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# Technoference: Parent Distraction with Technology and Associations with Child Behavior Problems

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## Abstract

Heavy parent digital technology use has been associated with suboptimal parent-child interactions, but no studies examine associations with child behavior. This study investigates whether parental problematic technology use is associated with technology-based interruptions in parent-child interactions, termed "technoference," and whether technoference is associated with child behavior problems. Parent reports from 170 U.S. families (child mean age = 3.04 years) and Actor Partner Interdependence Modeling showed that maternal and paternal problematic digital technology use predicted greater technoference in mother-child and father-child

interactions; then, maternal technoference predicted *both* mothers' and fathers' reports of child externalizing and internalizing behaviors. Results suggest that technological interruptions are associated with child problem behaviors, but directionality and transactional processes should be examined in future longitudinal studies.

Keywords: Parent media use; digital technology; smartphones; child behavior; parent-child relationship; problematic phone use; parenting



# Technoference: Parent Distraction with Technology and Associations with Child Behavior Problems

Emerging mobile and digital technologies such as smartphones, tablets, wearables, and other mobile devices are now embedded throughout the daily lives of young children and their families, with research evidence on their use and effects lagging behind their rate of adoption (Radesky, Schumacher, & Zuckerman, 2015b). These multimodal devices, with their access to unlimited Internet content, social contacts, work duties, information, and personal data, have revolutionized the ways in which people interact with digital technology and with each other (Katz, 2002; Campbell, Ling, & Bayer, 2014).

Despite the significant benefits that individuals reap from their use of technology, such as increased social support (McDaniel, Coyne, & Holmes, 2012) and the ability to work from home (Chesley, Slibak, & Wajcman, 2013), sociological and psychological research has highlighted the potential for disruption of in-person social dynamics when mobile and digital technologies are in use. This was initially described as 'absent presence,' or the act of being physically present but having one's mind elsewhere based on communication or content from mobile phones (Gergen, 2002), followed by descriptions of new social norms allowing invasion of portable devices into personal spaces (Ito, Okabe, & Matsuda, 2005; Campbell & Park, 2008). More recently, the concept of 'technoference,' defined as everyday interruptions in interpersonal interactions or time spent together that occur due to digital and mobile technology devices, has been introduced (McDaniel, 2015; McDaniel & Coyne, 2016a). Such interruptions may occur during face-to-face conversations, routines such as mealtimes or play, or the perception of an intrusion felt by an individual when another person interacts with digital technology during time

together. In adult romantic relationships, technoference has been associated with more conflict with one's partner over technology use and poorer relationship satisfaction (McDaniel & Coyne, 2016a) as well as more negative perceptions of coparenting quality (McDaniel & Coyne, 2016b).

In a separate line of investigation, overuse of technology has been studied in terms of Internet addiction and self-reported problematic mobile phone use behaviors (e.g., having difficulty disconnecting, ruminating about possible messages received, etc.); both are associated with mental health problems such as depression, anxiety, and social difficulties (e.g., Bianchi & Phillips, 2005). Psychological correlates of problematic mobile technology use have included anxious dependence in relationships (Cheever, Rosen, Carrier, & Chavez, 2014), poorer self-regulation abilities and lower degree of mindfulness (Feldman, Greeson, Renna, & Robbins-Monteith, 2011), susceptibility to the unconscious automaticity of mobile phone checking (Bayer & Campbell, 2012; Drouin, Kaiser, & Miller, 2012), or perceiving social norms of needing to answer calls or texts (Rainie & Keeter, 2006). However, none of these studies have specifically examined these dynamics in the context of parenting.

In an attempt to define what constitutes 'problematic' media use for parents, several studies have examined how parent digital technology use associates with quality and quantity of parent-child interactions. Adding to a literature showing interruption of parent-child play by background television (Kirkorian, Pempek, Murphy, Schmidt, & Anderson, 2009), recent studies have suggested that parent mobile technology use around children is associated with fewer parent-child interactions (Radesky, Miller, Rosenblum, Appugliese, Kaciroti, & Lumeng, 2015a), lower responsivity to child bids (Hiniker, Sobel, Suh, Sung, Lee, & Kientz, 2015), and qualitative observations of parent hostility in response to child bids for attention (Radesky, Kistin, Zuckerman, Nitzberg, Gross, Kaplan-Sanoff, Augustyn, & Silverstein, 2014). Additionally, technological interruption during parenting has been associated with mothers' perceptions of lower coparenting quality (McDaniel & Coyne, 2016b). In interviews, children describe feeling that parents should not use digital technology during family routines because of their expectation that the parent be present and model good digital technology habits (Hiniker, Shoenebeck, & Kientz, 2016). Parents echo this experience of discomfort with 'absent presence' when using digital technology around their children, describing it as "multitasking" that makes them feel less effective in their parenting (Radesky et al., 2016).

However, this emerging literature on parent digital technology use and parent-child relationships is limited by small sample sizes, assessment of parent digital technology use only during brief episodes such as meals or playground visits, and none have specifically examined child behavioral outcomes. Because of the hypothesized potential for technology to alter parenting responsiveness, which is an important predictor of positive child social-emotional outcomes (see Bornstein, Tamis-Lemonda, Hahn, & Haynes, 2008; Davidov & Grusec, 2006), more research on parent digital technology use and child behavior is needed. The aim of the present study was to examine cross-sectional associations between problematic parent digital technology use (e.g., having trouble resisting the urge to check the device, using the device too much, etc.), technoference (i.e., technology interference) in parent-child interactions, and child behavior. We hypothesized that greater self-reported problematic digital technology use would be associated with more frequent technoference in daily parent-child interactions (H1); and greater reported technoference in daily parent-child interactions would be associated with greater child externalizing and internalizing behavior (H2), as has been described in prior ethnographic work (Radesky et al., 2014).

## Method

### Participants & Procedure

Participants included mothers and fathers from 183 heterosexual couples with a young child who took part in the *Daily Family Life Project* (McDaniel, 2016), a longitudinal study of parenting and family relationships conducted from 2014 to 2016. Participants were recruited through: (1) letters and phone calls to families who were part of a family research database in a Northeastern U.S. state, (2) announcements on parenting websites and listservs, and (3) flyers in the local community. To be eligible to participate, individuals had to speak English, be over age 18, be a parent of a child age 5 or younger, and currently live with their spouse/partner and child. Their spouse/partner also had to be willing to participate. Participants were emailed a survey link through which they completed informed consent and a baseline online survey via Qualtrics. Participants also completed follow-up assessments at approximately 1, 3, and 6 months. At baseline, 98% ($n$ = 360) of parents completed their survey.

In the present study, we utilized the baseline survey data of 333 of these 360 parents (168 mothers and 165 fathers from 170 families) who had completed child behavior rating scales; 11 families ($n$ = 22 parents) who had a child younger than 1 year were excluded from the present

analysis, since the behavior rating items were not appropriate for infants. In addition, 3 mothers and 3 fathers were missing behavior ratings, and 1 mother and 4 fathers did not respond to their surveys and thus provided no baseline data at all. In our analytic sample of 333 parents, families resided in the following U.S. regions: 53% Northeast, 16% Midwest, 16% South, and 15% West. On average, mothers were 31.82 years old (*SD* = 4.22; range 22 to 42), and fathers were 33.34 (*SD* = 4.93; range 22 to 52). Most families (61%) had more than one child (*M* = 1.90, *SD* = 0.91), and the index child was 3.04 years old on average (*SD* = 1.24; *Range* = 1.0 to 5.5 years; 55% female). Most parents were Caucasian (92%), married (95%), and had at least a Bachelor's degree (73%). Median yearly household income was approximately $69,500 (*M* = $75,360, *SD* = $39,320), but ranged from no income to $250,000, with 20% of families reporting some form of state or federal assistance (e.g., medical assistance, food stamps). Average relationship length was 10.13 years (*SD* = 4.02), with 93% in a relationship of 5 years or longer.

Utilizing chi-squares and t-tests to examine potential demographic differences between our analytic sample and those not in our analyses due to having a child under age 1 or who were missing behavioral rating data, we found that parents in our sample were on average older ($t(360) = 2.18$, $p = .03$), in a longer relationship ($t(360) = 2.61$, $p = .009$), and had more children ($t(360) = 3.63$, $p < .001$); the samples were otherwise similar.

**Measures**

**Parent problematic digital technology use.** We assessed parent problematic digital technology use using a 3-item self-report scale adapted from prior studies of problematic mobile phone use (e.g., Derks & Bakker, 2014): (1) "When my mobile phone alerts me to indicate new messages, I cannot resist checking them." (2) "I often think about calls or messages I might receive on my mobile phone." (3) "I feel like I use my mobile phone too much." Parents responded on a 6-point scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Items were averaged to produce an overall score (for mothers, *M* = 3.24, *SD* = 1.18; for fathers, *M* = 2.87, *SD* = 1.17) with higher scores indicating more problematic use (Cronbach's alpha = .74 for mothers, .78 for fathers).

**Technoference in parent-child relationships.** Perceived technoference (i.e., technology interference) in the mother-child relationship and in the father-child relationship was assessed via mother and father self-report. Items were adapted from the *Technology Device Interference Scale* (TDIS; McDaniel & Coyne, 2016a), which originally measured technoference in couple

relationships; for this study, we reworded the scale to refer to interactions with one's child. Parents were asked, "On a typical day, about how many times do the following devices interrupt a conversation or activity you are engaged in with your child?" The 6 items on the scale included the following devices: (1) cellphone/smartphone, (2) television, (3) computer, (4) tablet, (5) iPod, and (6) video game console. Parents responded to each item on a 7-point scale ranging from 0 (*none*) to 6 (*more than 20 times*). As this is a count measure and we expected there to be variability (as opposed to consistency) within individuals' responses across these various devices (i.e., some devices might interfere more than others), it was not appropriate to calculate Cronbach's alpha. Items were averaged, with higher scores representing more frequent technoference in the parent-child relationship; raw mean scores are reported in Table 1. We also found that participants' scores were positively skewed (skewness values for the overall mean score were 2.38 for mothers and 3.46 for fathers); therefore, we performed a square root transformation on the overall mean scores, which resulted in scores that were more normally distributed and more appropriate for analysis (skewness = -0.04 for mothers, 0.57 for fathers).

**Child externalizing and internalizing behavior problems.** Parents completed the items that make up the internalizing (36 items) and externalizing scales (24 items) of the *Child Behavioral Checklist* (CBCL; Achenbach & Rescorla, 2000). These items concern their child now or within the past two months on a 3-point scale ranging from 0 (*not true, as far as you know*) to 2 (*very true or often true*). Internalizing consists of items such as “whining,” “sulks a lot,” and “feelings are easily hurt.” Externalizing consists of items such as “can’t sit still, restless, or hyperactive,” “easily frustrated,” and “temper tantrums or hot temper.” Items were summed to produce separate mother and father ratings of internalizing and externalizing child behavior (Cronbach’s alpha for internalizing = .90 for mothers, .88 for fathers; alpha for externalizing = .92 for mothers, .93 for fathers). We then converted these raw sum scores to normed externalizing and internalizing t-scores for analysis (Achenbach & Rescorla, 2000).

**Potential confounding variables.** Parents reported their age, educational attainment, marital status, race/ethnicity, family composition, household income, and child’s age, gender, and health at baseline. They also reported their child’s daily duration of screen media use, as well as measures of coparenting quality, depressive symptoms, and parenting stress.

Parents rated how much time, on a typical day, their child spent using screen media devices across 8 items (e.g., computer, TV, smartphone, tablet, video games) on an 11-point

scale ranging from 0 (*None*) to 10 (*7 or more hours*). Items were summed to produce an overall child screen use score (Cronbach's alpha = .77 for mothers, .76 for fathers).

As this sample consists of two-parent families, we controlled for coparenting quality—or how well parents work together in rearing their child as a parenting team (e.g., Feinberg et al., 2012). Coparenting quality has been shown to predict child behavior problems (e.g., Murphy, Jacobvitz, & Hazen, 2015); therefore, controlling for the potential influences of coparenting lends further weight to any potential associations we may find between technoference and child behavior. We assessed coparenting quality with an established measure, the *Coparenting Relationship Scale* (CRS; Feinberg et al., 2012) which consists of 35 items (e.g., "When I'm at my wits end as a parent, partner gives me extra support I need" and "My partner undermines my parenting") that assess various dimensions of coparenting such as support, undermining, and agreement on a 7-point scale ranging from 0 (*not true of us*) to 6 (*very true of us*). After reverse coding negatively worded items, all items were averaged to produce an overall coparenting score with higher scores indicating parent perceptions of higher quality coparenting (Cronbach's alpha = .94 for mothers, .93 for fathers).

Depressive symptoms were measured utilizing the validated *Center for Epidemiologic Studies Depression Scale* (CES-D; Radloff, 1977). Participants rated how often they experienced 20 symptoms (e.g., "I felt depressed" and "I felt sad") in the past week on a 4-point scale ranging from 0 (*rarely or none of the time, less than 1 day*) to 3 (*most or all of the time, 5 to 7 days*). Items were averaged to produce an overall depression score (Cronbach's alpha = .90 for mothers, .80 for fathers). We controlled for depressive symptoms as depressed mood has been associated with quality of parent-child interactions (e.g., Elliston et al., 2008; McDaniel & Teti, 2012) and greater technoference in couple relationships (McDaniel & Coyne, 2016a).

Finally, we also controlled for parenting stress which we measured using 27 items from the *Parenting Stress Index* (PSI; Abidin, 1995). Following other scholars in the field (e.g., Feinberg et al., 2010; Leavitt et al., 2016; Maas et al., 2015), we chose to use 27 items from the 36-item PSI Short Form due to lower factor loadings on 9 of the items, as was found by Abidin (1995). Items were averaged to produce an overall stress score (Cronbach's alpha = .90 for mothers, .92 for fathers). Parenting stressors are common in parents with young children (Crnic & Low, 2002) and often predict poor family functioning (Cummings & Davies, 1994; Gelfand, Teti, & Radin Fox, 1992). Feeling stressed could hypothetically lead parents to use digital

technology devices as a potential means of escape (Radesky et al., 2016) as well as to allow children to more frequently use digital technology (Pempek & McDaniel, 2016).

**Data Analysis**

We first examined the associations between our study variables using bivariate correlations in SPSS. Then, using Actor Partner Interdependence Modeling (APIM; Kenny, Kashy, & Cook, 2006), we tested a structural equation model (SEM) of (H1) mother and father problematic digital technology use predicting technoference in mother-child and father-child interactions, which (H2) technoference then predicted mother and father reports of child behavior problems. One model was tested for externalizing behavior, and one model was tested for internalizing behavior (Figures 1 and 2). The models were tested utilizing AMOS (Arbuckle & Wothke, 1999), and both mother and father variables were entered. Standardized estimates are shown for the models in Figures 1 and 2. Mother and father ratings of parenting stress and coparenting quality were also controlled in the models. Other potential confounders including depressive symptoms, family income, parent education, marital status, race/ethnicity, child age, child gender, child health status, and child screen use were also entered, but were removed from the final models as results did not change significantly. Any missing data were handled using full information maximum likelihood estimation. As access to and use of digital technology by adults and children varies by child age and family socioeconomic status (e.g., Wartella et al., 2013), we also examined potential moderation of path estimates in our final models by child age, parent education, and family income.

## Results

Descriptive data and bivariate correlations for study variables are presented in Table 1. On average, mothers and fathers perceived about 2 devices as interfering in their interactions with their child at least once or more on a typical day, and only 11% of participants reported that technoference did not occur. Furthermore, 17% of participants reported that technoference occurred 1 time, 24% reported 2 times, and 48% reported 3 or more times on a typical day. On average, 40% of mothers and 32% of fathers stated that they used digital technology (specifically their mobile phone) in problematic ways (score of 3.5 or higher). Mothers perceived their phone use as more problematic than fathers perceived their own use ($t$ (162) = 3.15, $p < .01$). No significant mean differences were found between mothers and fathers on other study variables. In our sample, 4% of parents' ratings of children met or exceeded the clinical cut-off (t-score of 70

or above; Achenbach & Rescorla, 2000) for externalizing behavior and 3% for internalizing behavior.

As expected, parent problematic digital technology use and technoference were correlated (see Table 1). Additionally, in fathers, higher perceived problematic digital technology use was associated with greater internalizing behavior, higher income, more child screen time, and greater parenting stress; however, mothers' problematic digital technology use was not associated with any other variables besides technoference. In both mothers and fathers, technoference in parent-child activities was associated with greater internalizing behavior and more child screen time. Furthermore, technoference in parent-child activities was associated with greater externalizing behavior as reported by mothers and worse perceptions of coparenting, depressive symptoms, and parenting stress as reported by fathers.

The model predicting child externalizing behavior with technoference and parent problematic digital technology use fit the data well ($\chi^2$ (18) = 15.83, *ns*; RMSEA = .00; CFI = .99) as did the model for internalizing behavior ($\chi^2$ (18) = 11.74, *ns*; RMSEA = .00 CFI = .99). As hypothesized (H1), greater mother and father problematic digital technology use significantly predicted their perceptions of greater technoference in their own interactions with their child (for mothers, $\beta = .35$, $p < .001$; for fathers, $\beta = .39$, $p < .001$). We also found support for hypothesis 2 in that greater technoference in the mother-child relationship significantly predicted greater child externalizing behavior as reported by *both* mothers ($\beta = .20$, $p < .001$) and fathers (at the trend level, $\beta = .12$, $p = .06$). Unexpectedly, technoference in the father-child relationship did not predict greater externalizing behavior. Similar results also appeared for internalizing behavior, adding further support for our hypothesis 2: Greater technoference in the mother-child relationship significantly predicted greater child internalizing behavior as reported by *both* mothers ($\beta = .16$, $p < .01$) and fathers ($\beta = .14$, $p < .05$), but again technoference in the father-child relationship did not predict internalizing behavior.

We also examined whether the model results held when utilizing only *mobile* technoference (e.g., phones, tablets, iPods) as opposed to all of the technoference items. After entering the overall mobile technoference variable in the models in the place of overall technoference, the models still fit the data well for externalizing ($\chi^2$ (18) = 14.96, *ns*; RMSEA = .00; CFI = .99) and internalizing ($\chi^2$ (18) = 10.72, *ns*; RMSEA = .00; CFI = .99), and our results remained significant. In other words, greater mother and father problematic mobile technology

use significantly predicted their perceptions of greater mobile technoference in their own interactions with their child (for mothers, $\beta = .34$, $p < .001$; for fathers, $\beta = .49$, $p < .001$). Moreover, greater mobile technoference in the mother-child relationship significantly predicted greater child externalizing behavior as reported by *both* mothers ($\beta = .17$, $p < .01$) and fathers ($\beta = .13$, $p = .04$) *and* significantly predicted greater child internalizing behavior as reported by *both* mothers ($\beta = .18$, $p < .01$) and fathers ($\beta = .17$, $p < .01$).

To explore potential differences in the strength of these associations by child age, parent education, and family income, we utilized a multigroup structural equation modeling approach in AMOS. In this approach, the model fit is compared between a model where all paths are allowed to vary freely across groups and a model where all paths are constrained to be equal across groups. If a significant difference is found in the model fit, this suggests that differences exist in some of the path estimates between the groups. We split our moderator variables into groups as follows: child age (1 = age 3 and up, 0 = younger than 3), parent education (1 = Bachelor's degree or higher, 0 = less than a Bachelor's degree), and family income (1 = higher than $69,500, 0 = less than or equal to $69,500; family income was split at the median).

No differences were found in model fit for child age or father education. However, the externalizing model with estimates constrained to be equal across groups showed worse fit with mother education ($\Delta\chi^2$ (19) = 35.93, $p = .01$) and family income ($\Delta\chi^2$ (19) = 38.10, $p < .01$). The same occurred for the internalizing model with mother education ($\Delta\chi^2$ (19) = 35.41, $p = .01$) and family income ($\Delta\chi^2$ (19) = 37.83, $p < .01$). In terms of moderation of main model paths, the association between fathers' ratings of technoference and fathers' ratings of externalizing child behavior was stronger in families with lower maternal education ($z = -1.98$, $p < .05$), although the path was not significant in either group. In terms of family income, the association between mothers' ratings of technoference and mothers' ratings of externalizing behavior was stronger in families with higher income ($\beta = .33$, $p < .001$) as compared to those with lower income ($\beta = .03$, $p = .78$; $z = 2.42$, $p < .05$). No other significant differences emerged in our main model paths.

## Discussion

Our study is the first to show significant associations between parent self-perceptions of problematic digital technology use, perceived technoference in parenting, and reported child behavioral difficulties. Perceived technoference in mother-child interactions was associated with externalizing and internalizing behavior as rated by *both* mothers and fathers. The fact that

technoference in mother-child interactions also related to fathers' reports of child behavior lends further weight to the current results, as this indicates that the results are not likely due to single reporter bias.

Surprisingly, technoference in father-child interactions was not associated with reports of externalizing or internalizing behavior by either parent. This discrepancy between findings related to maternal versus paternal digital technology use is interesting and could be explained by several mechanisms. First, fathers may be less reliable reporters of their own digital technology use during parent-child activities; however we believe this is less likely given that fathers' self-reported problematic digital technology use was significantly correlated with their reports of technoference. Another explanation is that children co-regulate their emotions and behavior differently with their mothers and fathers (Lunkenheimer, Olson, Hollenstein, Sameroff, & Winter, 2011), and thus may have differential reactions to changes in maternal versus paternal responsiveness. It is also possible that children simply spent more time with their mothers on a daily basis in our sample, so there were a greater number of opportunities for technoference in mother-child activities as compared with fathers. In this study sample, 45% of mothers worked 30 hours or more per week versus 82% of fathers; therefore fathers may have taken part in fewer activities with their children overall as compared with mothers.

As this is a cross-sectional analysis, it is important not to assume directionality between technoference and externalizing or internalizing child behavior. In recent in-depth interviews, parents reported having more difficulty multitasking between children and their mobile device, making it more difficult to read and respond to child cues and effectively manage difficult child behavior (Radesky et al., 2016). This concept is supported by naturalistic mealtime observations of children escalating their behavior in order to get the attention of their mobile-device using caregivers, who then sometimes responded with anger or frustration (Radesky et al., 2014). An alternative explanation for our findings is that mothers who perceive their children as more behaviorally dysregulated may use digital technology during parent-child activities as a means of withdrawal (Nakamura, 2015), taking a break from difficult social interactions so that they can lower their stress levels. In qualitative interviews, many stay-at-home mothers reported using digital technology as a way to "escape" the boredom or frustrations of childrearing, or to regulate their own emotions or arousal (Radesky et al., 2016). However, it is important to note that our current results remained significant after controlling for parent depression or stress levels.

It is also possible that greater parent digital technology use is a marker of other parent or household characteristics that independently predict digital technology use and child behavioral problems, such as greater family dysfunction (Hinkley, Verbestel, Ahrens, et al., 2014). To account for this we adjusted for numerous other household characteristics and coparenting quality, and again our results remained. Nonetheless, it is possible that problematic digital technology use is a marker of an unmeasured parent characteristic such as anxiety (e.g., Cheever, Rosen, Carrier, & Chavez, 2014) or emotion regulation difficulties (e.g., Feldman et al., 2011).

As parent and child digital technology use differ depending on child age and family socioeconomic factors (e.g., Wartella et al., 2013), we explored whether the strength of the associations in our model would differ depending on such factors. Of particular note, mothers' ratings of technoference in higher income households (as compared with those in lower income households) were linked more strongly with mothers' ratings of externalizing behavior. This difference was not due to higher income families having access to a greater number of devices; in post-hoc analyses we found no significant difference by family income in the number of devices in the home, technoference, problematic digital technology use, or child externalizing behavior. It is possible that the variance in child externalizing behavior in low-income households is driven by other factors, such as stressful life events. We suggest that further research is needed with larger, more diverse samples to better understand the potential differences in these associations by income and other factors.

It is perhaps premature to draw implications from this study for clinical practice, but our findings contribute to a growing literature showing associations between greater digital technology use and potential relationship dysfunction (e.g., McDaniel & Coyne, 2016a; McDaniel & Coyne, 2016b) or changes in interpersonal interactions (Przybylski & Weinstein, 2013). Although some professional societies such as *Zero To Three* and the *American Academy of Pediatrics* now recommend "unplugged" family time, it has not yet been tested whether manipulating digital technology use during parent-child activities leads to improvements in child behavior.

A primary limitation of this study was the use of parent self-reports of digital technology use and child behavior; objective assessments of child behavior and parent/child digital technology use would reassure us that observed associations are not due to reporter bias. However, self-report methods allow examination of this topic in larger sample sizes and from

both parents, which were limitations of prior studies. Moreover, although effects were generally small in size, the agreement of both maternal and paternal report of greater child behavioral symptoms with greater maternal technoference provides some support to our findings. Future studies should consider using methods such as video coding of child behavior during parent-child activities.

Although this study was limited by its cross-sectional design and having a primarily Caucasian, fairly-educated sample, its findings are a first glance at complex family processes around rapidly adopted digital technologies. We were able to demonstrate that even low and seemingly normative amounts of technoference were associated with greater child behavior problems, which may have great public health relevance. Future, larger-scale and more diverse studies should continue to examine whether associations between parent technoference and child behavioral problems depend on other contextual influences such as parenting style, sensitivity, or family stressors. Yet, we hope that our results can be a springboard for future research into both the specific cascades of parent-child interactions that underlie these associations, as well as longitudinal transactional relations between difficult child behavior, family digital technology use, and parenting.



## References

Abidin, R.R. (1995). *Parenting Stress Index: Professional Manual* (3rd ed.). Lutz, FL: Psychological Assessment Resources, Inc.

Achenbach, T. M., & Rescorla, L. A. (2000). *Manual for the ASEBA Preschool Forms and Profiles*. Burlington: University of Vermont, Department of Psychiatry.

Arbuckle, J. L. & Wothke, W. (1999). *Amos 4.0 user's guide.* Chicago: Small Waters.

Bayer, J., & Campbell, S.W. (2012). Texting while driving on automatic: Considering the frequency-independent side of habit. *Computers in Human Behavior, 28,* 2083-2090. doi: 10.1016/j.chb.2012.06.012

Bianchi, A., & Phillips, J. G. (2005). Psychological predictors of problem mobile phone use. *Cyberpsychology & Behavior, 8,* 39-51. doi: 10.1089/cpb.2005.8.39

Bornstein, M.H., Tamis-Lemonda, C.S., Hahn, C.S., Haynes, O.M. (2008). Maternal responsiveness to young children at three ages: Longitudinal analysis of a multidimensional, modular, and specific parenting construct. *Dev Psychol, 44,* 867-74. doi: 10.1037/0012-1649.44.3.867

Campbell, S. W., & Ling, R., & Bayer, J. (2014). The structural transformation of mobile communication: Implications for self and society. In M. B. Oliver & A. Raney (Eds.), *Media and social life* (176-188). New York: Routledge.

Campbell, S. W, & Park, Y.J. (2008). Social implications of mobile telephony: The rise of personal communication society. *Sociology Compass, 2*, 371-387. doi: 10.1111/j.1751-9020.2007.00080.x

Cheever, N.A., Rosen, L.D., Carrier, L.M., & Chavez, A. (2014). Out of sight is not out of mind: the impact of restricting wireless mobile device use on anxiety levels among low, moderate, and high users. *Computers in Human Behavior, 37,* 290-297. doi: 10.1016/j.chb.2014.05.002

Chesley, N. A., Slibak, A., & Wajcman, J. (2013). Information and communication technology use and work-life integration. In D. Major & R. Burke (Eds.), *Handbook of work-life integration of professionals: Challenges and opportunities*, 245-266. Elgar Publications.

Crnic, K., & Low, C. (2002). Everyday stresses and parenting. In M. Bornstein (ed.), *Handbook of parenting: Practical issues in parenting (2nd edition), vol. 5*. (pp. 243-267). Lawrence Erlbaum Associates: Mahwah, NJ.

Cummings, E. M., & Davies, P. T. (1994). Maternal depression and child development. *Journal of Child Psychology and Psychiatry, 35*, 73-112. doi: 10.1111/j.1469-7610.1994.tb01133.x

Davidov, M., Grusec, J.E. (2006). Untangling the links of parental responsiveness to distress and warmth to child outcomes. *Child Development, 77*, 44-58. doi: 10.1111/j.1467-8624.2006.00855.x

Derks, D., & Bakker, A. B. (2014). Smartphone use, work–home interference, and burnout: A diary study on the role of recovery. *Applied Psychology, 63*, 411-440. doi: 10.1111/j.1464-0597.2012.00530.x

Drouin, M., Kaiser, D. H., & Miller, D. A. (2012). Phantom vibrations among undergraduates: Prevalence and associated psychological characteristics. *Computers in Human Behavior*, *28*, 1490-1496. doi: 10.1016/j.chb.2012.03.013

Elliston, D., McHale, J., Talbot, J., Parmley, M., & Kuersten-Hogan, R. (2008). Withdrawal from coparenting interactions during early infancy. *Family Process*, *47*, 481-499. doi: 10.1111/j.1545-5300.2008.00267.x

Feinberg, M. E., Brown, L. D., & Kan, M. L. (2012). A multi-domain self-report measure of coparenting. *Parenting*, *12*, 1-21. doi: 10.1080/15295192.2012.638870

Feinberg, M. E., Jones, D. E., Kan, M. L., & Goslin, M. C. (2010). Effects of Family Foundations on parents and children: 3.5 years after baseline. *Journal of Family Psychology*, *24*, 532-542. doi: 10.1037/a0020837

Feldman, G., Greeson, J., Renna, M., & Robbins-Monteith, K. (2011). Mindfulness predicts less texting while driving among young adults: Examining attention- and emotion-regulation motives as potential mediators. *Personality and Individual Differences, 51*, 856-861. doi: 10.1016/j.paid.2011.07.020

Gelfand, D. M., Teti, D. M., & Radin Fox, C. E. (1992). Sources of parenting stress for depressed and nondepressed mothers and infants. *Journal of Clinical Child & Adol. Psych., 21*, 262. doi: 10.1207/s15374424jccp2103_8

Gergen, K.J., & Gergen, K.J. (2002). The challenge of absent presence. In J. E. Katz & J. E. Aakhus (Eds.), *Perpetual Contact: Mobile Communication, Private Talk, Public Performance* (pp. 227-241). Cambridge, UK: Cambridge University Press.

Hiniker, A., Sobel, K., Suh, H., Sung, Y.C., Lee, C.P., & Kientz, J. (2015). Texting while parenting: How adults use mobile phones while caring for children at the playground. *Proceedings of CHI 2015; Seoul South Korea.* doi: 10.1145/2702123.2702199

Hiniker, A., Schoenebeck, S.Y., Kientz, J.A. (2016). Not at the dinner table: Parents' and children's perspectives on family technology rules. *CSCW '16, ACM* doi: 10.1145/2818048.2819940

Hinkley, T., Verbestel, V., Ahrens, W., Lissner, L., Molnar, D., Moreno, LA., et al. (2014). Early childhood electronic media use as a predictor of poorer well-being: A prospective cohort study. *JAMA Pediatrics*, 168, 485-492. doi: 10.1001/jamapediatrics.2014.94

Ito, M., Okabe, D. & Matsuda, M. (2005). Personal, portable, pedestrian: Mobile phones in Japanese life. *East Asian Science, Technology, and Society: an International Journal, 3*, 147-151.

Katz, J.E. (2002). *Perpetual contact: Mobile communication, private talk, public performance*. Cambridge, UK: Cambridge University Press.

Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic data analysis.* New York: Guilford.

Kirkorian, H.L., Pempek, T.A., Murphy, L.A., Schmidt, M.A., & Anderson, D.R. (2009). The impact of background television on parent-child interaction. *Child Development*, 80, 1350-1359. doi: 10.1111/j.1467-8624.2009.01337.x

Leavitt, C. E., McDaniel, B. T., Maas, M. K., & Feinberg, M. E. (2016). Parenting stress and sexual satisfaction among first-time parents: A dyadic approach. *Sex Roles.* doi: 10.1007/s11199-016-0623-0

Lunkenheimer, E.S., Olson, S.L., Hollenstein, T., Sameroff, A.J., & Winter, C. (2011). Dyadic flexibility and positive affect in parent-child coregulation and the development of child behavior problems. *Dev. Psychopathology, 23*, 577-591. doi: 10.1017/s095457941100006x

Maas, M. K., McDaniel, B. T., Feinberg, M. E., & Jones, D. E. (2015). Division of labor and multiple domains of sexual satisfaction among first-time parents. *Journal of Family Issues*. doi: 10.1177/0192513X15604343

McDaniel, B. T. (2015). "Technoference": Everyday intrusions and interruptions of technology in couple and family relationships. In C. J. Bruess (Ed.), *Family communication in the age of digital and social media*. New York: Peter Lang Publishing.

McDaniel, B. T. (2016). *Understanding stability and change in daily coparenting: Predictors and outcomes in families with young children* (Doctoral dissertation, The Pennsylvania State University).

McDaniel, B. T., & Coyne, S. M. (2016a). "Technoference": The interference of technology in couple relationships and implications for women's personal and relational well-being. *Psychology of Popular Media Culture, 5*, 85-98. doi: 10.1037/ppm0000065

McDaniel, B. T., & Coyne, S. M. (2016b). The interference of technology in the coparenting of young children: Implications for mothers' perceptions of coparenting. *The Social Science Journal, 53*, 435-443. doi: 10.1016/j.soscij.2016.04.010

McDaniel, B. T., Coyne, S. M., & Holmes, E. K. (2012). New mothers and media use: Associations between blogging, social networking, and maternal well-being. *Maternal and Child Health Journal, 16*, 1509-1517. doi: 10.1007/s10995-011-0918-2

McDaniel, B. T., & Teti, D. M. (2012). Coparenting during the first three months after birth: The role of infant sleep quality. *Journal of Family Psychology, 26*, 886-895. doi: 10.1037/a0030707

Murphy, S. E., Jacobvitz, D. B., & Hazen, N. L. (2015). What's so bad about competitive coparenting? Family-level predictors of children's externalizing symptoms. *Journal of Child and Family Studies*, 1-7. doi: 10.1007/s10826-015-0321-5

Nakamura, T. (2015). The action of looking at a mobile phone display as nonverbal behavior/ communication: A theoretical perspective. *Computers in Human Behavior, 43,* 68-75. doi: 10.1016/j.chb.2014.10.042

Pempek, T., & McDaniel, B. T. (2016). Young children's tablet use and associations with maternal well-being. *Journal of Child and Family Studies, 25*, 2636-2647. doi: 10.1007/s10826-016-0413-x

Przybylski, A. K., & Weinstein, N. (2013). Can you connect with me now? How the presence of mobile communication technology influences face-to-face conversation quality. *Journal of Social and Personal Relationships, 30*, 237-246. doi: 10.1177/0265407512453827.

Radesky, J.S., Kistin, C., Eisenberg, S., Gross, J., Block, G., Zuckerman, B., Silverstein, B. (2016). Parent perspectives on their mobile technology use: The excitement and exhaustion of parenting while connected. *Journal of Developmental Behavioral Pediatrics, 37*, 694-701. doi: 10.1097/DBP.0000000000000357

Radesky, J. S., Kistin, C. J., Zuckerman, B., Nitzberg, K., Gross, J., Kaplan-Sanoff, M., ... & Silverstein, M. (2014). Patterns of mobile device use by caregivers and children during meals in fast food restaurants. *Pediatrics, 133*, e843-e849. doi: 10.1542/peds.2013-3703

Radesky, J., Miller, A. L., Rosenblum, K. L., Appugliese, D., Kaciroti, N., & Lumeng, J. C. (2015a). Maternal mobile device use during a structured parent–child interaction task. *Academic Pediatrics, 15*, 238-244. doi: 10.1016/j.acap.2014.10.001

Radesky, J. S., Schumacher, J., & Zuckerman, B. (2015b). Mobile and interactive media use by young children: The good, the bad, and the unknown. *Pediatrics, 135*, 1-3. doi: 10.1542/peds.2014-2251

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*, 385-401. doi: 10.1177/014662167700100306

Rainie, L., & Keeter, S. (2006). Americans and their cell phones. *Pew Internet & American Life Project*. Retrieved from http://www.pewinternet.org/Reports/2006/Americans-and-their-cell-phones.aspx

Wartella, E., Rideout, V., Lauricella, A., & Connell, S. (2013). Parenting in the age of digital technology: A national survey. *Center on Media and Human Development*. Retrieved from https://contemporaryfamilies.org/wp-content/uploads/2014/04/Wartella.pdf

Table 1. Bivariate Correlations and Descriptives for Study Variables for Fathers (above diagonal) and Mothers (below diagonal)

| | Prob. Tech. Use | Tech. Interfere | Ext. Beh. | Int. Beh. | Income | Eductn | Parent age | Child age | Child screen time | Cop. | Dep. | Parenting stress |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Problematic digital technology use | ***.23*** | .41*** | .00 | .20** | .18* | .06 | -.08 | -.05 | .17* | -.11 | .09 | .20** |
| Technology interference | .33*** | ***.28**** | .12 | .26*** | .07 | -.05 | -.05 | -.02 | .45*** | -.32*** | .18* | .32*** |
| Externalizing Behavior | .11 | .27*** | ***.59**** | .72*** | -.10 | .02 | -.01 | .02 | .05 | -.34*** | .30*** | .55*** |
| Internalizing Behavior | .08 | .25*** | .68*** | ***.61**** | -.11 | -.05 | -.05 | .14 | .12 | -.32*** | .37*** | .58*** |
| Income | .08 | .00 | -.05 | -.08 | -- | .25** | .28*** | -.01 | .02 | .01 | -.17* | .02 |
| Education | .13 | .05 | -.12 | -.08 | .35*** | ***.43**** | -.06 | .04 | -.08 | .01 | .04 | .11 |
| Parent age | -.02 | -.07 | .05 | .00 | .38*** | .19* | ***.72**** | -.04 | -.04 | .01 | -.03 | -.01 |
| Child age | -.11 | -.01 | .08 | .21** | .00 | -.20* | -.02 | -- | .28*** | .05 | .06 | .00 |
| Child screen time | -.05 | .41*** | .25*** | .23*** | -.06 | -.22** | -.10 | .33*** | ***.66**** | -.15 | .08 | .12 |
| Coparenting | -.08 | -.09 | -.21** | -.20** | .00 | .06 | -.06 | -.03 | -.19* | ***.41**** | -.41*** | -.49*** |
| Depression | .12 | .11 | .18* | .22** | -.19* | -.12 | -.12 | -.09 | .14 | -.43*** | ***.29**** | .53*** |
| Parenting stress | .08 | .13 | .53*** | .54*** | -.03 | .01 | -.07 | -.02 | .12 | -.43*** | .49*** | ***.47**** |
| *Mothers* | | | | | | | | | | | | |
| Mean | 3.24 | 0.55 | 47.79 | 46.11 | 75.36 | 5.33 | 31.82 | 3.04 | 6.20 | 4.99 | 11.12 | 2.05 |
| Std. Dev. | 1.18 | 0.41 | 10.40 | 10.48 | 39.32 | 1.65 | 4.22 | 1.24 | 5.45 | 0.77 | 8.79 | 0.57 |
| *Fathers* | | | | | | | | | | | | |
| Mean | 2.87 | 0.47 | 47.91 | 46.76 | 75.36 | 5.07 | 33.34 | 3.04 | 6.81 | 4.97 | 10.24 | 2.06 |
| Std. Dev. | 1.17 | 0.56 | 10.94 | 10.84 | 39.32 | 1.73 | 4.93 | 1.24 | 5.59 | 0.75 | 8.49 | 0.59 |

Note. *p < .05, **p < .01, ***p < .001. N = 168 mothers and 165 fathers (from 170 families). Correlations for fathers are presented above the diagonal and for mothers below the diagonal. Correlations between fathers and mothers are bolded, italicized, and on the diagonal. Income is in $1,000 units, and Externalizing and Internalizing scores are in normed t-score units.

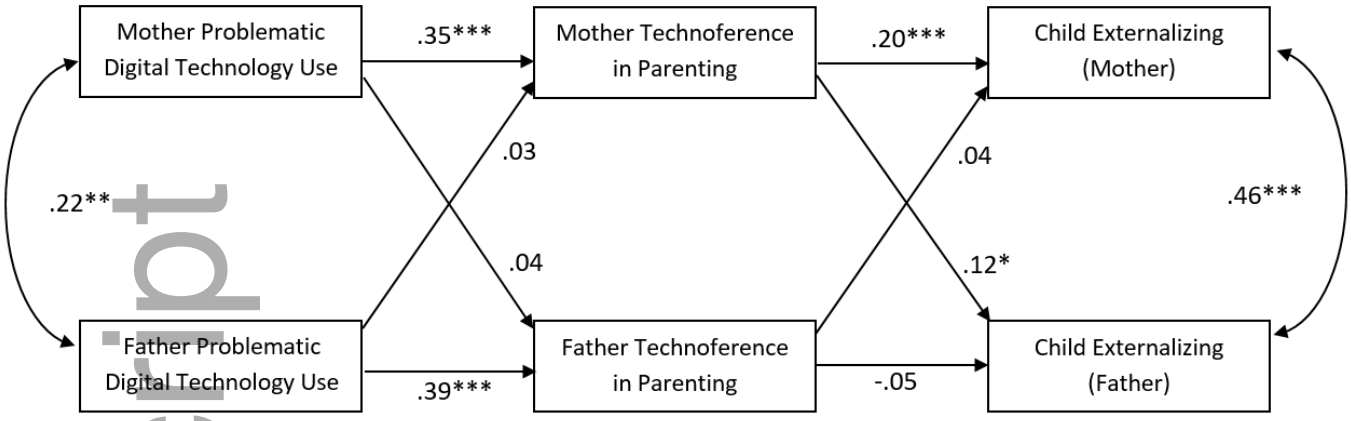


**Figure 1.** Model of parent problematic digital technology use predicting technoference during parent-child interactions which finally predicts child externalizing behavior. Standardized estimates are reported. Parenting stress and coparenting quality were also controlled in the model (paths not displayed here). Entering demographics, depression, and child age and media use as controls did not change the results and were therefore omitted from the final model. Note: *** $p < .001$, ** $p < .01$, * $p = .06$.

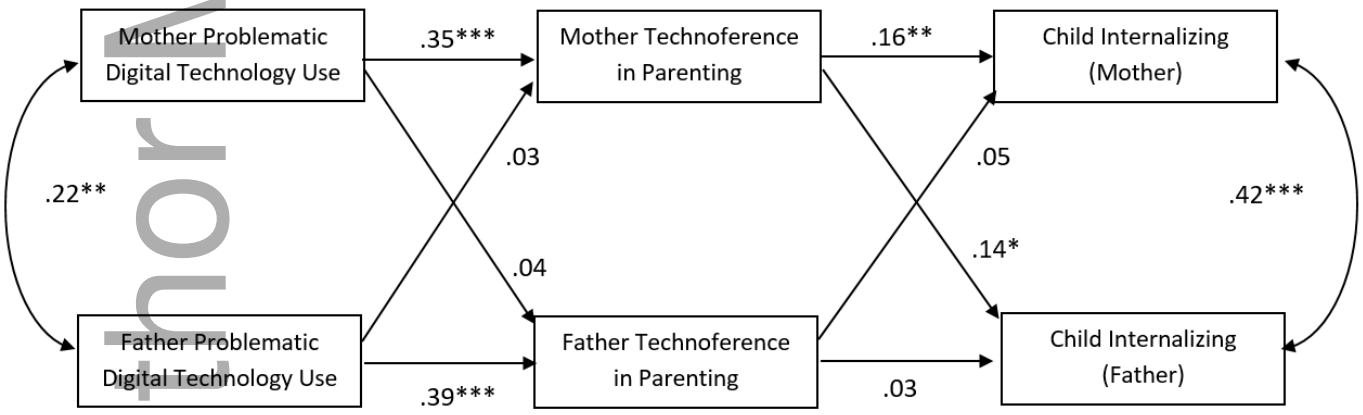


**Figure 2.** Model of parent problematic digital technology use predicting technoference during parent-child interactions which finally predicts child internalizing behavior. Standardized estimates are reported. Parenting stress and coparenting quality were also controlled in the model (paths not displayed here). Entering demographics, depression, and child age and media use as controls did not change the results and were therefore omitted from the final model. Note: *** $p < .001$, ** $p < .01$, * $p < .05$.