used the Emotional Reliance Scale to measure adolescents' feelings of closeness with friends and parents (ER; Ryan et al., 2005). Participants responded to 10 Likert-type questions measuring their attachment to parents and friends in terms of the extent to which they rely on them for emotional support when

distressed. An example question is, "When I am anxious or scared about something, I turn to my friends/parents." Participants responded on a scale from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Cronbach's alpha for friend closeness was .88 and for parent closeness was .91.

Volitional Dependence. To measure adolescents' feelings of agency in combination with closeness to parents we used the Volitional Dependence scale created by Van Petegem and colleagues (2013). Participants responded to seven questions measuring the extent to which they feel they freely choose and desire to rely on and be supportive of parents. Example items on the volitional dependence scale are, "If I am with my parent(s), it is because I personally choose to be with them" and "I personally find it important to sometimes do things for my parent(s)". Participants responded on a scale from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Cronbach's alpha was .82.

Independent Decisions. We used the Family Decision-Making scale (Dornbusch et al., 1990) to measure the extent to which adolescents make decisions without consulting their parents. The survey begins with the question "Who Decides?" followed by 25 topics such as chores, and time to wake up in the morning. Participants responded on a scale from 1 (*My parents decide without discussing it with me*) to 5 (*I decide*). Cronbach's alpha was .87.

Data Analysis Plan

In order to test RQ1a, 2a, and 3a concerning the associations between daily changes in CMC and FtF hours, we conducted multilevel analyses using maximum likelihood estimation. Only participants who answered communication questions across all days were included in these analyses. All analyses were conducted using SPSS 20. Our data had a two level structure: 5 daily observations (level 1) nested in 169 individuals (level 2). In all analyses, both slopes and intercept were tested as fixed. We conducted separate regressions for the

predictor variables of CMC hours and number of texts because the variables were too highly

correlated to include in the same analysis and would have caused multicollinearity issues.

In order to test RQ1b, 2b, and 3b concerning associations between adolescents' typical

CMC and their typical FtF hours, we conducted bivariate correlations on the amount of CMC

hours, texts, and FtF hours averaged across five days.

To test RQ4 about whether CMC is associated with qualities of attachment

relationships, we conducted hierarchical regressions. We first examined bivariate correlations

between the averaged communication variables, volitional dependence, and independent

decision-making, and then conducted hierarchical regressions to test hypotheses about the

relative contributions of various forms of communication.

Gender was not associated with any variables in the study but age was positively

associated with independent decisions and FtF hours with friends. We, therefore, included age

as a control variable in all of our regression analyses.

Results

Adolescents' Communication with Friends

RQ1a Daily changes in CMC and FtF time with friends

In the model for CMC hours, we entered age as a control variable and daily hours of

CMC with friends as the predictor variables for daily FtF hours with friends. Age was

positively associated with daily FtF hours with friends, $b = 0.362$, $t(162.568) = 2.307$, $p =$

.022. Daily change in CMC hours was inversely related to daily change in FtF hours with

friends, $b = -0.112$, $t(792,574) = -2.511$, $p = .012$. On days that adolescents reported more

CMC hours with friends, they reported less FtF hours with friends.

In the model for texts, we entered age as a control variable and daily number of texts

exchanged with friends as the predictor variables for daily FtF hours with friends. Age was

once again positively associated with daily FtF hours with friends, $b = 0.360$, $t(162.587) =$

2.330, $p = .021$. Daily texts exchanged were not associated with daily FtF hours with friends, $b = 0.000$, $t(602.383) = 0.307$, $p = .759$.

RQ1b Average CMC and FtF time with friends

Table 1 includes bivariate correlations for all communication variables averaged across five days. Average CMC hours with friends was unrelated to average FtF hours with friends. However, average number of texts with friends was positively correlated with average FtF hours with friends. Adolescents who exchanged more texts with friends had more FtF time with them.

Adolescents' Communication with Parents

RQ2a Daily changes in CMC and FtF time with parents

In the model for CMC hours, we entered age as a control variable and daily hours of CMC with parents as predictors of daily FtF hours with parents. Age was not associated with FtF hours with parents ($p = .913$). Daily change in CMC hours with parents was positively associated with daily change in FtF hours with parents, $b = 0.319$, $t(816.261) = 2.274$, $p =.023$. On days when adolescents reported more CMC hours with parents they also reported more FtF hours with them.

In the model for texts, we entered age as a control variable and daily number of texts exchanged with parents as predictors of daily FtF hours with parents. Age was once again not associated with FtF hours with parents ($p = .932$). Daily change in number of texts with parents was also not associated with daily FtF hours with parents.

RQ2b Average CMC and FtF time with parents

Bivariate correlations in Table 1 show that adolescents who typically reported more CMC hours with parents also reported more FtF hours with parents. However, average texts exchanged with parents was unrelated to average FtF hours with parents.

Adolescents' Communication with Friends and Parents

RQ3a Daily changes in CMC with friends and FtF time with parents

In the model for CMC hours, we entered age as a control variable and daily hours of CMC with friends as a predictor of daily FtF hours with parents. Age was not associated with FtF hours with parents (p =.953). Daily change in CMC hours with friends was positively associated with daily change in FtF hours with parents, $b = 0.124$, $t(798.597) = 2.950$, $p = .003$. On days when adolescents reported more CMC hours with friends, they also reported more FtF hours with parents.

In the model for texts, we entered age as a control variable and daily number of texts with friends as a predictor of daily FtF hours with parents. Age was not a significant predictor of FtF hours with parents ($p = .942$). Daily change in number of texts with friends was positively related to daily FtF hours spent with parents, $b = 0.002$, $t(752.024) = 2.783$, $p = .006$. On days that adolescents reported more texts with friends, they also reported more FtF hours with parents.

RQ3b Average CMC with friends and FtF time with parents

Contrary to predictions, bivariate correlations in Table 1 show that adolescents who typically reported more CMC hours with friends reported more, not less, FtF hours with parents on average. However, texts with friends was unrelated to FtF hours with parents. In addition, Table 1 shows that adolescents who reported more CMC hours with friends also reported more CMC hours with parents; those who exchanged more texts with friends also exchanged more texts with parents; and those who had more FtF hours with friends also had more FtF hours with parents.

Adolescents' Communication and their Relationships with Friends and Parents

Bivariate correlations in Table 1 show that closeness to friends and parents were positively correlated; volitional dependence was positively, and independent decision-making was negatively, associated with parent closeness. In addition, texts, CMC and FtF hours with

friends were associated with friend closeness; texts, CMC and FtF hours with parents were associated with parent closeness. CMC hours and texts with parents were correlated with volitional dependence with parents whereas FtF hours and texts with friends were correlated with independent decision-making with parents.

RQ4a Closeness to friends

To test associations between CMC hours with friends and adolescents' closeness to friends considering their FtF hours with friends, we ran a 2-step hierarchical regression. The values associated with the regression analyses are reported in Table 2. In the first step, we used age and average FtF hours with friends. The overall regression equation was significant $R^2 = .077, p < .002$. FtF hours with friends was positively associated with friend closeness and age was not associated with closeness. In the second step we entered average CMC hours with friends which improved the predictive power of the equation, $\Delta R^2 = .024, p = .041$.

To test associations between texts with friends and adolescents' closeness to friends considering their FtF hours with friends, we ran a three step hierarchical regression. Regression values are reported in Table 3. In the first step, we entered age as a control variable and FtF hours with friends. The overall regression equation was significant, but only FtF hours with friends was a significant positive predictor of friend closeness, $R^2 = .077, p < .002$. In the second step we entered number of texts exchanged with friends which improved the predictive power of the equation, $\Delta R^2 = .030, p = .021$, and were positively associated with friend closeness. These results indicate that both CMC hours and texts with friends are associated with an increase in friend closeness above and beyond FtF time spent with friends.

RQ4b Closeness to parents

To test associations between CMC hours with parents and closeness to parents, considering FtF hours spent with parents, we ran a two-step hierarchical regression for which the values are reported in Table 4. In the first step, we entered age and FtF hours with parents;

the overall regression equation was significant R^2 = .046, p = .005, and only FtF hours with

parents was positively associated with closeness to parents. In the second step, we entered

CMC hours with parents. The overall regression equation was significant, however the ΔR^2 =

.020, p = .066 was not significant and CMC hours with parents was not a significant predictor

in the regression model.

        To test associations between texts with parents and closeness to parents, we ran a two-

step hierarchical regression. Values for the regression analyses are reported in Table 5. In the

first step we entered age and FtF hours with parents. The overall regression equation was

significant, R^2 = .046, p = .005, and FtF hours with parents was positively associated with

closeness to parents. Age was not a significant predictor. In the second step we entered

average number of texts exchanged with parents. The overall regression equation and the ΔR^2

= .024, p = .042 were significant, and texts with parents was positively associated with

closeness to parents. These results indicate that texting with parents, but not CMC hours, is

associated with closeness to parents above and beyond the effects of FtF time with parents.

        RQ4c Volitional dependence

        We examined whether or not CMC hours and texts with parents are associated with

volitional dependence independently. We ran a hierarchical regression with age as a control

variable in the first step and CMC hours with parents and texts with parents in the second step

to predict volitional dependence. The regression values are reported in Table 6. The

regression equation in step one with age predicting volitional dependence was not significant.

In the second step, the overall regression equation was significant. Only CMC hours with

parents was a unique predictor of volitional dependence.

        RQ4d Independent decisions

        We examined whether FtF hours with friends and texts with friends are associated

with independent decision-making above and beyond age. CMC with friends was not entered

as a predictor because the bivariate correlation was not significant. Regression values are reported in Table 7. The first step with age predicting independent decision-making was significant, $R^2 = .062$, $p = .001$, and age was positively associated with independent decision-making. In the second step, the overall regression equation was significant, and adding FtF hours and texts with friends added a significant amount of predictive power, $\Delta R^2 = .042$, $p = .024$. Only texts with friends was uniquely linked with independent decision-making. More texting with friends was positively associated with independent decision-making.

Discussion

Concerns about the negative impacts of communication technologies on adolescents' relationships and their socioemotional well-being are understandable; however, the current study offers reasons to be more optimistic, and less technologically deterministic, about social development and technology mediated communication.

Adolescents' Daily Communication

Although daily level analyses revealed negative associations between CMC hours with friends and FtF hours with friends, the association was not significant when examining typical communication. Moreover, average communication across days showed that adolescents who typically exchanged more texts with friends had more FtF time with friends. These data support boyd's (2014) observation that substitution of CMC for FtF time at the daily level does not necessarily indicate displacement. Instead, daily level fluctuations likely reflect how adolescents use digital technologies to maintain closeness with FtF friends when they are physically apart, thereby enhancing their friendships rather than supplanting them, which adds to an accumulation of empirical work rejecting the idea that CMC displaces offline friendships in adolescence (Dienlin, Masur, Trepte, 2017; Valkenburg & Peter, 2011). Media multiplexity theory was supported in adolescents' communication with friends and also with parents, although the pattern of associations was slightly different. FtF and CMC hours with

parents were positively correlated at both the daily level and when examining typical communication averaged across days.

We also did not find evidence that CMC with friends displaces FtF time with parents. Adolescents who typically reported more CMC hours with friends tended to have on average more, not less, FtF hours with parents. On a daily level, CMC hours with friends and texts exchanged with friends were both positively associated with FtF hours with parents, lending further credence to the idea that U.S. teenagers spend more time in CMC with friends to compensate for lack of FtF time with friends on days when they are spending more time with family. Alternatively, increased CMC with friends on family days could also be interpreted as evidence of distraction during parent FtF time. We specifically instructed participants not to count FtF time when they were not paying attention to their partner, however, adolescents might not have defined intermittent CMC with friends as lack of attention paid to parents during a FtF interaction.

Adolescents' Communication and their Relationship Attachments

Overall, our data paint a picture of continuity rather than discontinuity in adolescents' CMC, FtF time, and their closeness to friends and parents. Adolescents reporting greater communication in a particular communication modality with friends also tended to report greater communication in that same modality with parents (i.e., more FtF hours with friends, more FtF hours with parents). Similarly, those reporting greater closeness to friends also reported greater closeness to parents. Although our data are cross-sectional, they are consistent with longitudinal studies showing developmental continuities in communication and attachment (De Goede et al., 2009; Oudekerk et al., 2015) and suggest that cascade models could be useful for understanding the integration and impact of communication technologies in adolescent social development in the digital age. Our study also extends the uses and gratification perspective on media effects (Katz et al., 1973) to intergenerational

transmission and socialization, pointing to ways in which characteristics of adolescents' FtF and technology-mediated relationships with parents may be carried into their friendships, or also, vice-versa during the transition to adulthood.

Another important contribution of the current study is the application of the hyperpersonal model of CMC to adolescents' attachment relationships with parents. One of the basic tenets of the hyperpersonal model is that CMC can increase the agency of the individual, thereby enhancing closeness between communication partners. We found evidence for this view and also distinctions between different CMC modalities in adolescents' relationships with parents and friends. Whereas both texting frequency and CMC hours with friends contributed to friend closeness after accounting for FtF time with friends, only texting with parents uniquely contributed to parent closeness after accounting for FtF time with parents. CMC hours with parents was uniquely associated with greater volition in combination with closeness to parents. Volition in combination with decreased reliance on parents (independent decision-making) was associated with texting with friends. Here we see support for displacement effects of CMC in the sense that texting with friends might scaffold transference of support and reliance from parents to peers, particularly when CMC and FtF time with parents are low. Certain affordances of texting such as mobility, perpetual accessibility, and cue absence could multiply options to optimize one's social experience and thereby increase feelings of self-efficacy and attachment to peers (Manago & Vaughn, 2015). Future research should examine the purpose and function of different platforms and modalities in daily communications with potentially differing implications for the balance of autonomy-relatedness depending on the nature of the relationship.

Ribak's (2009) metaphor of the mobile device as a "transitional object" is useful for thinking about how CMC operates in the development of autonomy-relatedness in adolescent-parent relationships. A transitional object from object-relations theory is a possession such as

a teddy bear that substitutes for the main attachment figure and lessens the stress of separation

during infancy (Winnicot, 1965). In her interviews with Israeli adolescents and their parents,

Ribak found that mobile phones act like security blankets in that they ease the pain of

separation by symbolically representing the potential for communication at any time, even at

a physical distance. Interestingly, the pain of separation was most apparent from the parents'

perspectives—parents said they bought and continued to pay for their adolescent children's

phones in order to alleviate their own worries about their child's expanding physical and

social mobility. Adolescents in turn described greater freedom, personal choice, and

opportunities to be with friends while also feeling a sense of safety rooted in the knowledge

that their parents were always just a text or phone call away.

Additional Considerations

Of course, social and psychological consequences of communication technologies

depend on how their affordances are mobilized and regulated in the process of

development. Affordances of communication technologies for parental monitoring could

also yield greater intrusiveness, creating negative consequences for parent-adolescent

attachment (Mascheroni, 2014; Mesch, 2012; Weisskirch, 2009). Location tracking

systems and restrictive software are likely to be increasingly developed and marketed to

parents' safety concerns and yet, research has shown these kinds of parental control

applications may backfire by undermining trust and interrupting adolescents' learning

opportunities and establishment of personal boundaries (Boesen, Rode, Mancini, 2010;

boyd, 2014; Ghosh, Badillo-Urquiola, Rosson, Xu, Carroll, & Wisniewski, 2018). For

example, Ghosh and colleagues found associations between authoritarian styles of

parenting and use of parental control applications, which in fact, predicted *greater*

adolescent exposure to online risks. Another large scale study in Europe on the strategies

parents employ in managing their adolescents' media use showed that restrictive forms of

Internet mediation can protect children and early adolescents from online risks but come at the cost of digital inclusion (Livingstone et al., 2017).

The affordance of CMC for perpetual accessibility could also have negative consequences for attachment if CMC persistently disrupts FtF interactions ("technoference"), communicating to loved ones that something else is more important than being present with them (Brown, Manago, & Trimble, 2016; Stockdale, Coyne, & Padilla-Walker, 2018). Stockdale and colleagues (2018) found that greater technoference on the part of parents predicted poorer parent-adolescent attachment quality, whereas adolescents' technoference predicted elevated levels of cyberbullying, anxiety, and depression. However, the majority of their nationally representative U.S. adolescent sample reported experiencing technoference only occasionally and saw it as part of living in a social world permeated by digital technologies.

Limitations

There are a number of limitations in the current study. Cause-effect interpretations are not appropriate for our correlational data. Because we collected data from a single source (adolescents) using a single method (surveys), interpretations of our data cannot rule-out the possibilities of common method variance. Personality and cognitive characteristics of our sample could also explain our results. For example, positive associations between CMC, FtF communication, autonomy and closeness could reflect personality differences. Surveys required adolescents to pay close attention to their daily interactions and they likely differed in their conscientiousness and diligence with the diaries. In addition, because of social desirability, adolescents could have overestimated their FtF communication and underestimated their CMC in response to cultural narratives regarding the risks of communication technologies, or overestimated their time with friends relative to parents due to a heightened emphasis on peers at this age. Although we had a rather diverse sample in

terms of Euro-, Latino- and Asian-American adolescents living in rural and urban areas of

Washington state, our sample size restricted our ability to explore how communication and

relationships may be different among adolescents with different cultural backgrounds. We

only tested adolescents' feelings of agency within their parental relationships; communication

technologies may function differently in adolescents' agency within friendships, such as their

ability to negotiate disagreements with close friends or their negotiation of peer pressure and

conformity. Lastly, our data are limited to general modalities of communication, rather than

specific communication platforms or behaviors, which may factor into adolescents'

relationships and social development in unique ways.

Conclusion and Future Directions

The overall conclusion of the current study is that communication technologies can

be conducive to adolescents' emotional connectedness with friends and parents, potentially

through affordances for mobility, convenience, and message optimization that can amplify

human agency within close relationships. However, multi-method longitudinal studies with

larger and more diverse samples are needed to confirm this idea and examine lingering

questions. Observational methods, qualitative methods, and additional time sampling

techniques (e.g. random time sampling) can help to better capture communication in

adolescents' daily lives while longitudinal research will be necessary to test the unfolding

of attachment and communication styles mediated by CMC. The cascade model offers a

tremendously useful approach for avoiding technological determinism and understanding

bidirectional dynamics between the qualities of adolescents' relationships and their use of

communication technologies over time. Our study, among others (Valkenburg & Peter,

2011), demonstrates possibilities for positive social development through the use of

communication technologies, which should be better understood and promoted in digital

societies.

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Table 1

Bivariate correlations between communication and relationship variables

	M	SD	1	2	3	4	5	6	7	8	9	10
1 Age	16.70	1.01										
2 CMC friend	1.50	1.81	-.008									
3 CMC parent	0.24	0.54	-.028	.314**								
4 Texts friend	122.43	162.50	.097	.564**	.105							
5 Texts parent	8.63	10.85	-.034	.138	.490**	.275**						
6 FtF friend	2.84	2.04	.179*	.078	.179*	.181*	.154*					
7 FtF parent	2.66	2.33	.006	.221**	.327**	.144	.111	.361**				
8 Friend closeness	3.93	0.66	.057	.175*	.141	.220**	-.009	.277**	.102			
9 Parent closeness	3.70	0.82	-.011	-.066	.203**	-.064	.178*	.103	.215**	.169*		
10 volitional dependence	3.81	0.67	.133	.024	.226**	.019	.159*	.089	.103	.105	.682**	
11 Independent decisions	3.98	0.53	.250**	.132	-.092	.196*	-.018	.181*	-.128	.077	-.238**	-.054

Note. *p < .05, ** p < .01; CMC = computer-mediated communication hours; FtF = face-to-face hours.

Table 2

Summary of hierarchical regression analysis predicting friend closeness from friend CMC hours

Variable	b	t	F	R^2
Step 1			6.758**	.077
Age	0.005	0.106		
FtF friend	0.089	3.597***		
Step 2			6.012**	.100
Age	0.008	0.154		
FtF friend	0.085	3.453**		
CMC friend	0.056	2.062*		

Note. CMC = computer-mediated communication hours; FtF = face-to-face hours. * = p < .05. ** = p < .01. *** p < .001.

Table 3
Summary of hierarchical regression analysis predicting friend closeness from texts

Variable	b	t	F	R²
Step 1			6.758**	.077
Age	0.005	0.106		
FtF friend	0.089	3.597***		
Step 2			6.434***	.106
Age	-0.002	-0.047		
FtF friend	0.079	3.204**		
Texts friend	0.001	2.328*		

Note. FtF = face-to-face hours. * = $p < .05$. ** = $p < .01$. *** $p < .001$.

Table 4

Summary of hierarchical regression analysis predicting parent closeness from parent CMC

Variable	b	t	F	R^2
Step 1			3.953*	.046
Age	-0.010	-0.158		
FtF parent	0.076	2.808**		
Step 2			3.804*	.066
Age	-0.006	-0.102		
FtF parent	0.059	2.071*		
CMC parent	0.225	1.842		

Note. CMC = computer-mediated communication hours; FtF = face-to-face hours. * = $p < .05$. ** = $p < .01$. *** $p < .001$.

Table 5
Summary of hierarchical regression analysis predicting parent closeness from texting with parents

Variable	b	t	F	R^2
Step 1			3.953*	.046
Age	-0.010	-0.158		
FtF parent	0.076	2.808**		
Step 2			4.078**	.070
Age	-0.005	-0.088		
FtF parent	0.070	2.591*		
Text parent	0.012	2.043*		

Note. FtF = face-to-face hours. * = $p < .05$. ** = $p < .01$. *** $p < .001$.

Table 6
Summary of hierarchical regression analysis predicting volitional dependence

Variable	b	t	F	R^2
Step 1			2.952	.018
Age	0.088	1.718		
Step 2			4.308**	.074
Age	0.093	1.860		
CMC Parent	0.243	2.269*		
Text Parent	0.004	0.775		

Note. CMC = computer-mediated communication hours; * = p < .05. ** = p < .01. *** p < .001.

Table 7
Summary of hierarchical regression analysis predicting independent decision-making

Variable	b	t	F	R^2
Step 1			10.894**	.062
Age	0.132	3.301**		
Step 2			6.297***	.104
Age	0.113	2.827**		
FtF friends	0.030	1.488		
Text friend	0.001	2.044*		

Note. FtF = face-to-face hours. * = p < .05. ** =   p < .01. *** p < .001.