INFANTS' PERCEPTIONS OF MOTHERS' PHONE USE: IS MOTHERS' PHONE USE GENERATING THE STILL FACE EFFECT?

Cory A. Kildare

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APPROVED:

Wendy Middlemiss, Committee Chair
Robin Henson, Committee Member
Rebecca Glover, Committee Member
Amarie Carnett, Committee Member
Abbas Tashakkori, Chair of the Department of Educational Psychology
Bertina Combes, Interim Dean of the College of Education
Victor Prybutok, Vice Provost of the Toulouse Graduate School

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Using a modified still-face procedure the present study explores 3-6-month-old infants' behavioral and physiological responses to mothers' screen distractions during mother-infant interactions. In the modified phone still-face procedure the neutral face of the traditional still face procedure was replaced with mothers' texting on their mobile phones. Infants' cortisol stress responses to mothers' device use were assessed through the collection of 3 infant saliva samples. Infants' behavioral responses including facial expressions, vocalizations, gaze and self-comforting behaviors were also explored. All mother-infant interactions were videoed recorded and coded for analysis. Thirty-four mother-infant dyads participated, average ages for mothers was 29 years and 4.4 months for infants. As predicted, infants demonstrated the changes in affect associated with the still-face effect, with significant differences in positive and negative affect during the play phases and the phone still face phase. As a whole, infants did not respond with increased cortisol responses, however, when individual differences were explored 47% responded with increased stress during mothers' phone distractions. Mother's frequency and attitudes towards device use were also assessed but were unrelated to infant responses. Implications and directions for future research are discussed.

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INFANTS' PERCEPTIONS OF MOTHERS' PHONE USE: IS MOTHERS' PHONE USE GENERATING THE STILL FACE EFFECT?[1]

Introduction

Mobile phones have quickly become an integral part of our daily lives, yet research exploring how parents' device use in the presence of their children impacts the parent-child relationship is limited. Research has begun to demonstrate the prevalence of caregivers' absorption in their mobile phones while supervising their children and how screen distractions limits caregivers' ability to engage during playtime and possibly places the parent-child relationship and child safety at risk (Hinkier, 2015; Radeskey et al., 2014). To build on this growing body of research, the present study developed a modified still face (SF) procedure to investigate 3 to 6-month-old infants' behavioral and salivary cortisol responses to mothers' phone distractions during a structured mother-infant interaction.

The Still Face Procedure

The SF paradigm is a standardized approach to assess infant's socioemotional stress regulation in response to disrupted parent-child interactions (for a review see, Adamson & Frick, 2003; Mesman, van IlJzendoorn, & Bakermans-Kranenburg, 2009; Provenzi, Giusti & Montiross, 2016). This procedure is used to evaluate infants' expectations of social interactions by interrupting a mother-infant play interaction with the mother ceasing all social exchanges and staring blankly at her infant (Tronick et al., 1978). Although the SF procedure has been modified in a variety of ways, the standard protocol follows a three phase A-B-A design, where an infant and an adult, typically their mother, are placed facing one another and engage in three separate

[1] This chapter is presented in its entirety from Kildare, C. (in progress). Infants' perceptions of mothers phone use: Is mother phone use generating the still face effect. *Child Development* with permission from Wiley.

sequential 2-minute interactions. In this procedure, A is the first typical play interaction, B is the SF phase, and the second A is another play interaction. The first phase, the face-to-face (FF) phase, is characterized by a typical face-to-face, mother-infant interaction usually without toys or objects of play. The second phase, the still face (SF) phase, is characterized by the mothers' cessation of all facial expressions, use of sounds and physical interactions with her infant. In the SF phase, the only interaction is the mother maintaining eye contact with the infant or staring at the infants' forehead. Finally, in the third phase, the RE phase, mothers are instructed to resume the positive play interactions that took place in the FF phase (Tronick et al., 1978).

Still Face and Infant Behavioral Responses

Infants exposed to the SF phase consistently demonstrate a reduction in positive affect, marked by a decrease in smiling, laughing, looking at their mother, and an increase in negative affect, marked by crying, screaming, attempting to remove themselves from the infant seat, and looking away from their mother (Mesman et al., 2009; Tronick et al., 1978). Infants respond additionally with a partial recovery in positive affect, known as the carry-over effect (Tronick et al., 1978), where infants demonstrate an increase in positive affect from the SF to the RE phase but the rate is not as high as it was in the FF phase. As a whole, this reliable pattern of changes in infant's responses to the SF procedure has been termed the still face effect (SFE) and indicates infants expect their mothers to respond to their bids for interaction (Adamson & Frick, 2003; Mesman et al., 2009). It is still difficult to determine infants' interpretations of the reason for the sudden lack of maternal interactions. Are infants' responses in reaction to the loss of maternal social exchanges and what role does maternal intention play? To explore this, prior studies have used the traditional SF procedure with a disrupted mother-infant interaction by having mothers turn away to speak to a stranger (Mesman et al., 2009), having mothers wear an expressionless mask, or instructing the mother to drink from a water bottle while maintaining eye contact (Legerstee & Markova, 2007). In response to these modified interruptions, infants did not respond with increased negative affect (Legerstee & Markova, 2007). The authors explained this as the infant's awareness of a reason for why their mother was unresponsive – a situation with which infants would have had prior experience. Notably, infants' reactions could be related to maternal eye contact, as all of these modified interactions included continuous eye contact. However, other studies wherein mothers were instructed to stare just above her infant's head (Delgado, Messinger & Yale, 2002; Haley & Stansbury, 2003), look away at the wall or another person (Striano, 2004), or close her eyes entirely (Mesman et al., 2009) resulted in increased negative affect in response to the modified SF phases. This suggests that the SFE is not merely in response to the sudden loss of mothers' vocal or physical interaction, but that mothers' neutral facial expression and gaze combined with a lack of vocal and physical interactions generates the SFE.

Still Face and Infant Physiological Responses

Early life stress has been shown to affect the development of infants' stress response system (Gunnar, 1998; Haley & Stansbury, 2003; Lupien, McEwen, Gunnar, & Heim, 2009) and can adversely affect later physical and emotional functioning (Loman & Gunnar, 2010; Lupien et al., 2009). Experiencing stress activates the hypothalamic-pituitary-adrenal (HPA) axis causing the adrenal glands to secrete an excess of glucocorticoids (stress hormones, such as cortisol). The resulting activation of the infants' sympathetic nervous system and the related physiological changes in hormonal secretions can affect infants' developing stress response system (Ha &

Granger, 2016). The continued stability or allostatic load based on high sustained activation of the HPA-axis is associated with hypo- and hypersensitive stress responses (Lupien et al., 2009).

The SF procedure is a reliable and replicable method of producing infant stress. Several studies have explored infants' cortisol responses to the SF procedure (Crocket et al., 2013; Feldman, Singer & Zagoory, 2010; Grant et al., 2009; Haley, 2011; Haley & Stansbury, 2003; Haley et al., 2011). Results demonstrate considerable variation in infants' cortisol responses. Some studies report a statistically significant difference in infants' cortisol levels from baseline to stressor (Crocket et al., 2013; Feldman et al., 2010; Haley, 2011; Haley et al., 2011; Haley & Stansbury, 2003). However, other studies report a decrease from baseline to stressor (Grant et al., 2009), or report no difference (Feldman et al., 2010; Grant et al., 2009; Martinez-Torteya et al., 2015; Montirosso et al. 2013). Reasons for these differences have been proposed across the available literature and addresses the number of phases in the SF procedure or environmental considerations.

Phone Use

To better understand infants' perceptions of mothers' phone use it is also important to investigate infants' level of exposure to mothers' phone distractions and the possible connection this has to infant distress. Adoption of mobile devices has steadily increased since ownership of cellphones and smartphones were first tracked. Currently, 95% of American adults own a cellphone, up from 53% in 2000; and 77% own a smartphone, up from 35% in 2011 (Anderson, 2015; PEW Research Center, 2017). Unlike cellphones, smartphones, with their texting and Internet capabilities, have altered patterns of social interaction. This can be seen in the new opportunities to continually engage with a device and be perpetually available through a device, providing endless opportunities for mobile device distractions and disrupted parent-child interactions (Harmon & Mazmanian, 2013; McDaniel & Coyne, 2016; Oulasvirta, Rattenbury, Ma, & Raita 2012).

Patterns of Use

National rates of device ownership do not differentiate between device owners who are or are not parents. Therefore, exact ownership rates of parents is difficult to determine. It is known, however, that phone ownership of one or multiple devices and use of technology are higher in households with children in comparison to households without children (Allen & Rainie, 2002; Hughes & Hans, 2001; Wellman et al., 2008). Additionally, adults with children are more likely than adults without children to download mobile applications (48% to 33%; Lenhart, 2012). Yet, whether or not this use is conducted during child supervision remains unknown.

Parents express conflicting attitudes towards their device, acknowledging it as both a source of distraction from their parenting and a cause of worry about not being fully present and modeling appropriate use for their children (Harmon & Mazmanian, 2013; Hiniker et al., 2015; Radesky et al., 2016). Yet, parents also feel their mobile device is a facilitator of more effective parenting, allowing users to simultaneously manage multiple work, parenting, and social roles as well as access parenting information and support (Radesky et al., 2016).

Facial Expressions and Use

A key component to sensitive and synchronous mother-infant interactions, just as with all human interactions, is nonverbal communication cues, specifically facial expressions. Given that mothers’ facial expressions are typically the first and most frequent expressions to which infants are exposed (Ainsworth, 1979; Cohn, Campbell, Matias, & Hopkins, 1990), the lack of facial expressions observed during texting, checking e-mail, and surfing the web via a mobile phone (Radesky et al., 2014), would introduce risk to the infants' perceptions of their mothers' emotional availability.

Although research has yet to explore mothers' facial expression during phone use and infants' perception of mother emotional availability, infants may perceive a blank facial expression during phone use the same way they perceive a neutral facial expression exhibited in the SF procedure. Similarly, infants may perceive the facial expression during phone use similar to the lack of affect and expressiveness exhibited by depressed mothers. This may result in the same effects on mother-child interaction as maternal depression (Cohn, Matias, Tronick, Connell, & Lyons-Ruth, 1986). Mothers diagnosed with depression are reported to smile less at their infants and interact in an overall withdrawn and neutral style compared to mothers not diagnosed with depression (Cohn, et al., 1986). Depressed mothers' neutral facial expressions and muted interactions alter infants' social experiences, placing them at a higher risk of developing insecure attachment relationships (Gelfand & Teti, 1990; Pickens & Field, 1993), as well as exhibiting depressive symptoms and behavior problems later in life (Martins & Gaffan, 2003).

Given the connection between infants' socioemotional development and mothers' lack of affect demonstrated in the research addressing maternal depression (Beebe et al., 2010; Blehar et al., 1977), it is important to determine whether mothers' phone use and associated lack of facial expression and eye contact creates a similar risk for infants' wellbeing. If mothers' phone use during play interactions creates the same environment as that of depressed mothers, then high levels of phone use may impact the nature of the mother-infant interactions. As demonstrated by

Boles and Roberts (2008) and Radesky and colleagues (2014), some parents engaged in technology are unaware of their children's bids for attention. This absence of parental attention is associated with increases in children's engagement in risky behaviors. Further, technologically distracted parents are found to be unaware of how their non-responsive, empty facial expressions affect their infants' future bids for attention (Ekas, Haltigan, & Messinger 2013).

The Present Study

This study was conducted to investigate infants' behavioral and physiological stress responses to mothers' mobile device distractions during mother-infant interactions. Due to this study's interest in infants' responses to the lack of facial expressions and interaction conveyed during most phone use, a modified version of the SF procedure, the **phone still face** (PSF) was developed. This modified procedure replaced the typical still/neutral face of the SF phase with mothers facial expressions exhibited during texting on their mobile phones. This was thought to produce a structured interruption to mother-infant interactions due to mothers phone use. Three research questions were included:

- RQ1: Does the modified PSF procedure elicit an increased cortisol response in 3-6-month-old infants?
- RQ2: Do infants exposed to the modified PSF procedure exhibit the pattern of changes in positive and negative affect as reported in the SF literature?
- RQ3: What role does mothers' frequency of phone use play in infants' cortisol response after exposure to the PSF protocol?

Central to this study, it was hypothesized that as a result of being exposed to PSF phase, the 3 to 6-month-old infants would exhibit outward signs of distress associated with the SFE, such as increased crying, looking away, and attempting to re-engage their mothers in response to the loss of maternal engagement (Mesman et al., 2009; Tronick et al., 1978). It also was expected that infants would exhibit inward signs of distress demonstrated through elevated salivary cortisol levels, signifying their negative physiological responses to mothers' unresponsiveness while on their phone (Crocket et al., 2013; Feldman et al., 2010; Haley, 2011; Haley et al., 2011; Haley & Stansbury, 2003). Given the current lack of research to guide hypothesis generation, it was anticipated as possible that infants would not demonstrate increased cortisol levels, as not all SF studies which have included a measure of infant cortisol have demonstrated increased cortisol levels in response to the SF procedure (Lewis & Ramsay, 2005; Grant et al., 2009; Montirosso et al., 2013; Tollenaar et al., 2011). In this modified SF procedure, it was anticipated that mothers level of device use would be a predictor of infants' responses to the PSF phase. Specifically, mothers with higher levels of device use would have infants with higher cortisol responses due to the lack of maternal responsiveness produced by mothers phone use (Crocket et al., 2013; Feldman et al., 2010; Haley, 2011; Haley et al., 2011; Haley & Stansbury, 2003). As noted in regard to cortisol levels overall, it is possible also that exposure to a repeated stressor of the same type (a homotypic stressor; de Weerth, Buitelaar & Beijers, 2013) would result in a dampened cortisol response due to habituation of mothers phone use. Although this has not been discussed in relation to infants cortisol responses to the SF procedure, a decreased cortisol response has been observed in newborns experiencing a stressor event, such as being discharged from the hospital (Gunnar et al., 1989), as well as in maternal separation studies (de Weerth, Buitelaar & Beijers, 2013).

Methods

Participants

Participants were 34 mother-infant dyads (Table 1). Infants (18 males) ranged in age from 3 to 6 months (*M* age = 4.4 months, *SD* = 1.13). Mothers were 21 to 39 years of age (*M* age = 29 years, *SD* = 4.4). For 38% of mothers, the participating infant was their first born. Of participating mothers, 77% were White; 21%, Hispanic; and 3%, African American. All mothers had earned at least a high school diploma with 39% having earned a bachelor's degree and 25% a graduate degree. In regard to employment, 39% of mother's identified as being stay at home mothers and 49% worked outside the home. Forty-four percent of mothers (*n* = 15) had owned a phone with Internet capability for 5 years or less, 56% (*n* = 19) had owned a phone with Internet for more than 5 years. Although mother's length of ownership is related to self-report technological dependency it was not related to mothers' self-report frequency of device use. The number of mobile device applications (apps) on mothers' phones across the duration of ownership ranged from 2 to 50 apps (*M* = 16; *SD* = 9.4) and was not related to the length of device ownership or frequency of phone use. All mothers received a $50 gift card for participating.

Recruitment

Mothers were recruited from physical and virtual locations frequented by mothers of infants, using flyers/advertisements with a link and QR code to the study's website and contact information. To participate mothers needed to be 18 years of age or older, own a cellphone/smartphone and report having a healthy infant. Infant health was assessed during initial contact. Mothers were asked if their infant had any health risk factors including low birth weight (less than 5 pounds), premature birth (born before 37 weeks gestation), hospitalization after birth or any prenatal or postnatal complications. Mothers who answered yes to any of these health risks were not included in the study. Of the 69 total mothers who responded to study announcements, 8 did not meet inclusion criteria, 3 did not attend their scheduled sessions, 1 declined participation after learning about the study, and 23 expressed interest but did not respond to the researcher's 2 contact attempts.

PSF Procedure

When the mother and infant dyad arrived at the university or center laboratory settings, a 20 minute acclimation period began. During this period, study procedures were reviewed and consent forms were signed. After the acclamation period, the first saliva sample (baseline) was collected following the cortisol sampling practices during SF procedures (Haley & Stansbury, 2003). After the baseline sample was collected, the PSF procedure began. Each 2-minute phase occurred sequentially, with phase changes prompted by the researcher who was not visible to the infant. The stressor and recovery samples were collected 20 and 30 minutes after exposure to the PSF phase (Erickson et al., 2013; Haley, 2011; Haley, Handmaker, & Lowe, 2006). The final complete procedure from arrival to departure, comprised of the following sequence: acclimation period, baseline sample, FF phase, PSF phase, RE phase, stressor sample, survey and recovery sample.

During the PSF procedure, mothers sat in a height-adjustable chair 18 to 24 inches away from their infant who was in an infant seat. For consistency, all infants sat in the same infant seat; however, mothers could choose to lay a blanket down on the seat. It was anticipated that this could reduce the potential distraction of the infant due to the pattern on the infant seat. It was further anticipated that having a familiar item, such as a blanket, would provide a sense of familiarity to the new surroundings and situation. The play interactions for the FF phase and the RE phase were the same. During these phases mothers were allowed to touch, make eye contact with, and talk to their infant by playing a game, such as peek-a-boo. These interactions were not scripted; mothers were simply instructed to play with their infants as usual while remaining in the seats provided. During the PSF phase, mothers held their phone so it was visible to their infant. Mothers were instructed to cease all vocal and physical interactions with their infant and to text the alphabet as fast as they could to ensure their focus remained on the device. To encourage smooth phase transitions, prior to beginning the procedure, mothers were instructed to have their phones set to silent and readily available for the PSF phase. All structured mother-infant interactions were video recorded using two cameras, one focused on the infant's whole body and one focused on the mother's face and upper torso. These videos were saved as MPEG files for coding purposes.

Consistent with SF protocol, the PSF procedure was not completed if infants cried uncontrollably for 20 seconds while in the infant seat (n = 1; Braungart-Rieker et al., 1998; Ellsworth et al., 1993; Haley & Stansbury, 2003; Lergerstee & Markova, 2007). Although mothers' videos were not coded for this study, procedural checks were conducted by viewing mothers' videos. These video checks were used to confirm that mothers did not look at, talk to or touch their infant, as these interactions have been shown to decrease the SFE (Adamson & Frick, 2003, Feldman et al., 2010; Muir & Lee, 2003). In instances where mothers broke procedure and touched or laughed at their infant (n = 3), it was only for a duration of 1 to 4 seconds. Analyses were run with and without these sessions. As no statistically significant differences were found, all session were retained in subsequent analyses. Toys were not permitted during any phase, although mothers introduced toys during two sessions. Analyses were computed with and without these sessions. No statistically significant differences were found between sessions with and without toys; therefore all session were retained in subsequent analyses.

Infant Cortisol Sampling

Use of salivary cortisol sampling is an accepted, noninvasive means of assessing activation of the HPA-axis and level of the salivary stress response (Gunnar & Quevedo, 2007). Three saliva samples were collected from each infant to capture their responses to the PSF procedure. Saliva was collected using a swab specifically designed for infants. No saliva stimulants were used, and mothers were instructed not to feed their infant 30 minutes prior to the procedure in order to avoid sample contamination. If an infant had eaten within this period (n = 3), or spit up during the acclimation period or PSF procedure (n = 2), mothers swabbed their infants mouth with a damp cloth prior to the next sample collection (Haley et al., 2006). All saliva collections were under 2 minutes in duration. Following collection, the saturated swab was immediately placed in a cryogenic vial and stored at -80ºC until the time of shipping to Salimetrics in Carlsbad, CA, for assay. All infants in the present study had sufficient saliva to conduct duplicate testing for every sample.

Cortisol data were screened for outlying values, i.e., values ≥3 *SD*s above the mean for a given time point (Provenzi et al., 2016). One subject's samples were identified as outliers. To maintain the sample size, the outlying samples were replaced by a value that was proportional to the non-outlying values. However, no statistically significant differences emerged in subsequent analyses regardless of whether the uncorrected data for the outliers were included (Crockett et al., 2013; Haley et al., 2006). Final baseline, stressor and recovery cortisol level averages were

.264 µg/dL (*SD* = .15 µg/dL) .283 µg/dL, (*SD* = .19 µg/dL) .267 µg/dL (*SD* = .16 µg/dL) respectively.

Cortisol data was examined for the law of initial values (LIV) effect; no LIV correction was needed as the baseline values were not inversely related to stressor samples (Haley et al., 2006; Haley & Stansbury, 2003; Lewis & Ramsay, 2005). Due to positive skew of sample variables at each time point, all values were subjected to a $\log_{10}$ transformation (Erickson et al., 2013; Grant et al., 2013; Haley & Stansbury, 2003) to normalize the distributions. Final transformed baseline, stressor, and recovery cortisol levels were. -.645 µg/dL (*SD* = .24 µg/dL) -.644 µg/dL, (*SD* = .29 µg/dL) -.645 µg/dL (*SD* = .24 µg/dL), respectively. For subsequent analyses, the transformed values were used.

Location and Time of Day

Testing was conducted between 8:00 a.m. and 7:00 p.m. at two locations to encourage participation. To determine if study location and arrival time were a source of variation in infant stress responses as measured by cortisol levels, correlational analyses exploring the association between location and time of day with cortisol responses were conducted. As with other all other SF studies exploring infant cortisol responses (Erickson et al., 2013; Grant et al., 2009; Lewis & Ramsay, 2005; Provenzi et al., 2016; Thompson & Trevathan, 2008), there was no relation to arrival time and cortisol levels (baseline r = -.35, p = .846; stressor r = -.007, p = .966; and recovery r = -.028, p = .875). Additionally, as reported by Erikson and colleagues (2013), no relation was found between location and infant cortisol levels (baseline r = -.18, p = .50; stressor r = -.07 p = .68; and recovery r = -.06, p = .70). Therefore, time of day and location were not considered any further.

Measures

Infant Positive and Negative Affect

Infant vocalizations and infant facial expressions were coded at 1-second intervals. Vocalizations were scored using the following scale: -3 screaming (loud sharp cry/screech), -2 crying (negative murmuring, louder fussing), -1 mild fussing (soft negative murmuring, whimper), 0 neutral (no vocalizations), 1 cooing (soft positive murmuring), 2 quiet chuckle (more intense cooing, louder postive murmuring), 3 delight (loud positive scream/squeal). Facial expressions were scored as: -3 large grimace (mouth open, furrowed brow, eyes may be closed), -2 frown (mouth slightly open, slight furrowed brow), -1 small frown (closed, downward turned mouth, pout) 0 neutral (no facial expressions), 1 half smile (upward turned mouth closed or slightly open/parted lips), 2 large smile (upward turned and open mouth), 3 wide smile (mouth open wide; Braungart-Rieker et al., 1998; Braungart-Rieker et al., 2001; Braungart-Rieker et al., 2014). Each second of each phase received a score from -3 to +3. When coding facial expressions, if coders were unable to see an infants' face (infant turned away or blocked their face with their hands), facial expression was coded as missing (Moore & Calkins, 2009).

In order to achieve data reduction while representing the variations in infant affect during each phase, percent positive and negative vocalizations and facial expressions were calculated separately for each 2-minute phase (Braungart-Rieker et al., 2001; Erickson et al., 2013). Total affect scores for each phase were generated by averaging the vocalization and facial expression scores, resulting in 2 measures of infant affect, positive affect scores and negative affect scores (Braungart-Rieker et al., 2001). Means and standard deviations for infant affect are presented in Table 2

Table 1

Descriptive Information of Demographic Variables

Variable	Total (*n*=34) *n* (%)
Infant:	
Gender	
Male	18 (25.9%)
Female	16 (47.1%)
Age (months) *M*(*SD*)	4.4 (1.1)
3 months	10 (29.4%)
4 months	7 (20.6%)
5 months	10 (29.4%)
6 months	7 (20.6%)
Baseline µg/dL *M*(*SD*)	.264 (.156)
Stressor µg/dL *M*(*SD*)	.283 (.195)
Recovery µg/dL *M*(*SD*)	.267 (.168)
Mother:	
Age (years)	29.6 (4.5)
Race/Ethnicity	
Caucasian/white	26 (76.4%)
Hispanic	7 (20.5%)
African American	1 (2.9%)
Educational Level	
Bachelor’s degree	13 (38.2%)
Master’s degree	7 (20.5%)
Some college credit	5 (14.7%)
Associate degree	3 (8.8%)
High school graduate	3 (8.8%)
Doctorate degree	2 (5.8%)
Vocational training	1 (2.9%)
Employment	
Stay at home mom	13 (38.2%)
Employed outside home	12 (34.3%)
Self-employed	4 (11.7%)
Student	3 (8.8%)
Military	1 (2.9%)
Unable to work	1 (2.9)
Relationship Status	
Married	29 (85.2%)
Engaged	5 (14.7%)
Phone Ownership (years) *M* (*SD*)	6.5 (2.7)

Note. µg/dL = micrograms per deciliter

.

Table 2

Infant Affect and COPE by Phase

	FF *M*(*SD*)	PSF *M*(*SD*)	RE *M*(*SD*)
COPE Behavior			
Comfort	.13 (.17)	.33(.27)	.11(.15)
Object	.10(.11)	.53 (.23)	.10(.12)
Mother	.79(.17)	.21(.20)	.71(.21
Escape	.02(.03)	.09(.16)	.02(.05)
Affect			
Positive	1.02(.52)	.09(.13)	.96(.64)
Negative	.16 (.31)	.16(.31)	.43(.63)

Note. FF = face to face phase, PSF = phone still face phase and RE = reunion phase. *n* = 34.

Infant Regulation

Infant regulatory behaviors were coded as being present or absent at 1-second intervals using the COPE (Comforting, Object Orientation, Parent/Mother Orientation and Escape) scale (Braungart-Rieker et al., 1998; Braungart-Rieker et al., 2001). This scale included four aspects of coping behaviors: 1.Ccomforting behaviors (sucking their thumb/finger, rubbing their face/hair, and wringing hands), 2. Object orientation (gazeing at an object other than their mother, lowering gaze without closing eyelids, looking at mobile device), 3. Mother orientation (gazings at mothers face), and 4. Escaping the situation (infant makes an attempt to remove herself/himself from the infant seat, arching/twisting of back, gesturing to be picked up, pulling seatbelt). Two measures of infant attention patterns or gaze orientation were included due to research demonstrating that infants will look at an interesting stimulus, such as their mother, but will look away when the mother stares at them blankly (Legerstee & Markova, 2007; Toda & Fogel, 1993). Therefore both object orientation (looking away from the mother) and mother orientation (looking at mother) were included. Proportion scores for each COPE behavior were created by summing the number of intervals that the behavior was present for each 120-second phase, divided by the total number of intervals coded (Table 2).

Interrater Reliability

Affect and regulatory behaviors were coded using the open source VCode/VData software (version 1.2.1, Hailpern & Hagedom, 2015). To evaluate the interrater reliability (IRR), video coding was performed by two independent coders. All 4 coders were trained by the first author. The first author coded all videos. The second coder for each of the videos was one of the 4 trained coders. Disagreements were discussed and resolved until a 90% agreement was reached for each coded behavior. Coders were allowed to pause and rewind the recordings as often as needed. IRR was assessed using two-way, absolute, average-measures interclass correlation coefficients (ICC) to assess the degree that video coders provided consistency in their rating of infant vocalizations and facial expressions (Hallgren, 2012). ICCs of .92 (infant vocalizations) .90 (infant facial expressions), .94 (self-comforting), .90 (object orientation), .90 (mother orientation) and .96 (escape) were obtained, indicating very high agreement among coders.

Mothers Frequency of Phone Use**.** The Media and Technology Usage and Attitudes Scale (MTUAS) was used to assess mothers mobile device usage patterns (Rosen, Whaling, Carrier, Cheever, & Rokkum, 2013). In total, the survey assessing mothers technology use included 22 items. Frequency of phone use items were rated on a 10-point Likert scale (1 never, 2 once a month, 3 several times a month, 4 once a week, 5 several times a week, 6 once a day, 7 several times a day, 8 once an hour, 9 several times an hour and 10 all the time). Since this study was primarily concerned with mothers mobile phone use during mother-child interactions, the original MTUAS use items were modified to address only frequency of mothers device use while in the presence of her infant. Total phone use scores were created by averaging mothers' responses to the 22 items and then grouping scores into high (scores above (62%) and below the mean for phone use categories (*M* = 5, range: 2.27 - 8.23). According to Rosen and colleagues (2013), the MTUAS has good internal consistency with a strong Cronbach alpha of .93 for smartphone use items. In the present study, the Cronbach alpha coefficients was .89 for the 22 modified smartphone use items.

Table 3

Correlations Cortisol Responses, Affect and COPE Behaviors

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Baseline																				
2. Stressor	.61**																			
3. Recovery	.36*	.87**																		
Infant Affect																				
4. Positive 1	-.01	-.00	-.06																	
5. Positive 2	.08	.01	-.04	-.24																
6. Positive 3	-.16	-.12	-.14	.45**	-.08															
7. Negative 1	.27	.42*	.54**	**-.09**	-.17	-.22														
8. Negative 2	.17	.38*	.48**	-.19	**-.34***	-.22	.69**													
9. Negative 3	.16	.36*	.45**	-.14	-.22	**-.51****	.51**	.57**												
10. Comfort 1	.07	-.15	-.14	**-.13**	.39*	-.18	**-.01**	-.15	.00											
11. Comfort 2	.00	-.20	-.39	-.01	**.27**	-.24	-.22	**-.42***	-.26	.32										
12. Comfort 3	-.21	-.36*	-.27	-.22	.12	**-.24**	-.02	-.11	**-.02**	.73**	.36*									
13. Object 1	-.03	-.08	.06	**-.35***	.31	-.09	**.21**	-.10	-.12	**.15**	.01	.17								
14. Object 2	-.35*	-.59**	-.52**	.11	**.12**	.14	-.50**	**-.64****	-.39**	.09	**.18**	.15	.23							
15. Object 3	-.10	.07	.27	-.02	.04	**-.00**	.43*	.25	**.01**	-.01	-.09	**.14**	.18	.03						
16. Mother 1	-.16	-.00	-.18	**.34***	-.27	.24	**-.39***	-.00	-.05	**-.18**	-.02	-.20	**-.92****	-.06	-.16					
17. Mother 2	.32	.47*	.28	.07	**.20**	.23	-.06	**-.04**	-.10	-.01	**-.07**	-.22	-.32	**-.62****	-.18	.29				
18. Mother 3	-.01	-.04	-.23	.18	-.02	**.37***	-.47**	-.33	**-.42***	.02	.08	**-.13**	-.21	.07	**-.66****	.36*	.29			
19. Escape 1	.01	.02	.07	**-.18**	.22	.05	**.07**	.07	.01	**-.21**	-.34*	-.19	**.41***	.10	.15	**-.29**	-.14	-.17		
20. Escape 2	-.19	-.13	-.09	-.04	**.27**	.21	-.09	**-.17**	-.02	-.09	**-.18**	-.14	.29	**.32**	.04	-.17	**-.23**	.00	**.76****	
21. Escape 3	.03	.04	.00	-.15	-.01	**-.36***	.27	.07	**.58****	.03	-.18	**.04**	.27	.00	**-.07**	-.40*	-.25	**.37***	.39*	.25

Note: * *p* = <.05 ** *p* = <.005, 1 = face to face phase, 2 = phone still face phase, and 3= reunion phase. Boldface value represents the relation between measures within the same episode.

Results

Infants Cortisol Responses

A one-way repeated measures ANOVA was conducted to compare infant cortisol response scores for baseline (pre-stressor), stressor (response to PSF) and recovery (response to RE phase). There was no statistically significant effect for cortisol responses (Wilk's Lambda = .955, *F* (2, 32) = .75, $p = .47$, η_p^2=.045) indicating no statistically significant change in cortisol levels between each phase (Figure 1). Additionally the partial eta squared (η_p^2; the proportion of variance of infant stress that is explained by time) is very small (Cohen, 1992) suggesting that infant stress does not differ between each phase. Therefore, hypothesis 1 was not supported.

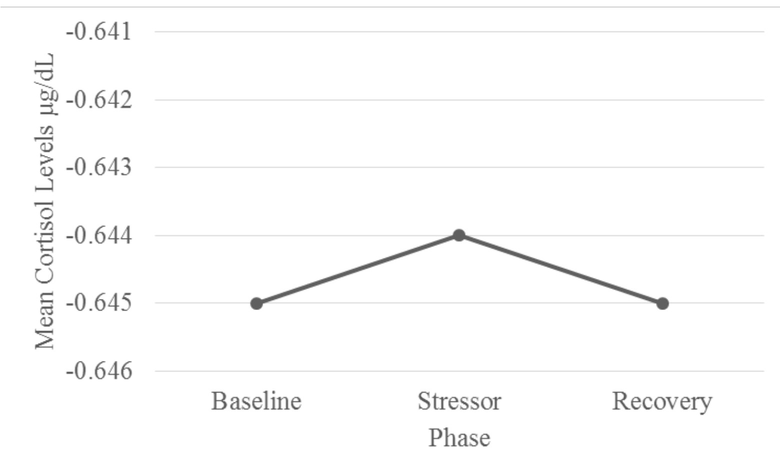

Figure 1. Infant cortisol responses.

Infant Affect and COPE Responses

To determine if the modified PSF procedure resulted in the same changes in infant affect responses similar to previous SF research (Tronick et al., 1978), a repeated measures ANOVA was conducted with phase as the repeated factor. As predicted, infant's affective responses differed by phase (*p* ≤.001): infants demonstrated greater positive affect in the FF phase and the RE phase than in the PSF phase (Figure 2). Anticipated responses were also found for infant negative affect ($p \leq .001$) with the expected increase in negative affect from the FF to the PSF phase and a decrease from PSF to RE phase (Figure 3). There was a statistically significant main effects for positive affect and phase (Wilks' Lambda=.250, F (2, 32) = 47.99, $p \leq .0005$, η_p^2= .750), as well as negative affect and phase (Wilks' Lambda = .324, F (2, 32) = 33.4, $p \leq .0005$, η_p^2= .676). Furthermore, infant positive affect increased from the PSF phase to the RE phase, but it did not indicate any carry over effect with affect levels in the RE phase similar to the FF phase (Mesman et al., 2009; Tronick et al., 1978). To demine if infants' behavioral response varied due to exposure to the modified SF procedure, repeated measures ANOVA were also conducted. Results indicate a reliable change in the proportion of time infants spent engaged in COPE behaviors ($p \leq .001$). Figure 2 shows the proportion of each COPE behavior for the FF, PSF and RE phases. Infants demonstrated expected changes between the FF to the PSF phase with increased self-comforting behaviors (Wilks' Lambda = .581, F (2, 32) = 11.35, $p \leq .0005$, η_p^2 = .419), increased object orientation (Wilks' Lambda = .231, F (2, 32) = 53.38, $p \leq .0005$, η_p^2 = .769) and escape behaviors (Wilks' Lambda = .747, F (2, 32) = 5.42, p = .009, η_p^2=.253). Additionally infants demonstrated the expected decrease in maternal gaze during the PSF phase (Wilks' Lambda = .127, F (2, 32) = 110.17, $p \leq .0005$, η_p^2 = .873).

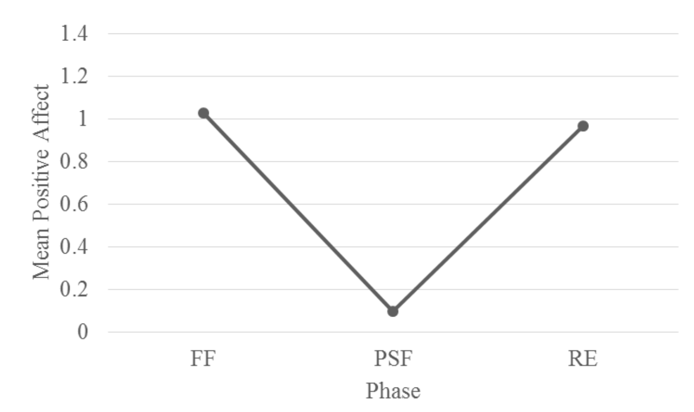

Figure 2. Infant positive affect by phase. FF = face to face phase, PSF = phone still face phase,

RE = reunion phase.

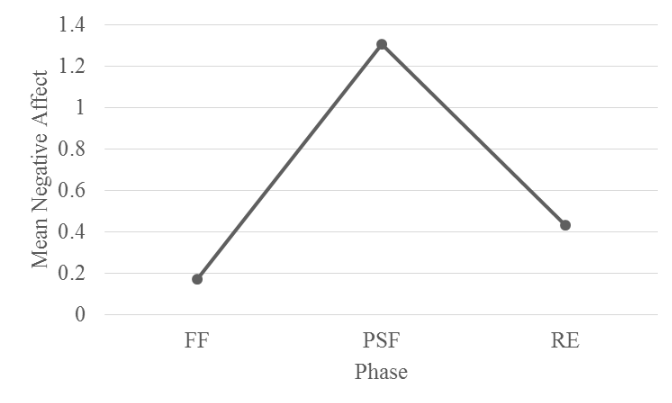

Figure 3. Infant negative affect by phase. FF = face to face phase, PSF = phone still face phase, RE = reunion phase.

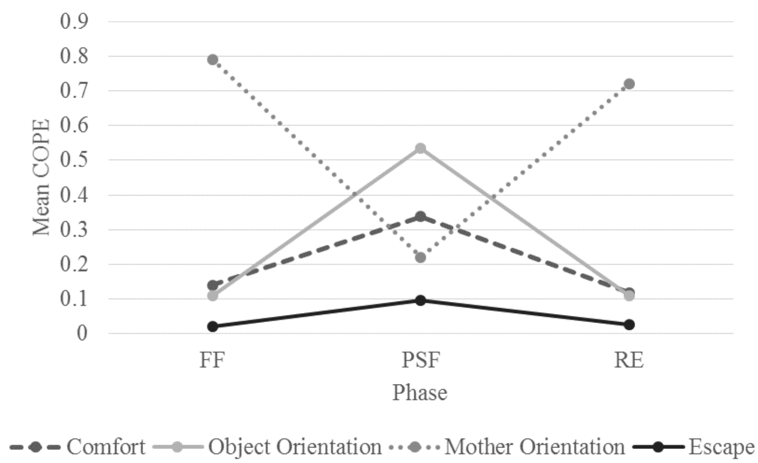

Figure 4. COPE behaviors by phase. FF = face to face phase, PSF = phone still face phase, RE = reunion phase.

In summary, infants were sensitive to the changes in the PSF procedure overall. Infants consistently decreased looking at their mothers during the modified phase while increasing their escape attempts and comforting behaviors when their mother was texting on her phone. Unlike previous studies where infant escape behaviors were coded but observed so infrequently they were removed from analyses (Braungart-Rieker et al., 2001), infant escape behaviors were observed (n = 11) in this study and included in analyses.

Mothers Phone Use and Infant Cortisol Responses**.** To determine the role mothers level of phone use (high and low grouped on mean splits) towards phone use plays in infants' cortisol response to the PSF protocol, separate split plot ANOVA were conducted (means and standard deviations are presented in Table 4). There was no main effect for infant cortisol response as measured by infant cortisol levels and mothers level of phone use (Wilks' Lambda = .998, *F* (2, 31) = .027, *p* = .974, η_p^2 = .002), indicating mothers uses of technology does not affect infant stress responses to the PSF procedure. Therefore, mothers phone use did not appear to play a role infant cortisol responses to the modified PSF procedure.

Table 4

Infant Cortisol Response and Mothers Phone Use

	Baseline *M*(*SD*)	Stressor *M*(*SD*)	Recovery *M*(*SD*)
Device Use			
High use	.26 (.16)	.30 (.21)	.27 (.17)
Low Use	.27 (.13)	.25 (.16)	.25 (.16)

Note. Cortisol measured as µg/dL (micrograms per deciliter).

Discussion

The aim of the current study was to investigate how 3- to 6-month-old infants respond physiologically, emotionally and behaviorally to mothers mobile device use through the use of a modified still face procedure.

Infant Cortisol Responses and the SF Procedure. The SF procedure was modified for the present research to examine the outcome in relation to this original procedure. Contrary to expectations in this research, however, infants experiencing the modified PSF did not demonstrate an increase in cortisol levels. Although prior research has demonstrated heightened cortisol levels with the SF procedure, (Crocket et al., 2013; Grant et al., 2009; Feldman et al., 2010; Haley et al., 2011; Haley et al., 2006; Haley & Stansbury, 2003, these studies were conducted with the modified double exposure procedure that includes an extra SF and RE phase. This 5-episode procedure has been shown to produce statistically significant increases in infants' cortisol levels across phases (Provenzi et al., 2016). Conversely, there are studies in which infants are exposed to the 3-phase procedure have shown no overall difference in infant cortisol levels from baseline to stressor (Lewis & Ramsay, 2005; Mörelius et al., 2015). Provenzi and colleagues (2016) suggest this difference could be due to infant's stage of HPA axis development. Repeated exposure to a stressor, such as maternal unresponsiveness, creates HPA axis susceptibility and will result in heightened cortisol responses. Whereas infants only exposed to a single stressor event, the stressor response is dampened by the immediate maternal interaction of the reunion phase. Future research should explore infant cortisol response between a 5-phase PSF procedure and a 5-phase traditional SF procedure.

SFE and Modified PSF Procedure. Consistent with the expected SF effect, infants did respond to the PSF procedure with a decrease in positive affect and an increase in negative affect, as well as an increase in regulatory comforting behaviors, object orientations and escape behaviors. To further understand infant physiological, emotional and behavioral responses to the modified procedure, maternal sensitivity, maternal responsiveness and dyadic interactions (synchrony) should be explored in future work, as they have been shown to influence infants' responses to the SF procedure (Braungart-Reiker et al., 1998; Haley & Stansbury, 2003). For instance, maternal sensitivity during play sessions is related to more positive affect during the SF phase (Braungart-Rieker et al., 2001; Conradt & Ablow, 2010) and material responsiveness is related to greater regulation during the SF phase (Haley & Stansbury, 2003). Infant characteristics, including temperament, could explain infant regulatory behaviors in response to the modified procedure (Braungart-Reiker et al., 1998).

One interesting component of the present study was the use of objects during the PSF phase. Prior work utilizing a traditional SF procedure with a disrupted mother-infant interaction due to an object did not result in the SFE (Legerstee & Markova, 2007). Notably, infants in the present study did respond to the PSF procedure with the SFE. It is possible that the SFE, in this case, is related to the lack of eye contact during mothers phone use. Few SF studies have modified mother's eye contact (Mesman et al., 2009) demonstrating that a lack of eye contact is related to increased negative affect. Future work should explore the role of eye contact and the typical facial expressions made while on the phone and infants responses. Specifically, exploring mothers distractions on the phone while maintaining eye contact (talking/listening on the phone but ceasing vocal interactions) and mother lack of eye contact while on the phone (texting or browsing social media).

Mothers Frequency of Phone Use. Contrary to expectations mothers frequency of phone use was not related to infant affect or cortisol responses. Although no prior work has investigated mothers frequency of use in relation to infants' responses in a modified SF procedure, observational research has shown increased attention seeking behaviors during caregiver mobile device distractions (Radesky et al., 2014). One possible explanation of this is mothers accuracy in reporting how often they use their device in the presence of their child. In future work, it will be important to provide an objective and accurate measure of mothers frequency of phone use, such as a mobile device use tracking application.

To increase our understanding of the frequency of mothers phones use, future research should investigate patterns of use by parents, questioning how often parents use their device for parenting related tasks, such as accessing parenting information, receiving support from family/friends, or posting pictures of their children on social media. The Facebook subscale of the MTUAS was not included in the present study, but thisinformation may be useful in future work since recent research has found parents are avid consumers of social media (Duggan Lenhart, Lampe, & Ellison, 2015). It may be of use to ask if mothers if their mobile phone is their primary source of Internet access, as the population of "smartphone only" adults is increasing (Horrigan & Duggan, 2015). To enhance our understanding of mothers' device use, future research should assess how having a phone assists with organizing family life, pressures parents may feel to be perpetually available via their phone, as well as assessing parent's attitudes about children's media use, parent-child co-viewing habits and infants media use would also provide greater insight into infant's responses to maternal device distractions.

Limitations. A major limitation of this study is that the data is cross-sectional and does not allow for causal interpretations of the results. Furthermore, the lack of a control group consisting of infants exposed to the traditional SF procedure would have provided a clear comparison between infant's cortisol and emotional responses to the modified procedure, specifically, if the traditional procedure elicits a stronger SFE compared to the modified PSF procedure.

Moreover, several procedural factors may have affected infants' cortisol levels during their participation. For example, a 20-minute acclimation period may not have been sufficient time prior to collection of baseline samples due to heightened stress of traveling to the lab and being in an unfamiliar setting. To account for this in the future, in addition to the acclimation period prior to taking baseline measures, a home-based cortisol sample could be collected as a comparison baseline measure. Furthermore, the screening process and exclusion criteria could be extended to address maternal factors, e.g., mothers' level of prenatal anxiety (Grant et al., 2009), prenatal alcohol exposure (Haley et al., 2006), and maternal depression (Forbes et al., 2004), that have been shown to influence infant affective and cortisol responses.

Additionally, this study has limited statistical power due to the modest sample size (n = 34). An initial power analysis indicated a sample size of 45 was necessary to achieve the desired effect size of .5 (Heirich Heine Universität Düsseldorf, 2013). Due to the small sample size, it may be difficult to assess relations found in prior SF research, primarily regarding age differences, with younger infants demonstrating a stronger SFE and cortisol response (Mesman et al., 2009; Provinzi et al., 2016). Despite compensation and extending the data collection time frame and data collection locations, the desired sample size was not achieved. However, due to the richness of the coding of video data, analyses of collected data was still possible. Also, the demographic profile of respondents in this study is also not nationally representative and only contains mothers, therefore, it is not generalizable to the larger population. Future research should include a larger, more nationally representative sample.

Conclusion. This study extends the present literature by building on our understanding of infants' reactions to mothers' unresponsiveness due to mobile device distractions. To our knowledge, this is the first study to explore the role of a lack of facial expressions while on the phone during mother-infant interactions and infant cortisol, emotional and regulatory responses. The findings provide preliminary support for maternal screen distractions resulting in increased negative affect and regulatory behaviors, as well as partial support for increased cortisol responses to the PSF phase. Future research is necessary to fully understand the individual differences in cortisol responses and the role of the lack of eye contact during phone use has on infants affect and cortisol responses. Ultimately, this study provides a foundation for future research which will enhance our understanding of parents device use behaviors. Additionally, further exploration into infant responses to parents mobile device distractions will expand our understanding of developmental outcomes. This, in turn, will provide a basis for guidelines for parent device use.

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IMPACT OF PARENTS MOBILE DEVICE USE ON PARENT-CHILD INTERACTION: A LITERATURE REVIEW[2]

Introduction

Mobile devices, e.g., smartphones, cellphones, and tablets have become an integral part of our everyday lives. While ownership rates of technological devices such as desktops, e-book readers, MP3 players and gaming consoles have decreased in ownership, mobile device ownership continues to increase among American adults (Anderson, 2015). Adoption of mobile devices has steadily increased since ownership of each device type was first tracked. Based on available reports, currently, 92% (up from 53% in 2000) of American adults own a cellphone, 68% (up from 35% in 2011) own a smartphone, and 45% (up from 3% in 2010) own a tablet (Anderson, 2015; Wormald, 2015).

Smartphones and tablets differ from cellphones in that they combine the capabilities of a traditional cellphone with a portable personal computer and Internet accessibility (Ames, 2013). Growth in ownership over the last five years has contributed to "smartphone only" adults (13% in 2015) who own a smartphone but have no other resource for an Internet connection in their home (Horrigan & Duggan, 2015). Having an Internet connection via a smartphone or tablet allows owners to continually engage with their device and be perpetually available through their device (Hertlein, 2012; Oulasvirta et al., 2012).

Through this continual connection and perceived availability, mobile devices provide endless opportunities for distractions (Harmon & Mazmanian, 2013; McDaniel & Coyne, 2016; Oulasvirta, et al., 2012). According to the displacement hypothesis (Coyne et al., 2014), time

[2] This chapter is presented in its entirety from Kildare, C. & Middlemiss, W. (under review). Impact of parents mobile device use on parent-child interaction: A literature review. *Computers in Human Behavior*, with permission from Elsevier.

spent with technology or media may displace and decrease meaningful parent-child connections. Much of the research on mobile distractions focuses on distracted driving and motor vehicle accidents (Benden, Smith, Henry, & Congleton, 2012), as well as perceptions of device use during face-to-face social interactions (McDaniel & Coyne, 2016; Przybylski & Weinstein, 2012). However, a growing body of research has begun exploring parents' mobile device use as a disruptor to parent-child interactions.

The occurrence and concern of parents plugging into their devices instead of attending to their children has received a great deal of media attention (AVG Technologies, 2016; Filucci, 2013; Hetter, 2011; Highlights Magazine, 2014; Scelfo, 2012; Winters, 2011). This distracted parenting phenomenon has even resulted in the creation of a Tumbler page (a microblogging platform) called *Parents on Phones.* This site claims to expose the culture of mobile device and parental negligence by collecting photos of parents absorbed in their mobile devices while supervising their children (Parents on Phones, 2016). This concern for parents' technological distractions has begun to be addressed empirically as well. To further our understanding of how increased access to mobile devices affects parenting this systematic review will examine empirical research on parents mobile device use as related to parent-child interactions and the implications for parent-child relationships. This will add to current understandings based on previous reviews related to technology and families, which have focused on how parents use the Internet (Dworkin, Connell & Doty, 2013) or on families use of older technology and the Internet before the ubiquitous use of smartphones and tablets (Hughes & Hans, 2001).

To better understand the relationship between parent-child interactions and parent's mobile device distractions, this review attempts to answer the following questions:

RQ1: How are parents using their mobile devices around their children?

RQ2: How do parents feel about their mobile device use during parent-child interactions?

RQ3: How do children respond to parents mobile device use during parent-child interactions?

RQ4: How do parents' mobile device distractions during parent-child interactions affect the parent-child relationship?

Methods

To guarantee a comprehensive search of articles on this complex topic, a combination of parent, child, mobile device, and interaction search terms were used (Table 5).

Table 5

Literature Search Key Terms

Child term	**Parent/Child Terms**	**Mobile Device Terms**	**Interaction Terms**
Child/Children	Caregivers	Cellphone	Attachment
	Dads/Fathers/Paternal	Digital device	Communication
	Parent/Parents/Parental	Hand-held device	Distractions
	Moms/Mothers/Maternal	Mobile device	Engagement
		Mobile phone	Face-to-face
		Mobile technologies	Family time
		Screen time	Interaction
		Smartphone	Monitoring
		Social media	Playtime
		Tablet	Responsiveness
		Technology	Supervision
		Texting	

A search for articles in English, published between January 2000 and November 2016 was conducted using both academic databases (Academic Search Complete, ProQuest, Science Direct, and Web of Science) and broad search engines (Google Scholar and Google). Due to the novelty of this topic, conference presentations, master's theses, and doctoral dissertation research sources were included in the search. This review focused on articles relating to parents' mobile device use during parent-child interaction and implications of parent's mobile device distractions on parent-child relationships. Articles exploring children's and adolescents' own use of mobile devices, using devices to distract children during medical procedures and using devices to monitor children's medical conditions/ medication were not included in this review. Articles that met the inclusion criteria were selected based on a reading of the abstract. If relevant to the present review, an analysis of the full text was conducted. A total of 18 articles meeting the inclusion criteria were found using combinations of the key terms. Through reference list and citation searches of these 18 articles, nine new articles were retained based on the inclusion criteria, providing a total of 27 articles for review (see Figure 3, Arksey & O'Malley, 2005).

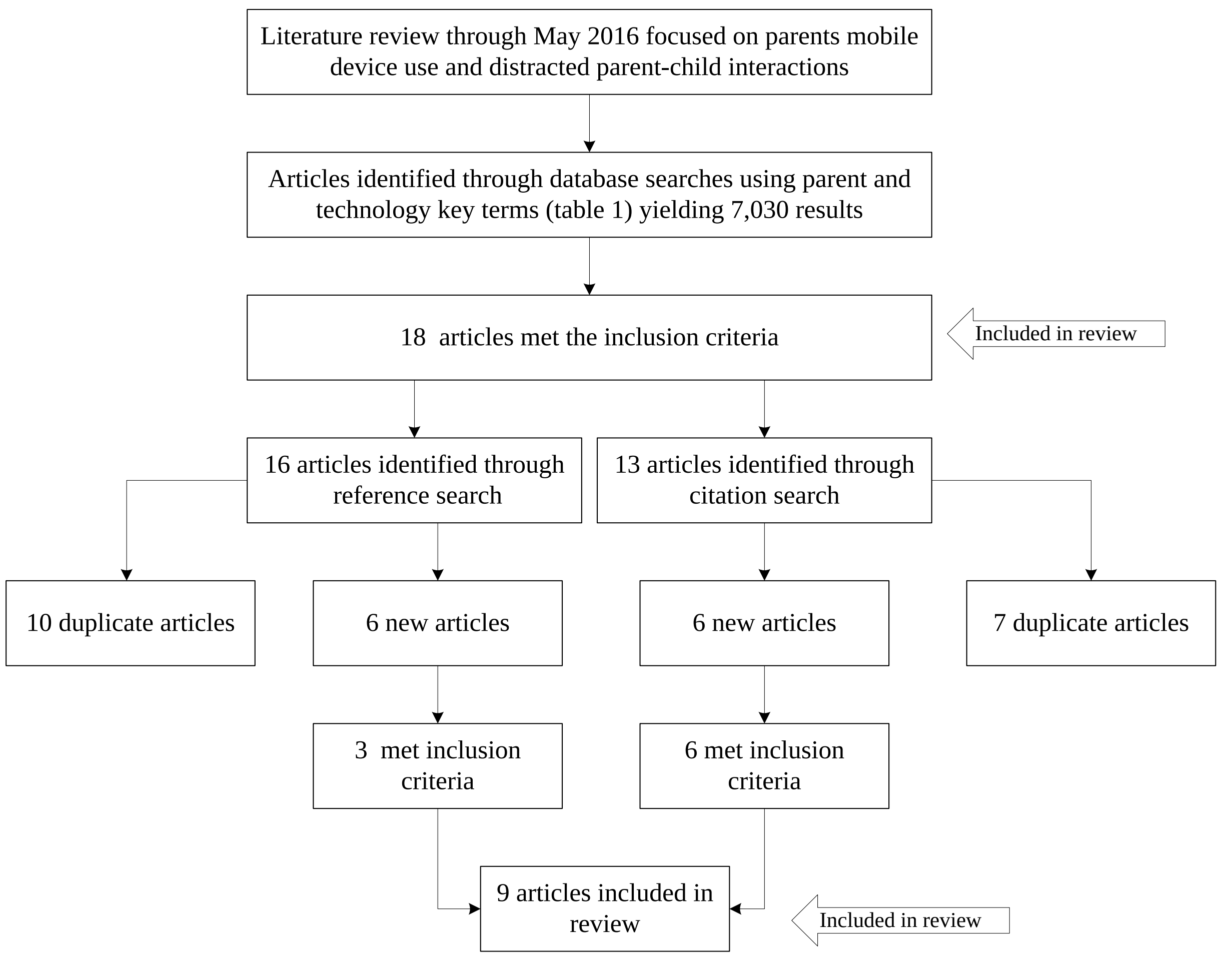

Figure 5. Summary of literature review methods.

Of the articles included, 17 were published research papers, 4 were conference presentations, 4 were unpublished doctoral dissertations and 2 were unpublished master's theses. Of the 27 articles addressing mobile device distractions during parent-child interactions 23 were conducted within the United States, 2 in multiple English-speaking countries 1 in Canada and one in New Zealand. These studies include both qualitative (11), quantitative (11) and mixed methods (5) designs. A detailed summary of these articles is provided in Table 6.

Results

Parent's Mobile Device Absorption

Although specific data on parents device ownership is limited, it is known that households with children are more likely to own and use technology (Allen & Rainie, 2002; Hughes & Hans, 2001; Smith, 2012) and have multiple mobile devices compared to households without children (Wellman et al., 2008). Additionally, parents are more likely than non-parents to download mobile applications (apps), 48% to 33% (Lenhart, 2012). Many of these parents, 57%, download apps for their children, either for entertainment (46%) or for educational purposes (31%; Lenhart 2012). Parents are also avid social media users. Compared to adults without children, parents use Facebook, Pinterest, and Linkedin more often (Duggan et al., 2015). Mothers are more likely to use certain social networking sites such as Facebook, Pinterest, and Instagram, while fathers are more likely to use Linkedin and Twitter (Duggan et al., 2015). However, much less is known about how parents are using their devices in the presence of their children.

Radesky and colleagues (2014a) were the first to operationalize parents' level of device use during parent-child interaction as "the extent to which the primary focus of the caregiver's attention and engagement was with the device rather than the child" (Radesky et al., 2014a; p. 845). Similarly, Blackman (2015) identifies parental screen distraction as the time parents spend engaged in a screened device and are distracted from parenting behaviors.

Table 6

Summary of Key Articles on Parents Phone Use during Parent-Child Interaction

Citation		Country	Theory	Purpose	Sample/Method	Variables of Interest	Key Findings
1	Ante-Contreras (2016)	US	Attachment Theory	Explore how parents' social media use affects parent-child attachment and parenting style	*n*= 167 parents of children ages 0-4 Quantitative – online surveys	- Parent-child attachment - Social media - Cellphones/ Smartphones	- 75% Parents self-reported to using their device at least three times a day while supervising their children - Only 10% view social media as a distraction to caring for their children or places child safety at risk.
2	Blackman (2015)	US	Parental Development Theory	Explore parents screen time and screen distractions on parent-child relationships including frequency of use and caregiver responsiveness to children during use	*n*=93 Parents and caregivers of children between 2 and 18 years of age Mixed Methods – surveys and interviews	- Technologically distracted parents - Parents responsiveness - Parents device uses and ownership - Children's device uses and ownership	- Child use increases with increased parents use - Positive relationship between parental screen time and parental screen distractions among caregivers - Distracted parents are less responsive - Parents screen time (PST) and Parents screen distractions (PSD) significantly moderated by caregiver education level and income
3	Boles & Roberts (2008)	US	None	Explore the relationship between distracted parenting at home while watching TV, answering the phone and using the computer on children's risky behaviors	*n*=40 parents and their 2-5-year-old children Mixed Methods – survey, interviews, and video recorded observations	- Landline phone use - Parents visual attention, proximity, and engagement - Child responses	- Children increase risky behaviors when parents are distracted by TV, a phone call, and computer use - Parents attention and engagement are reduced during distracted behaviors - Proximity between parent and child was reduced most for parents phone use

(table continues)

Table 6 *(cont.)*

Citation		Country	Theory	Purpose	Sample/Method	Variables of Interest	Key Findings
4	Golen & Ventura (2015a)	US	None	Mothers distractions during infant feeding	*n*=209 mothers and their 0-6-month-old infants Quantitative – surveys and infant feeding record	- Infant feeding during parent distraction	- Mothers engage in a variety of distracted behaviors while feeding, most often watching TV - Mothers reported to talking on the phone 4% of the time during infant feeding
5	Golen & Ventura (2015b)	US	None	Investigate if distracted moms during bottle-feeding result in lower maternal sensitivity to infant cues?	*n*=28 Infants under two months old Mixed Methods – video recorded observations, surveys, infant feeding record	- Infant feeding during parent distraction - Mothers responsiveness	- 29% of mothers engaged in a distracted behavior such as using their phone, talking to another person or sleeping for more than 75% of feeding time. - Distracted moms were less sensitive when responding to infant cues - Infants with low regulation capacities and distracted moms tended to overfeed
6	Harmon & Mazmanian (2013)	US	None	Review news articles and advertisements about smartphone use to identify reoccurring	*n*=100 print advertisements, 20 commercials, and 50 articles. Qualitative – discourse analysis	- Smartphone use - Perceptions of use	- Two common themes emerged: Technological integration and technological disintegration - Four users types (multitask master, distracted addict, authentic human, out of touch luddite) - Conflicting use of technology. Disengage from technology and use technology to connect with others - Parents struggle to balance work-family life and mobile connectivity

(table continues)

Table 6 *(cont.)*

Citation		Country	Theory	Purpose	Sample/Method	Variables of Interest	Key Findings
7	Hiniker et al., (2015)	US	Socio-technical Theory	How caregivers use their phones when caring for children at the playground and why	*n*=466 caregivers Mixed Methods – naturalistic observation, semi-structured interviews, and surveys	- Technologically distracted parents - Child supervision - Parents perceptions of use	- Parents feel more available to their children when they are not on their phone. - 28% of caregivers feel phone use while supervising children is acceptable as long as their child is safe - 44% of parents believe phone use should be related to being at the park - 40% of parents would like to decrease their use
8	Hiniker et al., (2016)	US	None	Understand children and parents perceptions about mobile device use at family meal time	*n*=249 parent and their 10-17-year-old child Quantitative – parent and child surveys	- Phone use - Mealtimes - Parent perceptions - Child perceptions	- Parents and children both agree that everyone should unplug from their devices during mealtimes or conversations. - Children feel parents needs to initiate family time and put away their device and follow their rules about not devices at the dinner table.
9	Joyner-Bagby (2015)	US	Self-Determination Theory	Explore parents perceptions and motivations for phone use while driving with adolescent children	*n*=14 parents (10 couples and four single parents) of teenage soccer players Qualitative - open-ended survey questions	- Parents phone use - Perceptions of use - Distracted driving	- Four themes emerged about talking on the phone while driving: 1.) devices are a necessity to keep up with their busy lives 2.) Parents would be able to accomplish daily tasks without their device 3.) Parents feel they are effective multitaskers and can safely drive while using a device 4.) Parents see texting is more dangerous than talking. Hands-free devices would reduce any risk of mobile use while driving

(table continues)

Table 6 *(cont.)*

Citation		Country	Theory	Purpose	Sample/Method	Variables of Interest	Key Findings
10	Kushlev (2015)	Canada	None	Investigate how parents smartphone use affects the quantity and quality of face to face interactions with their children	Study 1: *n*=90 parents at festival Study 2: *n*=200 parents and children at museum Quantitative – surveys	- Smartphone use - Perceived connectedness - Level of phone use	- Study 1, parents used their phones as they normally would. High-use parents compared to low-use parents no had lower quality of attention - Study 2: Parents instructed to use their phone more had lower levels of attention and lowered perceived connectedness - Reason for phone use moderates feelings of connected, if shared experience perceived connectedness is greater
11	Macy, Carter, Bingham, Cunningham, & Freed (2014)	US	None	Explore the distractions of parents driving with their children	*n*=570 parents of 1-12-year-old children Quantitative – surveys	- Technologically distracted parents - Parents phone use while driving with children	- Parents who are distracted by their phones while driving places child safety at risk due to increased accidents - Parents are less likely to be distracted by their children than by their phones while driving
12	McDaniel & Coyne (2016)	US	Displacement Hypothesis	Investigate mothers perceptions of technological distractions on coparenting	*n*=213 mothers of children three years of age or younger Quantitative – surveys	- Technologically distracted parents - Mobile devices	- Cellphones/Smartphones disruption interfered most with coparenting - 20% of mothers said technology interfered with playtime and spending time with child - Interruptions were more common during unstructured coparenting interactions - Technology interruptions were related to higher maternal depressive symptoms, lower relationship, and coparenting satisfaction

(table continues)

Table 6 *(cont.)*

Citation		Country	Theory	Purpose	Sample/Method	Variables of Interest	Key Findings
13	Moran (2010)	New Zealand	None	Examine supervisory behaviors of parents of young children at the beach	*n*=544 caregivers with children under ten years of age Qualitative – naturalistic observations	- Technologically distracted parents - Child supervision - Child safety	- 130 of the parents who were not supervising their children, 27% were focused on their cellphone, other distractions included sunbathing (30%) and socializing (28%)
14	Moser, Schoenebeck & Reinecke (2016)	Australia, Canada, New Zealand, UK and the US	None	Investigate perceptions of device use during mealtimes and factors that contribute to the attitudes regarding use	*n*=1163 between 8 and 88 years of age Quantitative – survey	- Attitudes of mobile phone use - Family mealtimes	- Phone use during mealtimes is less acceptable in the presence of children - Despite family rules, parents still answered their phone during family mealtimes - Less acceptable for children to use their device compared to parents - Individual use is the strongest predictor of their perception of others uses at mealtimes - Texting and answering the phone is more appropriate than going online or accessing social media
15	Oduor et al., (2016)	Canada and the US	None	Investigate when and why smartphones and tablets are used within in front of others in home environment	*n*=20 North American adults between 20 to 60 years old. Mixed Methods - diary, survey, and interviews	- Perceptions of mobile use - Work/family balance	- All parents of young children believe their device use is affecting their parenting - Parents of younger children were less responsive to their children. - Disengagement from family through a device is sometimes needed - Devices allow for enhanced connection and shared experiences via videos and SNS

(table continues)

Table 6 *(cont.)*

	Citation	Country	Theory	Purpose	Sample/Method	Variables of Interest	Key Findings
16	Palen & Hughes (2007)	US	None	Examine the bi-directionality of how family life is shaped by technology use and how family life shapes technology use	*n*= five families with children between 3 and 13 years of age. Qualitative – daily call logs, two interviews, and voicemail diaries	- Technologically distracted parents - Parents device use at home - Work-family life balance	- When in the presence of their children, parents did not have their phones with them. When at home parents are less likely even to be aware of if their phone is on/off - When around younger children parents use their phone to connect with other adults. - Parents use phone to stay in touch with adolescents - Parents expressed difficulty balancing work and family
17	Palsson, 2014	US	None	To explore the connection of smartphone ownership and child injuries for children ages 0-10	NEISS 2003-2012 data set and CPSC hospital of childhood injuries Quantitative - secondary data analysis	- Technologically distracted parents - Child supervision - Unintentional child injury	- Childhood injuries for children 0-5 increased after the 3G network for smartphones entered the market
18	Radesky et al., (2016c)	US	Grounded Theory	To explore parents perceptions of mobile device use and identify potential interventions	*n*=35 parents/caregivers of 0-8-year-old children Qualitative – semi-structured group interviews and individual interviews	- Parent - Mobile device use	- Three themes emerged 1.) The cognitive tension – complexity and exhaustion of managing work, home and social roles with media use. 2.) Emotional tensions – possible for increased familial conflict and guilt for device use 3.) Parent-child tensions – interrupting time spent with children.

(table continues)

Table 6 *(cont.)*

Citation		Country	Theory	Purpose	Sample/Method	Variables of Interest	Key Findings
19	Radesky et al., (2014c)	US	None	To examine how mothers mobile device use during a structured laboratory task affects parent-child interaction	*n*=255 low-income mothers and their 6-year-old children Qualitative – video recorded observation	- Mothers mobile device use - Mother-child interaction - Mothers responsiveness	- 23.1% of moms spontaneously use their device during the new food tasting task - Compared to moms who did not use their device, moms who use their devices were less verbally and non-verbally responsive to their child
20	Radesky et al., (2014a)	US	None	To investigate caregivers level of absorption with mobile devices during a family meal	*n*=55 caregivers and their children. Infants (*n*=6), toddlers (*n*=16), preschoolers (*n*=14) and school age children (54) Qualitative – naturalistic observation	- Parent-/caregiver technological distraction - device absorption - Child responsiveness - Parental sensitivity	- 40 of the 55 caregivers use their phones during meal time. - Caregivers who are absorbed in their devices are less responsive to the children and sometimes responded negatively to child misbehavior. - Unsupervised children will engage in more risky behaviors (climbing on tables)
21	Roney, Violano, Klaus, Lofthouse & Dziura (2013)	US	None	Investigate how driver's use differs when driving with children, adults or alone	*n*=539 drivers of children Quantitative – survey	- Technologically distracted parents Parents phone use while driving with children	- 92% of all participants used their phone while driving 80% of drivers use a device while in the presence of children while driving
22	Sharaievska & Stodolska, (2016)	US	Socio-technological model	Understand the bidirectional relationship between using SNS for leisure and family and leisure satisfaction	*n*=22 individuals from 7 families with 13-17-year-old children Qualitative – semi-structured family and individual interviews	- Technology - family time - Communication	- Using SNS brought families closer together and enhanced sense of belonging - Using SNS also decreased the amount of time spent with family, lowered responsiveness during face to face interactions - Parents specifically express concerns for children social development

(table continues)

Table 6 *(cont.)*

Citation		Country	Theory	Purpose	Sample/Method	Variables of Interest	Key Findings
23	Simon, Tamura & Colton (2003)	US	None	Explore parents supervisory behaviors for children under 5 and reasons for leaving children unsupervised	*n*=259 caregivers/parents of children under 5. Quantitative – survey	- Child supervision - Child injury/death	- 20% of parents reported to answering the phone while their child was bathing, leaving them unsupervised
24	Smale (2011)	US	None	Explore whether the frequency of parents calling and texting spouses and children affects their satisfaction with time spent with family	*n*=417 parents of children under 18 Quantitative - Secondary data analysis	- Frequency of parents phone use - Family time - Family life satisfaction	- Phone calls to communicate with family has no relationship to satisfaction with time spent with family - Texting children is positively associated with family life satisfaction - Parents in families who eat dinner together have higher family life satisfaction
25	Stupica (2016)	US	Attachment Theory	Explore children's athletic performance when parents were engaged/responsive and while parents were unengaged and on their phone.	*n*=50 3-12-year-old children Qualitative- observational video data	- Parents phone use - Attachment - Responsiveness	- Parents sensitivity and responsiveness predicted how fast a child would run around a baseball base - Children ran faster when parents sensitivity was increased - Children ran slower when parents were unresponsive and engaged in their phone
26	Sullivan (2013)	US	None	Explore the effects of technology on parent-child relationships among people with an Internet Addiction Disorder (IAD)	*n*=6 - 2 IAD adolescents and four clinicians Qualitative - telephone interviews	- Technology addiction - Parent-child attachment unique	- It is difficult for less tech savvy parents to enforce technology limits - As children, the adolescent boys had to compete with their mom's cellphone use - Helicopter parenting associated with giving device to child.

(table continues)

Table 6 *(cont.)*

Citation		Country	Theory	Purpose	Sample/Method	Variables of Interest	Key Findings
27	Yu, X. (2015)	US	None	Understand how families use and perceive cellphone use while on a family vacation	*n*=37 smartphone users who took a family vacation in the last two years Qualitative – In-depth semi-structured interviews	- Smartphone distractions - Child perceptions - Parent perceptions - Family vacation	- Smartphone are used to maintain a digital record of family vacation experiences - Smartphones are also used to enhance shared family experiences (getting/sharing directions to destination) - Smartphone use on vacations is also a source of conflict and disconnect from family - Smartphones are intentionally used by induvial members to escape family time

Connected parenting has been observed in many settings, including family mealtimes (Hiniker et al., 2016; Moser et al., 2016; Oduor et al., 2016; Radesky et al., 2016c; Radesky et al., 2014a; Schoenebeck & Reinecke, 2016;), during infant feeding or playtime (Ante-Contreras, 2016; Golen & Ventura, 2015a; Golen & Ventura, 2015b; McDaniel & Coyne, 2016), public places (Hiniker et al., 2015; Kushley, 2015; Moran, 2010; Radesky et al., 2014a), in the car (Macy et al., 2014; Roney et al., 2013), on vacation (Yu, 2015) and in the home (Blackman, 2015; Boles & Roberts, 2008; Harmon & Mazmanian, 2013; Palen & Hughes, 2007; Sharaievska & Stodolska, 2016; Simon, Tamura & Colton, 2003). Few studies directly assessed the amount of time parents spend distracted on a device (Blackman, 2015; Hiniker et al., 2015; Radesky et al., 2014a).

Qualcomm (2013) was the first to directly assess the frequency of parents' phone use during times of parent-child interaction, revealing that 35% of American adults reported to frequently using their phone while playing with their children. Blackman (2015) surveyed 93 caregivers and found those parents to spent between 30 minutes and 7.5 hours a day with a screened device but with only 0-5 of these hours reporting use the presence of children. However, observational data revealed that some caregivers were their device consistently during a meal with their children (Radesky et al., 2014a) or when at the park (Hiniker et al., 2016). Ante-Contreras (2016) found 75% of the 167 parents were on their device at least 3 times a day while in direct supervision of their children. Despite this, parents do not feel their use it affects their ability to effectively supervise their children (Ante-Contreras, 2016; Hiniker et al., 2015). However, some parents say when their children are around them they are less likely to use their device and intentionally turn it off or leave it at home (Ante-Contreras, 2016; Hiniker et al., 2015; Palen & Hughes, 2007).

Mobile devices allow users to simultaneously manage multiple roles related to their parenting, work, and social spheres (Kushlev, 2015; Radesky et al., 2016c). Although useful, this capacity contributes to increased devices use in the presence of children. Furthermore, the continual availability through email, texting, calls, and social media provided through an Internet connection has created a growing expectation that users, inclusive of parents, will respond immediately to electronic communication (Harmon & Mazmanian, 2013; Pielot, Church, & de Oliveira, 2014; Smale, 2011). This expectation is evidenced in phone users' reports of hearing complaints from coworkers and family members if they were slow in responding (Ames, 2013; Pielot et al., 2014; Smith, 2012; Yu, 2015). Working parents fear also missing work-related content leading them to have their devices readily available even during family time (Harmon & Mazmanian, 2013; Joyner-Bagby, 2015; Kushlev, 2015; Moser et al., 2016; Oduor et al., 2016; Palen & Hughes, 2007; Radesky et al., 2016c; Sharaievska & Stodolska, 2016). This results in a continual struggle for work-life-family balance (Harmon & Mazmanian, 2013; Joyner-Bagby, 2015; Palen & Hughes, 2007), and many users report complaints from their spouse or children telling them they are on their device too much (Harmon & Mazmanian, 2013; Sharaievska & Stodolska, 2016; Yu, 2015). Parents are struggling to be available 24/7 for work, but also express a strong desire to be unavailable and, therefore present, for their family (Harmon & Mazmanian, 2013).

One way parents attempt to manage daily life and establish a work-family balance is to multitask, primarily using their phone while driving (Joyner-Bagby, 2015). However, this use not only distracts parents from being attentive drivers, but it also distracts them from being an attentive parent. Parents who are distracted by talking on the phone, texting/emailing, or looking at the Internet are less responsive to their children and, for some, the car ride from school or an extracurricular activity is one of the few hours in a day that parents get to spend with their children (Joyner-Bagby, 2015; Macy et al., 2014, Turkle, 2011). Rates of parents' use of mobile devices while driving are similar to the general population, and parents engage in similar distracted driving behaviors (Macy et al., 2014; Roney et al., 2013). Roney and colleagues (2013) found that drivers with children in the car are more likely to surf the web and send text messages when stopped at red lights than while the car is moving. Phone use while driving with children is significantly lower than when compared to driving alone or with another adult; however, over 80% of the parents reported using a phone while driving with their children in the car (Roney et al., 2013). This not only contributes to the growing concern for distracted driving but also places child safety at risk and models unsafe driving practices for children and teens. This is of particular concern given that children are likely also to be a distraction to parents while driving, especially younger children who require more attention (Macy et al., 2014; Roney et al., 2013). Of note, parent's desire to model appropriate device use decreases distracted driving behaviors in the presence of their teenagers for they are close to driving age (Macy et al., 2014).

Another way parents try to manage work, family, and social spheres while curbing their device use is by setting limits for their individual use. Parents want to decrease their device use to spend more time with family and lessen their concern about modeling appropriate phone use for their children (Hiniker et al., 2015; Macy et al., 2014; Oduor, 2016; Radesky et al., 2016c). Parents report to setting aside specific times without a phone, turning off their phone from time to time, skimming to see how urgent a notification/message is or only allowing themselves to engage in quick short bursts of use such as checking a text message instead of reading a news article (Harmon & Mazmaninan, 2013; Hiniker et al., 2015, Hiniker et al., 2016; Moser et al., 2016). Others try to only use a device for location appropriate activities, such as taking pictures of their child while at the park, however, parents still struggle to disconnect (Harmon & Mazmanian, 2013; Hiniker et al., 2015).

Similarly, limits regarding device use have been established for family mealtimes, typically having a no phones at the table rule (Harmon & Mazmaninan, 2013; Hiniker et al., 2015, Hiniker et al., 2016; Moser et al., 2016). Mealtimes are a key component to family life and family life satisfaction and several of the studies focused on this time for displaced parent-child interactions (Hiniker et al., 2016; Moser et al., 2016; Oduor, 2016; Radesky et al., 2014a; Yu, 2015). Parents and children primarily state that parents being present is the most important rule to follow and that all devices should be put away during meals and when speaking to children (Hiniker et al., 2016). Phone use at mealtimes is also less acceptable when younger children are present compared to other adults (Moser et al., 2016). Despite these rules parents still answer their phones during family meals and are frequently admonished by their children, primarily teenagers for the double standard regarding mobile device use at the table (Hiniker et al., 2016; Moser et al., 2016).

Research also suggests that phones provide users with the opportunity to take a break from social interactions (Oduor et al., 2016; Palen & Hughes, 2007; Yu, 2015). Some studies have found that parents use their devices differently depending on the age of their child (Palen & Hughes, 2007; Radesky et al., 2014a). While adolescents tend to use their device to disconnect from their parents and connect with their friends (Sharaievska & Stodolska, 2016; Yu, 2015), parents tend to use their device to stay connected with their adolescent children, but use it to intentionally disconnect from their younger children and connect other adults by going on social media (Ante-Contreras, 2016; Palen & Hughes, 2007; Radesky et al., 2016c).

Parents Attitudes about Device Use

Parents' perceptions of how their device use affects their relationship with their children are complex and variable with parents reporting both positive and negative attitudes. Semi-structured interviews with 35 parents revealed the complexity of parents' attitudes regarding their device use in general and specifically in the presence of their children (Radesky et al., 2016c). These parents reported cognitive, emotional, and parenting tensions related to device use. Many parents acknowledge their device as a source of distraction (Ante-Contreras, 2016; Hiniker et al., 2015; Joyner-Bagby, 2015; Kushlev, 2015; Radesky et al., 2016c) and are worried about not being a good parent if they are not fully present around their family (Harmon & Mazmanian, 2013; Oduor, 2016; Radesky et al., 2016c). In coparenting situations, mothers perceived phone notifications to interrupt their time with their playtime children and places a strain on their coparenting relationship (McDaniel & Coyne, 2016). Parents also express feelings of guilt when using their phone around their children regardless of the duration of their use (Harmon & Mazmanian, 2013; Hiniker et al., 2015; Oduor, 2016). This could be attributed to parents being judged or shamed by other parents, such as on the Parents on Phones Tumbler page, or by their family members for using their device too much (Harmon & Mazmanian, 2013; Yu, 2015). At the park, 27% of all distracted parents reported to feeling judged by other parents when on their phone (Hiniker et al. 2015).

On the other hand, 65% of parents believe their phones make them better parents (Qualcomm, 2013). Many parents use their mobile device to monitor their children, their children's' social media use (Devitt & Roker, 2008; Duggan et al., 2015; Hiniker et al., 2016; Palen & Hughes, 2007), as well as to access parenting information, advice, and support (Dworkin et al., 2013 Duggan et al., 2015; Radesky et al., 2016c). Mothers are reporting that having a phone assists with managing family life (Palen & Hughes, 2007; Radesky et al., 2016c). Additional positive influences have primarily been found through the use of social networking sites, allowing family members to remain connected, and providing an easy way to plan face-to-face family events (Sharaievska & Stodolska, 2016). However, easily accessible parenting information and continual communication may be of concern regarding parents' use of technology if this use interrupts parent-child interactions or places child safety at risk.

Children's Reactions to Parents Device Use

Children notice when their parents are distracted. With high rates of parental device absorption children have been found to compete with their parents' mobile device for attention (Oduor, 2016; Radesky et al., 2016c; Radesky et al., 2014a; Sullivan, 2003). During fast food mealtimes, for example, young children were mostly bothered by their parents intermittent, quick checking and their parent's continual absorption with their screen. During this time, older school-age children do not seem bothered by parents' phone use and do not make any bids for their parents' attention even when their parents were on their phones for the entire meal (Radesky et al., 2014a). This could be because older children are used to the lack of parental attention or have experienced negative responses from their parents when they interrupt their parent's phone use.

An observational study explored 3-12 years old children's responses to parental sensitivity and responsiveness during their child's baseball/softball game (Stupica, 2016). Parents were instructed to either be available and responsive or unavailable and unresponsive (engaged with their phone) while children were running around a base. A counterbalanced randomized repeated measures design was used so children would experience both parent conditions. Results indicated children ran faster when their parents were attentive and sensitive in their responses. When their parents were engaged with their phones, children ran slower and were more likely to trip or fall while running. This reduction in children's performance also was observed when parents were attentive but expressed harsh instead of supportive responses.

It has been well established that unsupervised children will engage in risky, sometimes life-threatening behaviors when attempting to re-engage a parent and that distracted parents are less likely to warn children of a potentially risky situation or behavior (Palsson, 2014; Petrass, Blitvich & Finch, 2009; Saluja et al., 2004). In public places, children have been reported to make bids for their parent's attention by misbehaving, e.g., crawling under tables or standing in chairs in fast food restaurants (Hiniker et al., 2015; Radesky et al., 2014a). This attention seeking behavior could be placing child safety at risk (Boles & Roberts, 2008, Palsson, 2014; Moran, 2010; Radesky et al., 2014a). Increased phone ownership and related increases in parents' inattentional blindness or lack of awareness and attention to children while distracted is related to the sudden increase in childhood injuries (Hyman et al., 2010; Kushlev, 2015; Palsson, 2014; Radesky et al., 2014a). This trend is seen also with non-mobile devices, such as talking on a landline, using a desktop computer or watching TV (Boles & Roberts, 2008).

In the presence of parental technological distractions, younger children are more likely to engage in risky behaviors and therefore more likely to be injured (Boles & Roberts, 2008; Moran, 2010; Palsson, 2014; Radesky et al., 2014a; Steiner-Adair, 2013). News reports of infant/toddler deaths in connection with caregivers' technological distractions are not unheard of (Kemp, 2013). Simon and colleagues (2003) interviewed parents while at the hospital about their supervision of their children's bath time. Parents reported leaving children under 5 years of age unsupervised for 1-5 minutes during bath time to answer the phone, cook dinner, or grab a towel, thus placing their children at risk for drowning (Simon et al., 2003). In an observational study of parental supervision at the beach, a quarter of parents were distracted by various non-technological behaviors such as sunbathing, yet of these distracted caregivers, 27% were engaged with their cellphones, which is suggested to be related to the increased number of the drownings among school age children (Moran, 2010).

While at the park, Hiniker and colleagues (2015) interviewed and surveyed parents regarding their ability to pay attention to their child when on the phone. Interestingly, 22 of the parents interviewed, and 123 of surveyed parents acknowledged that they paid less attention to their physical surroundings when engaged in their mobile devices. Many of these parents (57%) reported to not using their phone because they believed it would compromise their child's safety and lower their ability to respond (65%). Yet parents in the same study expressed confidence in their ability to effectively monitor their children and that it was acceptable for them to use their phone as long as they thought their child was safe (Hiniker et al., 2015). When these parents were asked what their child was doing while they were on the phone, these parents became defensive or gave vague general responses. Efforts should be made to further investigate connected parents' ability to supervise their children in order to fully understand the level of distraction in relation to childhood safety to ultimately provide guidelines for parents use.

Implications for Parent-Child Relationships

It is clear that when parents are absorbed with mobile devices their ability to attend to their children is limited (Boles & Roberts, 2008; Hiniker et al., 2015; Hiniker et al., 2016; Moser et al., 2016; Oduor et al., 2016; Radesky et al., 2014a). In a structured task observing 6-year-olds eating behaviors, Radesky and colleagues (2014c) found that mothers distracted with their mobile devices had lower levels of verbal and non-verbal communication with their children compared to the mothers who were not engaged in a device. Mother-child interactions were most severely disrupted when the children were presented with a new and unfamiliar food, in these situations children received less encouragement from their distracted mothers and were less likely to try the new food (Radesky et al., 2014c).

Technologically distracted parents are also slower to respond to their children's reengagement attempts but also tended to be less sensitive in their eventual responses (Blackman, 2015; Hiniker et al., 2015; Kushlev, 2015; Oduor, 2016; Radesky et al., 2014a; Stupica, 2016). When children attempt to recapture caregiver attention, parents initially attempted to ignore but eventually respond (Harmon & Mazmanian, 2013; Radesky et al., 2016c; Radesky et al., 2014a). Sometimes these responses are positive (Hiniker et al., 2015); other times children are scolded possibly without parents even looking up from their device (Radesky et al., 2014a). Other parents may respond in a physical manner, with one parent kicking the child under the table and another parent pushing the child away when the child attempted to regain their mother's attention by lifting her face up and away from the device (Radesky et al., 2014a).

In other cases when children made bids for attention, parents are completely unresponsive (Hiniker et al., 2015). This lack of responsiveness has also been seen among parents who were not technologically distracted, but talking to another adult or already attending another child (Hiniker et al., 2015). Some parents even report to intentionally ignoring their child by pretending to be engaged in their device, but eventually, they respond to their child's needs (Harmon & Mazmanian, 20013). However, some studies have found that after a distraction, parents become more attentive, sometimes even more than before the distraction occurred (Boles & Roberts, 2008; Hiniker et al., 2015).

It is necessary to consider the activity the parent is engaging in on the phone, which is not always available in these studies. Different activities may allow for safe supervision while on a device. In their observational study, Boles & Roberts (2008) explored parents' ability to supervise children while talking on a phone, using a computer or watching a TV show compared to no distracted behaviors. Parents were less responsive during the distracted behaviors and were less likely to be visually attentive to their child while on the computer compared to talking on the phone or watching TV (Boles & Roberts, 2008). Radesky and colleagues (2014a) also found that less absorbed parents who were talking on the phone, in comparison to those continually typing or swiping their screens, were more visually attentive to their child by maintaining eye contact. Therefore, it is necessary to investigate the actual activity on the phone and what role the specific activity plays in parent and child perceptions the effects of displaced parent-child interactions.

Parental screen distractions could be having an effect on child development as well. Less sensitive and responsive caregiving, as demonstrated by some technologically distracted parents, is associated with the development of insecure attachment styles and poorer developmental outcomes (Lyons-Ruth, 1996; Schneider, Atkinson, & Tardif, 2001). Although several studies identify device use as potentially compromising the development of a secure attachment relationship and child development (Ante-Contreras, 2016; Blackman, 2015; Kushlev, 2015; Radesky et al., 2014b; Radesky & Christakis, 2016; Stupica, 2016) research has yet to fully explore these concerns.

Much of the research on mobile device use focuses on the dangers of infants' and children's exposure to screen time, suggesting that it could be a public health concern (Haughton & Cheevers, 2015; Radesky & Christakis, 2016). However, one way distracted phone use could be affecting child development is during infant feeding. Infant feeding is a time for intense mother-infant bonding, and researchers have begun to express concern relating to maternal mobile distractions during this time. In a study exploring mothers distracted behaviors during infant feeding, mothers were most distracted by television and were only distracted by talking on the phone 4% of the time (Golen & Ventura, 2015a). Although phone distractions were not the primary source of displaced parent-child interactions, mobile devices provide many other opportunities for distractions such as videos, gaming, texting and social networking, which were not reported in this study. Considering the developmental concerns for parents television use and child development (Radesky & Christakis, 2016), and the lack of visual attention while watching television (Boles & Roberts, 2002), how mobile devices are used during infant feeding should be explored further. In a secondary analysis of the first study's data, Golen & Ventura (2015b) compared distracted and non-distracted mothers during bottle feedings and the mother's responsivity to her infant. More than 75% of the time mothers engaged in another activity, most often talking to another person or sleeping. These distracted mothers were less sensitive to infant cues of fullness or satiation and therefore at risk for overfeeding her infant which is connected to childhood obesity (Golen & Ventura, 2015b).

Additionally, parents are not only distracted by their device but also use their device to distract their children when they need to take care of something like making dinner without interruptions or to calm their child down (Oduor et al., 2016; Radesky et al., 2014a; Radesky et al., 2016a). Interviews with 144 parents revealed that children with socio-emotional difficulties are more likely to be given a phone as a way to help them calm down compared to children without socio-emotional difficulties (Radesky et al., 2016a). Concerns regarding the implications of this behavior relating to children's ability to entertain themselves and the development of self-regulation have been brought up, but research has yet to address this concern (Radesky et al., 2014b; Radesky et al., 2016a; Radesky & Christakis, 2016). Although these studies hint at possible developmental concerns, more research is needed to fully understand the longitudinal impact of parents device use on child development and the developing parent-child attachment relationship.

With the potential for devices to displace parent-child interaction, parents may be experiencing less positive parenting experiences (Kushlev, 2015). Phones become a source of familial conflict, especially regarding use in the presence of family members (Hiniker et al., 2015; Hinker et al., 2016; McDaniel & Coyne, 2016; Oduor et al., 2016; Qualcom, 2013; Radesky et al., 2014a, Radesky 2014c; Radesky et al., 2016c; Sharaievska & Stodolska, 2016; Yu, 2015). Parents express irritation when their children are too engaged in their phones to interact with them (Devitt & Roker, 2008; Hiniker et al., 2016; Qualcomm, 2013; Yu, 2015), and children show a similar response to their parent's use (Sharaievska & Stodolska, 2016). Children reprimand their parents for breaking their own rules for home device use and want their parents to turn off their smartphone and make time to be a family (Oduor et al., 2016; Yu, 2015).

An under-researched effect of parents phone use on parent-child relationships is “sharenting” or when parents share photos or stories about their children on their social media profiles without their children’s permission (Hiniker et al., 2016; Yu, 2015). Children, especially adolescents, get angry and embarrassed when their parents publically share information about them online, which could lead to parent-child conflicts (Hiniker et al., 2016). On the other hand, when exposed to familial conflict, children report to separating themselves from their family by going on social media (Sharaievska & Stodolska, 2016), illustrating the complexity of family life and mobile device use.

Discussion

Several common themes emerged from this review, including parent's level of absorption with their mobile devices, child safety in the presence of parents' mobile distractions and parents conflicted attitudes regarding device use and decreased parental responsiveness and sensitivity towards children while distracted. Although non-empirical work also supports these trends (AVG Technologies, 2016; Qualcomm, 2013, Striener-Adair, 2013; Turkle, 2011), empirical results demonstrate a wide variety of responses and attitudes towards device use. The integration of mobile devices in our day to day lives is complex with many parenting benefits and complications.

Future Research

Even with the growth in this area of research in the past decade, there are still many gaps in the literature. One area of future research is to explore children's perspectives of parents phone use. Although children are aware of the amount of time their parents are spending on their phones, it is uncertain exactly how they feel about it. Non-empirical studies have begun to explore this, and in a survey of over 1,500 children 6 to 12 years old, 62% reported to feeling their parents spend too much time on their phones and 51% feel their parents are most distracted by their phones (Highlights Magazine, 2014). AVG's Digital Diary project has found similar attitudes through their interviews with 6,000 parents and their 8-13-year-old children. Sadly 32% of the children said they felt unimportant when their parent is distracted on their phone and 54% said they feel their parents check their mobile device too frequently (AVG Technologies, 2015). Children also reported that they would be happy if their parents misplaced their phone because then their parents might pay attention to them (Highlights Magazine, 2014). Parents tend to agree with their children, 52% said they check their phone too often, and 28% feel that their behavior was not modeling appropriate device use for their children (AVG Technologies, 2015). Adolescents are also aware of their parents' perpetual phone use, especially when they attempted to get their parents' attention and reported to feeling hurt when their parents were focused on a device instead of them. However, adolescents were hesitant to express their true feelings to their parents (Turkle, 2011). Understanding children's attitudes towards their parent's use would help parents moderate their own use and help families establish realistic limits for everyone's device use.

Perhaps the ultimate goal of future research should be to provide effective and realistic guidelines for parents' regarding their own media use. Current research suggests parents may not be modeling appropriate device use for their children (AVG Technologies, 2015; Hiniker et al., 2015; Radkesy et al., 2016c). This is of concern because children's screen time increases with parents screen time (Jago et al., 2012). Although official guidelines for children's device use have been established (American Academy of Pediatrics, 2016), guidelines for parents on how to monitor their own device use, especially while supervising their children are minimal. Radesky and Christakis, (2016b) suggest avoiding device use during family meals and playtime and for parents to coview media with their children which is also recommended by the American Academy of Pediatrics. Parents can also use resources like Common Sense Media.org to learn about managing their use and establishing their own Family Media Use Plan (Radesky et al., 2016b). However, within the media parents are more commonly told to just turn off their device (Alexander, 2014). Considering the complexity of device use and the possibility of mobile phone addiction (Kuss & Griffiths, 2011; Radesky et al., 2016c), guiding parents to simply turn on their phone is not realistic. Devices are embedded in our daily life for work, home, and fun.

Disentangling these areas of life and device use is not a simple, straightforward task. Guidelines need to acknowledge this, as well as the usefulness of devices (Harmon & Mazmanian, 2013). Phone use in social settings affects closeness, connection, and conversation quality especially for personally meaningful topics even when a device was present but not in use, e.g., sitting on a table (Przybylski & Weinstein, 2013). Therefore, suggesting to set your phone down while talking to someone maybe also not be a useful tip. One obvious guideline for parents is to limit their use in the presence of their children, although this is difficult for stay at home parents or for parents who work from home. It also important to note that parents who are able to work from home due to technological advances are still physically present more often than parents who work outside of the home. However, children may still perceive their parents as emotionally unavailable if their technology use interferes with parent-child interaction.

Another major gap is measuring how much time parents spend on their phone in the presence of their children. Out of the 27 studies included in this review only 2 directly measured caregiver's device use in the presence of their children (Ante-Contreras, 2016; Blackman, 2015). However, this data was retrospectively self-reported and with the implication for social bias a more accurate measurement of device use should be utilized. Ironically, using technology such as a tracking app to monitor device use would increase the accuracy of phone use reporting and therefore our understanding of the frequency of parents device use and the mobile activities they engage in. Yet parents may not be willing to use technology to reduce/track their use (Hiniker et al., 2015), it may be difficult to implement this method of data collection.

Furthermore, despite the growing understanding of how parents use their mobile devices, the exact reason for device use whether, for work, personal or family remains unclear. Several studies have explored the stress associated with technological spillover between the work and home environments (Chesley, 2005; Hertlein, 2012; Hughes & Hans, 2001; Palen & Hughes, 2007; Smale, 2011; Wajcam, Bittman, & Brown, 2008) but have not directly assessed what type of use distracts parents from their children most often. Additionally, research should expand on what activities parents engage in the most (texting, phone calls, social networking) and the possible difference in absorption levels.

Limitations

Despite the extensive search for related literature across databases and research fields, it is likely some related articles were missed due to the selected search terms and databases limitations. Another limitation is the ever-changing nature of technology, every mobile application and phone upgrade presents new opportunities to connect and use your device, and it is difficult for sound scientific research to stay up to date. Finally, due to the nature of these studies and their small samples, lack of longitudinal data and in some cases lack peer review much of these results are not generalizable. However, many of these studies are recently published, conducted within the past 3 years, and overall they provide great insight into how parents' mobile distractions could affect parent-child relationships and guide future research. Much more research is needed to fully understand this relationship and ultimately provide guidelines for parents and practitioners.

From this review, it is clear that the way parents use their phones in the presence of their children not only displaces parent-child interactions it also creates intrapersonal conflict for parents. From this review, it is clear that future research should seek to explore parents and children's attitudes toward use, investigate how use may affect parent-child attachment, examine how use may influence children's use and develop and use standard measurement instruments. This research will ultimately aid in the development of guidelines for parenting while connected.

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APPENDIX A

EXTENDED LITERATURE REVIEW

With the growing use of and dependence on technological devices, especially cellphones and smartphones, an important question to examine is the impact of cell phone and smartphone use on interpersonal relationships, primarily parent-child relationships. Research has begun to investigate the enhanced connectivity provided by mobile devices for families staying connected long distances (Carvalho, Francisco, & Relvas, 2015; Sharaievska & Stodolska, (2016). This connectivity has strengthened parent-children relationships during times of military deployment (Laser & Stephens, 2011) post-divorce parent-child relationships (Chesley & Johnson, 2014) and when children go off to college (Lee, Meszaros, & Colvin, 2009; Palen & Hughes, 2007). Research on children's use of phones is much less limited, with most studies focusing on parents perceptions of their children's screen time (Genc, 2014), children's screen time (Guernsey, 2007, Paudel, Leavy & Jancey, 2016) and the educational aspects of mobile technology (Hirsh-Pasek et al., 2015) especially for children with autism (Knight, McKissick, & Saunders, 2013). The only guideline for children's device use is for parents to co-view/co-use media with their children (American Academy of Pediatrics, 2015; Connell, Lauricella & Wartella, 2015; Lerner, 2014; Radesky et al., 2015). Very little is known about parent's phone use behaviors and even less is known about how parents use their phones in the presence of their children, and the implications of this use on parent-child relationships and child development.

Although only briefly examined in scientific research, concern for parents' mobile device distractions and child development has been addressed in the lay literature (Browning, 2012; Filucci, 2013; Hetter, 2011; Scelfo, 2010; Winters, 2011; Worthen, 2012). A growing body of literature addresses parents' mobile device distractions (Hiniker et al., 2016; Moser et al., 2016; Oduor et al., 2016; Radesky et al., 2014a; Radesky et al., 2016c; Schoenebeck & Reinecke, 2016). However, only a few studies directly assessed the amount of time parents spend distracted on a device while supervising their children (Blackman, 2015; Hiniker et al., 2015; Radesky et al., 2014a). These studies begin to explore caregivers' continuous engagement on their phones, the lack of facial expressions during general phone use, and children's need to compete with their parents' phones for their parents' attention. The current study will add to the limited scientific literature and answer the call for research on distracted phone use (Smale, 2011) by examining whether facial expressions common during phone use i.e., expressions lacking affect and eye contact, have a negative impact mother-infant interactions and mothers' availability to infants' bids for attention. This question will be addressed through the use of a modified version of Tronick and colleagues' (1979) still face (SF) experiment. Issues will be explored within the framework of infants' socioemotional well-being by examining whether mothers' phone use, accompanied by a lack of facial expression or attentiveness, is experienced as a stressful event by 3-6 month-old infants.

Phone Ownership

While ownership of technological devices such as desktops, laptops, e-book readers, MP3 players and gaming consoles have decreased in ownership, cell phones, and smartphone ownership continue to increase among American adults (Anderson, 2015). Currently, 92% of the adult population owns a cell phone and 68% own a smartphone (Anderson, 2015). Ownership rates have steadily increased since cell phone ownership was first tracked in 2000, with only 53% of American adults owning a cell phone (Wormald, 2015). Smartphones have seen a much steeper increase, with only 35% of American adults owning a smartphone in 2011 compared to 83% of cell phone owners (Wormald, 2015).

Gender. Cell phone ownership is common across all demographic groups, unlike smartphones (Table A.1; Anderson, 2015). As of 2015, men and women have the same ownership rates at 92% (Anderson, 2015) compared to 2014 when 93% of men own a cell phone and 88% of women owned a cell phone (Pew, 2014). Smartphone owners are slightly more likely to be men, 70% compared to women 66% (Anderson, 2015)

Age. Cell phone ownership is high among all age groups, but it is highest among young adults aged 18-29, of which 98% own a cell phone (Anderson, 2015). Young adults are also most likely to own a smartphone with 86% owning a smartphone in 2015 (Anderson, 2015).

Race/Ethnicity. Ownership rates are similar for whites, Hispanics, and Blacks among each device type. However, cell ownership is higher with a range of 91% to 94% compared to smartphones which range from 64% to 68%. Among both cell phone and smartphone owners, Blacks are slightly more likely to own a device compared to Whites and Hispanics (Anderson, 2015).

Socioeconomic Status. Cellphone and smartphone ownership are the highest among the highly educated and affluent households (Anderson, 2015). As the household income increase so does cell phone and smartphone ownership. This relationship is stronger among smartphone owners for most are more affluent, with 87% of smartphone owning households earning more than $75,000. Comparatively of the households earning less than $30,000 52% own a smartphone while 86% own a cell phone (Anderson, 2015). Persons with less than a high school education are also more likely to own a cell phone (86%) compared to a smartphone (40%).

Community type. Cell phone ownership is higher among all community types, (urban, suburban and rural with the greatest variation among rural areas where 87% are cell phone owners and only 52% are smartphone owners.

Table A.1

Demographics of Cellphone and Smartphone Owners in 2015

	Cellphones	Smartphones
Gender		
Men	92	70
Women	92	66
Race/ethnicity		
White	91	66
Black	94	68
Hispanic	92	64
Age		
18-29	98	86
30-49	96	83
50-64	90	58
65+	78	30
Household incomes		
<$30,000	86	52
$30,000 - $49,999	94	59
$50,000-$74,999	91	76
$75,000+	98	87
Educational Attainment		
Less than high school	86	40
High school	90	56
Some college	93	75
College	95	81
Community Type		
Urban	94	72
Suburban	92	70
Rural	87	52

Note. Data from (Anderson, 2015).

Phone Usage

The Frequency of Use. Data from 150,000 users of the Locket app, indicates that 75% users check their phone the most in the evening between 5:00pm and 8:00pm. Overall users of the Locket app averaged 9 unlocks an hour and 110 unlocks a day, but some users were found to check as much as 900 times a day (Hu, 2013). However, other studies have reported individuals check their phones up to 150 times a day (Meeker & Wu, 2013). Despite the differences in the frequency of unlocking a phone, it is important to note that even briefly unlocking a phone to check for messages can lead to increased overall use (Oulasvirta, Rattenbury, & Raita, 2012).

Smartphone Only. Most rates of activity are higher among smartphone owners, but this could be due to cell phone and smartphones differing capabilities. Smartphones are unique from cell phones because they include all the aspects of a cell phone but also provide an internet connection (Ames, 2013; Kumar, Kim, & Helmy, 2013). Smartphone owners are not only more connected but rely on their device more than cell phone owners. Smartphones also allow users to immediately access information, which 79% of smartphone owners use their phone to immediately access information while only 31% of cell phone owners use their phone to access information right away (Smith, 2011). Extensive growth in ownership over the last 10 years has contributed to the rise of the “smartphone only” adults (13% in 2015) those who own a smartphone but do not have an internet connection in their home (Horrigan & Duggan, 2015). Smartphone only adults are more likely to be non-white, young adults with lower incomes (Smith, 2015). Dependence on an internet connection whether through a phone or computer has increased, with 73% of American adults going online on a daily basis, a 10% increase from 2013 (Duggan & Smith, 2013). This reliance is especially true for young adults (18 to 29-year-olds), who not only have higher rates of smartphone ownership (86%; Anderson, 2015) but also 36% report to going online “almost constantly” either with a phone or computer (Perrin, 2015).

Online Activity. The constant connection facilitated by smartphones offer a wider range of online activities, These activities include those available with cell phones, but also expands to many more activities such as GPS/navigation (67%), applying for jobs (18%), finding a place to live (44%) and accessing educational content (30%; Smith, 2015). Smartphone owners are also avid social media users, 75% access some form of social networking (Facebook, twitter, Instagram) through their device on a daily basis (Smith, 2015). Basic cell phones have a much narrower range of activities and have lower rates compared to smartphone owners (see Table A.2). Among both types of phones, texting remains the most common activity, with 80% of adults sending and receiving text messages via their cell phone (Duggan & Ranie, 2012). Smartphone owners also text, but do so more often, with 97% sending and receiving messages daily (Smith, 2015). Globally, adults spend an average of 119 minutes a day on their phone, with the most time being spent on the Internet and texting (Page & Molina, 2013).

Table A.2

American Adults Phone Activities

	Cellphones		Smartphones	
	2011	2012	2011	2015
Send/receive text messages	73%	80%	92%	97%
Take a photo	73%	82%	92%	60%
Access the internet	44%	56%	84%	89%
Record video	34%	44%	59%	60%
Send/receive email	38%	50%	76%	88%
Download an app	31%	43%	69%	*
Online banking	18%	29%	37%	57%
Look for health/medical info	*	29%	*	62%

Note. 2011 cell phone data from (Smith, 2011). 2012 cell phone data from (Duggan and Ranie, 2012). Smartphone data from 2011 (Smith, 2011). 2015 data from (Smith, 2015) *data not available for that year.

Age. Although ownership rates for cell phones and smartphones are similar among young adults, aged 18-34 and adults aged 35-46, their usages patterns vary (Zickuhr, 2011). Millennials or young adults age 18 to 34 have the highest rates of cell phone usage among the most common activities (Zickuhr, 2011).

Table A.3

Age and Cellphone Activities

	Ages 18-34	34-46	47-56	57-65	66-74	75+
Take a picture	91%	83%	78%	60%	50%	16%
Send/receive text messages	94%	83%	68%	49%	27%	9%
Access internet	63%	42%	25%	15%	17%	2%
Play music	61%	36%	18%	10%	7%	5%
Play a game	57%	37%	25%	11%	10%	7%
Record a video	57%	39%	23%	11%	7%	4%
Send/receive emails messages	52%	35%	26%	22%	14%	7%

Note. Data from Zickuhr, 2011.

More recent data on smartphones shows less variation in use. Young adults still have the highest rates of use, but many of the most common activities such as texting, accessing the internet and phone calls have very similar rates of use among all age groups (Table A.3; Smith, 2015).

Table A.4

Age and Smartphone Activities

	Ages 18-29	30-49	50+
Send/receive text messages	100%	98%	92%
Access internet	97	90	80
Phone calls	93	91	94
Send/receive email	91	87	87
Access Social Networking Site	91	77	55
Watch video	75	46	31
Listen to music	64	39	21

Note. Data from Smith, 2015.

Entertainment. Smartphone owners depend on their device to entertain them when they are bored (Smith, 2015). While this is only a slight increased from 2011 (72% to 77%) it is still much larger than the 21% of phone owners who use their device for entertainment (Smith, 2011). Younger smartphone owners are more likely to turn to their device to avoid being bored. Ninetythree percent of young adults use their smartphone to avoid dull moments, compared to 82% of adults aged 30-49 and 55% of adults 55 and older (Smith, 2015).

Avoid Interaction. Another interesting trend of device owners, primarily younger users, is the tendency to engage in smartphone use to avoid people around them (Smith, 2015; Turkle, 2011). Twenty percent of smartphone owners use their device to avoid interacting with others, while only 8% of cell phone owners do this (Smith, 2011). For smartphone owners, rates of this specific device use have increased to 31% in 2015 (Smith, 2015). This is important because it demonstrates a lack of interest in human interaction and implications of this need to be explored further, especially among parent-child interactions.

Parents Phone Ownership

As previously stated, little is known about parents' rates of phone ownership. The limited body of work specifically exploring parents' phone ownership and use is partially due to the novelty of devices such as cell phones, smartphones, and tablets but also because technology changes so rapidly. It is known that households with children are more likely to own and use technology (Allen & Ranie, 2002; Hughes & Hans, 2001; Lenhart, 2010, Smith, 2011) and have multiple mobile devices (Wellman et al, 2008) compared to households without children. Single parents are less likely to be connected (58%) compared to married parents (71%), this could be related to access and time to spend on the internet (Allen & Ranie, 2002).

Adoption of mobile devices has steadily increased since ownership of cellphones and smartphones were first tracked. Currently, 95% of American adults own a cellphone, up from 53% in 2000; and 77% own a smartphone, up from 35% in 2011(Anderson, 2015). Other device ownership among parents also follows similar national trends, with lower rates for desktop computers, e-book readers, MP3 players and gaming consoles (Anderson, 2015; BabyCenter, 2015). Similarly, among American adults, tablet use also increases among parents, from 47% in 2013 to 57% in 2014 (Anderson, 2015). This is important because many mothers, 53% in one study, own both a tablet and a smartphone (BabyCenter, 2015).

Parents Phone Use

Frequency. Connected parenting has been observed in many settings including family mealtimes (Hiniker et al., 2016; Moser et al., 2016; Oduor et al., 2016; Radesky et al., 2014a; Schoenebeck & Reinecke, 2016;), during infant feeding or playtime (Ante-Contreras, 2016; Golen & Ventura, 2015a; Golen & Ventura, 2015b; McDaniel & Coyne, 2016), public places (Hiniker et al., 2015; Kushley, 2015; Moran, 2010; Radesky et al., 2014a), while in the car (Macy et al., 2014; Roney et al., 2013), on vacation (Yu, 2015) and within the home (Blackman, 2015; Boles & Roberts, 2008; Harmon & Mazmanian, 2013; Palen & Hughes, 2007; Sharaievska & Stodolska, 2016; Simon, Tamura & Colton, 2003). Even with the amount of studies investigating parents' mobile device distraction, only a few studies directly assessed the amount of time parents spend distracted on a device (Blackman, 2015; Hiniker et al., 2015; Radesky et al., 2014a).

Qualcomm (2013) was the first to directly assess the frequency of parents' phone use during times of parent-child interaction, revealing that 35% of American adults reported to frequently using their phone while playing with their children. Blackman (2015) surveyed 93 caregivers and found those parents to spend between 30 minutes and 7.5 hours a day with a screened device but 0-5 of these hours' devices were used in the presence of children. However, observational data revealed that some caregivers were their device consistently during a meal with their children (Radesky et al., 2014a) or when at the park (Hiniker et al., 2016). Ante-Contreras (2016) found 75% of the 167 parents were on their device at least 3 times a day while in direct supervision of their children. Despite this, parents do not feel their use it affects their ability to effectively supervise their children (Ante-Contreras, 2016; Hiniker et al., 2015). However, some parents say when their children are around them they are less likely to use their device and intentionally turn it off or leave it at home (Ante-Contreras, 2016; Hiniker et al., 2015; Palen & Hughes, 2007).

Age. As with American adult phone users, age is a factor amongst parents as well. Millennial mothers (mothers between 18 and 29 years of age) are among the highest group of device users. Mothers between the ages of 18 and 32 say they spend more time on their phone than they spend on their computer and almost as much time on their phone as they spend watching TV (BabyCenter, 2014; BabyCenter 2015). Compared to moms over 33 years of age, these younger mothers spend more time online via their phones and tablets (BabyCenter, 2015; Radesky et al., 2014a). In 2013 millennial mothers spent 1.7 hours a day on their smartphone compared to 2.3 hours on their smartphone in 2014 (BabyCenter, 2015). This supports the trend that younger individuals are more likely to be “smartphone only” with 48% of these mothers relying on their device as their primary source of Internet access (BabyCenter, 2015; Smith, 2015).

Mothers. More information is known about mothers phone use than fathers, but mothers use is similar to that of most American adults. Mothers spend most of their time texting, 98% of mothers reported to text and 88% reported to using social media weekly (BabyCenter, 2014).

Mobile apps. With the advent of the smartphone, development of mobile device applications or apps quickly followed. Parents are also more likely than non-parents to download a mobile app, 48% to 33% (Lenhart 2012). Many of these parents, 57% download apps for their children, either for entertainment (46%) or for educational (31% purposes (Lenhart 2012). This is consistent with existing literature stating that parents' believe infant media use provides an intellectual benefit to their children (Rideout, Vandewater, & Wartella, 2003).

Social media use. Compared to non-parents, parents use Facebook, Pintrest and Linkedin more often (Duggan, Lenhart, Lampe & Ellison, 2015). Mothers are more likely to use certain social networking sites such as Facebook, Pintrest, and Instragram, while fathers are more likely to use Linkedin and Twitter (Duggan et al., 2015). While on these social media sites, mothers are more likely to use social media to access parenting information compared to fathers (66% to 48%; Duggan et al., 2015).

Accessing parenting information. Although mothers still use their family and friends as a resource for parenting information, advice, and support, many parents', primarily mothers, use the internet to seek out parenting related information (Allen & Ranie, 2002; BabyCenter, 2014; Duggan, et al., 2015; Doty & Dworkin, 2014; Dworkin, Connell & Doty, 2013). This growing use is visible through the number of parenting websites and mobile device applications (apps; Allen & Ranie, 2002; BabyCenter, 2014; Doty & Dworkin, 2014; Dworkin, Connell & Doty, 2013). With roughly 2,000 parenting apps available for iPhones, 500 parenting apps available for Android (Apple Inc., 2016; Google Play, 2016), and at least 140 million websites related to parenting (National Effective Parenting Initiative, 2005), it is clear that parents are being recognized as a unique group of mobile device users by app developers.

Yet again, younger mothers are the most frequent consumers of apps and websites geared towards parenting (BabyCenter, 2014; Meeker & Wu, 2013), compared to 33-44-year-old mothers, young mothers are 15% more likely to access parenting information online (BabyCenter, 2014). Many young mobile moms are also "mommy bloggers", with 14% of American moms reporting to blogging about their parenting experiences or going to a blog for parenting advice (Nielsen, 2011). The convenience of sharing and accessing online parenting information allows mothers to quickly and sometimes anonymously access web-based parenting information and support groups (BabyCenter, 2015; Doty & Dworkin, 2014). However, easily accessible parenting information may be of concern regarding parents' use of phones, if this use interrupts mother-infant interactions.

Parental monitoring tool. Another way parents use their devices is to monitor their children, this can either be used to monitor their children's whereabouts and their children's behaviors on their own mobile devices, primarily with social media (Anderson, 2016). Much of the existing literature investigating parental monitoring focuses on parents checking what their children watch on the television (Coyne et al., 2012) as well as knowing what their children are doing when they are online (Anderson, 2015; Lenhart et al., 2010). Yet, a slowly growing body of research is focusing on the use of cell phones as a parenting monitoring tool (Weisskirch, 2009).

Parents use their phone to call or text their children to stay in touch and monitor their whereabouts (Devitt & Roker, 2008). Another way parent's use cell phones as a monitoring tool is through the GPS located within their child's cell phone (Gentile, Nathanson, Rasmussen, Reimer, & Walsh, 2012). Several phone carriers allow for basic 'kid tracking' services such as enabling parents to set limits on how many text messages their teens can send and receive, in addition to remotely programming the child's contact numbers and having a 'find now' application which will show the parent the exact location of their child. Some of these devices allow the children to receive notifications each time their parent tracks their location (Schreiner, 2007). Devices that offer services such as these, although highly controversial (among public and private spheres), have very little empirical evidence demonstrating the effects this technology has on parent-child interactions. Weisskirch (2001) found that when parents use their phones to monitor their children by asking where they are, who they are with or if they have started their homework, results in increased parent-child conflict, especially when adolescents avoid answering their parent's calls and/or text-messages (Weisskirch, 2011).

Implications of Continuous Connection

Having an internet connection via a smartphone allows owners to continually engage with their device and be perpetually available through their device (Duggan & Smith, 2013; Fallows, 2002; Hertlein, 2012; Lee, Meszaros, & Colvin, 2009; Merkle & Richardson, 2000; Yarosh, Chew, & Abowd, 2009). Being constantly connected provides many benefits such as staying in touch (Sharaievska & Stodolska, 2016; Smith, 2012b), managing daily life (Smith, 2015; Smith, 2012b; Harmon & Mazmaninan, 2013), and increased productivity (Smith, 2012b; Harmon & Mazmaninan, 2013). Smartphone users find this constant connection both freeing and helpful (Smith, 2015) but 24% of cell phone owners said being perpetually available is the worst thing about their phone (Smith, 2012b). However, according to the displacement hypothesis (Coyne et al., 2014), time spent with technology or media may displace and decrease meaningful parent-child connections. Several more recent non-empirical studies have also suggested some risks of being consistently connected (Browning, 2012; Filucci, 2013; Hetter, 2011; Scelfo, 2010; Winters, 2011; Worthen, 2012). Being perpetually connected creates many challenges including, feeling social pressure to respond to messages/calls, mobile device addictions, and mobile device distractions.

Social pressure. One challenge of being always on and always available through a mobile device is not only the managing multiple roles (parent, colleague, employee, spouse, friend; Harmon & Mazmanian, 2013) but also the expectation that users will respond immediately to electronic communication (Ames, 2013; Pielot, de Oliveira, Kwak, & Oliver, 2014; Smale, 2011; Smith, 2013). Many phone users also reported to hearing complaints from coworkers and family members if they were slow in responding to messages, e-mails, and phone calls (Ames, 2013; Pielot, de Oliveira, Kwak, & Oliver, 2014; Smith, 2013, Smith ,2012b). In one study 33% of cell owners say that people they know have complained because they do not check their phone frequently enough (Smith, 2012b). This implicit expectation leaves users feeling guilty when they are unable to respond quickly (Ames, 2013; Harmon & Mazmanian, 2013).

In response to this social pressure, many users reported to always having their phone present and almost never turned off (Ranie & Zickuhr, 2015). For many American adults, their mobile device is the first thing they reach for in the morning and the last thing they check before going to sleep (Frizzo-Barker & White, 2012; Information Dominance Corps, 2013; Karlson et al., 2009; TIME Mobility Poll, 2012; Smith, 2012a). According to the Internet and American Life project, 44% of American adults sleep with their phone next to their bed to avoid missing any work related or personal calls, messages, emails, or alerts (Pew, 2014) even though other research suggests the presence of small electronic screens next to or on the bed decreases the duration and quality of sleep in children (Falbe, et al., 2014; Lerner, 2014) and adults (White, Buboltz, & Igou, 2011).

Addiction. The proliferation of mobile device ownership combined with the increased opportunity and/or need to keep in touch with others is connected to the rise of Internet (Kuss & Griffiths, 2011) and a mobile device addictions (King et al., 2013) most often referred to as Nomophobia (derived from no-mobile-phobia; King et al., 2010; King et al., 2013). The disorder is used to classify the anxiety experienced when a mobile phone, personal computer, or tablet is not physically present or does not function properly (King et al., 2010; King et al., 2013). This area of research is complex and has only just begun to differentiate between addiction to mobile devices versus addiction through a mobile phone (e.g addicted to a certain mobile phone application; Davazdahemami, Hammer & Soro, 2016).

It is known that excessive internet addiction can lead to psychiatric disorders, lower self-esteem, depression and impaired academic and occupational performance (Jenaro, Flores, Gómez-Vela, González-Gil & Caballo 2007). Social networking sites (SNS) like Facebook and Twitter as well as games, such as Farmville, allow for continuous positive feedback about oneself, contributing to greater levels of internet use (Meshi, Morawetz, & Heekeren, 2013; Wallace, 2014).

One common measure of mobile phone addiction is the frequency of checking or unlocking a phone. According to the Pew Research Center, 67% of users find themselves checking their device for notifications even when their phone is not vibrating (Pew, 2014, Smith, 2012b). Flurry Analytics, an app advertising and tracking company has operationalized mobile addiction with 3 user types (Khalaf, 2014). The first type is a “Regular Users” who open apps under 16 times a day. The second user type, the “Mobile Super Users” open apps 16 to 60 times a day and “Mobile Addicts” open apps more than 60 times per day (Khalaf, 2014),). As with many forms of addiction, phone users seem to be in denial with 54% saying they could live without their phone (Smith, 2015). Even the possibility of mobile device addiction, and having family friends and coworkers tell users they are spending too much time on their phone, only 11% of cell phone owners and 15% of Smartphone owners have reported being worried about the amount of time they spend on their phone (Oulasvirta, et al., 2012; Smith, 2012b).

Absorption/Distractions. Although current research is beginning to explore the implications of phone distractions on human interactions (Hiniker, 2015; Radesky et al., 2014a; Radesky et al., 2014b; Vaidyanathan & Latu, 2007), most research examining the implications of phone use and distraction has focused on the dangers of phone distractions while driving (Benden et al., 2012; National Highway Traffic Safety Administration, 2013; Madden & Ranie, 2010). Phone distractions limit an individual's ability to focus on their surroundings (Hyman et al., 2010). Hyman and colleagues investigated the concept of inattentional blindness, or the inability to notice new or distinctive stimuli while on the phone. This study consisted of two groups: those participants who were allowed to use their phone while walking and those who were not allowed to use their phones while walking. The participants who walked while talking on the phone took longer to reach their destination, changed the direction of their walking more often, and were less likely to acknowledge other people around them or notice unusual activities, e.g., a unicycling clown.

Attitudes. Attitudes towards phone use while in the presence of others varies. More research has been conducted on views of mobile device etiquette (Ranie, Zickuhr, 2015) than overall attitudes towards individuals use. Younger adults tend to have a higher tolerance for mobile device use in social settings but this could be because they are more likely to use their device while in the presence of others (Ranie & Zickuhr, 2015).

Implications of Parents Absorption

Despite the growing knowledge of phone ownership and negative implications, little is known about the level of mobile device absorption among parents. The occurrence of parents "plugging in" to their devices instead attending to their children even when in the same room has been well documented in the media and non-empirical sources (Filucci, 2013; Hetter, 2011;

Highlights Magazine, 2014; Lerner, 2015; Scelfo, 2012; Winters, 2011). The existence of this phenomenon has even resulted in the creation of a Tumbler page (a microblogging platform) called Parents on Phones which attempts to “shine a light on the culture of mobile phones and parental neglect” by collecting photos of parents absorbed in their mobile devices instead of their children (Parents on Phones, 2015). This disparity between the amount of research literature compared to articles suggests there is a growing concern that research has not addressed. Despite the growing concern of distracted parenting, few empirical studies have directly explored this issue.

Frequency of parent’s device absorption. Radeskey et al., 2014 operationalized the level of use during parent-child interaction or their level of absorption, as “the extent to which the primary focus of the caregiver’s attention and engagement was with the device rather than the child” (Radesky et al., 2014b; p. 845). This qualitative, non-participant observations study exploring caregivers’ mobile device (phone and tablet) use in fast food restaurants in the United States. Caregivers with children were observed and the caregivers’ mobile device use was recorded. Children in this study included infants (*n*=6), toddlers (*n*=16), preschoolers (*n*=14) and school age children (54). Age was estimated by the observers based on physical and developmental characteristics of each child. Although 18 of the 55 parents did not use their device, or merely had it on the table, 16 parents used their device during the entire meal. Higher levels of caregiver absorption included when they ate and while they were talking to their children, this use typically involved continuous typing or swiping the screen rather than actual phone calls. Less absorbed parents were still somewhat engaged in their device by either talking on their phone while maintaining eye contact with their child or they were not looking at their device, but held it while doing others things. The authors believed the perpetual presence of the device suggested the parents were not providing their full attention to their children for they were always ready and waiting for an incoming message, phone call, or text.

In another study, Hinkier and colleagues (2015) explored caregiving behaviors and mobile device use while at the park. This study included two observations, one of caregiver behavior (*n* = 171), another of caregiver phone use (*n* = 111). Caregiver interviews (*n* = 25), and an online survey (*n* = 154) were also conducted. The observational portion of the study included 466 caregivers who were absorbed in their phone while supervising their children at the park. From their initial observations and interviews, 41% of the parents engaged in *techno-resistance* (Ames, 2013) and did not use their phone at all. When asked about their reasons for not using their phones, 57% said they did not want to compromise their child's safety and 67% stated they felt phone use would compromise their ability to respond to their child. This reasoning would be identified as *technosocial negotiation*, which is defined as the desire to disconnect from the technological world to engage in the physical world (Ames, 2013; Harmon & Mazmanian, 2013; Turkle, 2011). Even of those parents observed using their phone, nearly 50% spent less than 1 minute engaged in their device either sending a quick text message or placing a phone call (Hinkier et al., 2015).

Decreased parent-child interaction. It may seem obvious that when parents are absorbed in their mobile device their ability to attend to their children is limited. In a structured task observing 6-year-olds eating behaviors, Radesky and colleagues (2014a) found that mothers distracted with their mobile devices had lower levels of verbal and non-verbal communication with their children compared to the mothers who were not engaged in a mobile device. Mother-child interactions were most severely disrupted when the children were presented with an unfamiliar food and with less encouragement from their distracted mothers, the children were less likely to try the new food (Radesky et al., 2014a).

Hinkier and colleagues (2015) interviewed and survey parents regarding their ability to pay attention when on the phone. Interestingly 22 of the parents interviewed and 123 of surveyed parents acknowledge that they pay less attention to their physical surroundings when engaged in their mobile devices. Contradictorily, these parents also reported they are very confident in their ability to effectively monitor their children when on the phone. Yet, when these parents were asked what their child was doing while they were on the phone the parents got defensive and gave vague responses.

Children's bids for parent's attention. With high rates of parental device absorption children are forced to compete with their parent's mobile device for attention. Young children were most bothered by their parents intermittent, quick checking and or their parent's continual absorption with their screen (Radesky et al., 2014b). Young children attempt to re-engage their parents in a variety of ways most of the time by misbehaving and possibly placing their safety at risk (Boles & Roberts, 2008, Palsson, 2014; Moran, 2010; Radesky et al., 2014b; Steiner-Adair, 2013).

In studies where parents were distracted on their phones at fast food restaurants, younger children made bids for their parents by crawling under tables and standing in chairs (Radesky et al., 2014b). On the other hand, during mealtimes, older children do not seem bothered by parents' phone use and did not make any bids for their parents' attention even when their parents were on their phones for the entire meal (Radesky et al., 2014b). This could be because older children are used to the lack of parental attention or have experienced negative responses from their parents when they interrupt their parent's phone use. These negative responses were observed when younger children were misbehaving. In response parents initially attempted to ignore but eventually scolded the child for misbehaving or provided instructions in a "robotic manner" without looking up from the phone (Radesky et al., 2014b p. 847). Other parents respond in a physical manner, with one parent kicking the child under the table and another parent pushing the child away when the child attempted to regain their parent's attention by lifting their face up and away from her device (Radesky et al., 2014b).

Parent Absorption and Child Injury. It is clear that unsupervised children will engage in risky, sometimes life-threatening behaviors (Saluja et al., 2004). The Center for Disease Control (CDC) and psychologist Catherine Steiner-Adair have proposed that the skewed awareness associated with mobile device use and lack of awareness or inattentional blindness (Hyman et al., 2010) is related to the sudden increase in childhood injuries over the past 5 years (Worthen, 2012).

In the presence of parental technological distractions, younger children are more likely to engage in risky behaviors and therefore more likely to be injured (Boles & Roberts, 2008, Palsson, 2014; Moran, 2010; Radesky et al., 2014b; Steiner-Adair, 2013). In a study of parental supervision while at the beach, Moran (2010) found that 27% of distracted parents were engaged with their cell phones, which is suggested to be related to the increased number of drownings of school age children. Reports of infant/toddler deaths in connection with caregivers' technology distractions are not unheard of (Caulfield, 2011a; Caulfield, 2010b; Kemp, 2013). This could be because when it comes to mobile distractions, parents feel confident in their ability to effectively monitor their children and that it is ok for them to use their phone as long as they think their child is safe (Hinkier et al., 2015). Efforts should be made to further investigate parents' ability to use their mobile devices and supervise their children to fully understand the level of distraction in relation to childhood safety to ultimately provide guidelines for parents on how to moderate their use.

Attitudes towards Parent Device Use during Parent-Child Interactions

Parents' Attitudes. Sixty-five percent of parents believe their phones make them better parents (Time, 2012). This could be because many parents use their mobile device to monitor their children and their children's' social media use (Duggan et al., 2015). In a global study of parents of 8-13-year-olds, 52% said they check their phone too often and 28% feel that their behavior was not modeling appropriate device use for their children (AVG Technologies, 2015).

In the United States, parents who were interviewed about their phone use while at the park with their child had conflicting feelings about their device use (Hikier et al., 2015). Almost a third of parents (28%) said that as long as their child is safe and occupied it is ok for them to engage in their device, while 44% believed that their phone use should be related to playground-appropriate tasks such as taking picture of their children or monitoring the time. Alternatively, this group of parents also indicated they struggle to disengage from their device and no matter their level of use or intention of their device use.

Guilt. Many parents express feelings of guilt for being on their phone when around their children (Harmon & Mazmanian, 2013; Hinkier et al., 2015; Steiner-Adair, 2013). In her book, Catherine Steiner-Adair (2013), interviewed parents and children age 4-18 exploring how technology use is changing family life. One interview with a mother of a 6-month-old reflected on her technology use during parent-child interaction indicating feelings of guilt for not being physically present saying,

> He's just lying here and playing, so I'm on the iPad and suddenly he stops and he is looking at me! I mean so many time – that happens 90% of the time – and I don't know

> at what point he stopped playing and started looking at me. It breaks my heart because I don't know how long he has been starting at me. I mean, what is he thinking? I feel so guilty that I'm not present with him and he knows it. It's one thing if I'm unloading the dishwasher and talking to him. That doesn't require brainpower, but e-mail does. It's impossible to really be doing both. I know he knows I am completely disengaged, you can just see it in his eyes. So what does that mean to him [that] we are both in the same room together and I'm not being present with him? (p. 70)

Even parents with lower levels of absorption while supervising their children at the park reported to feeling some guilt about their device use and 27% of all distracted parents reported to feeling judged by other parents when on their phone (Hinkier et al. 2015). Although this does not empirically explore the effects of mothers phone use on infant development, it demonstrates the increased concern by parents distracted use and the need for further research.

Children's' attitudes. Children notice the amount of time their parents are spending on their phones. In a survey of over 1,500 children 6 to 12 years old, 62% reported to feeling their parents spend too much time on their phones and 51% feel their parents are most distracted by their phones (Highlights Magazine, 2014). These results reflect the feelings of children across the globe. Interviews were conducted with 6,000 parents and their children between the ages of 8-13 years of age to see how they feel about parental phone use. Sadly 32% of the children said they felt unimportant when their parent is distracted on their phone and 54% said they feel their parents check their mobile device too frequently (AVG technologies, 2015). Children reported that they would be happy if their parents misplaced their phone because then their parents might pay attention to them (Highlights Magazine, 2014).

Adolescents' attitudes. Adolescents are also aware of their parents' perpetual phone use, especially when they attempted to get their parents' attention (Turkle, 2011). Through interviews, adolescents reported to feeling hurt when their parents were focused on a technological device instead of paying attention to them, especially when they were being picked up from school or an extracurricular activity. However, the adolescents were hesitant to express their true feelings to their parents. Another study (Sullivan, 2013) consisted of three adolescent males who were receiving treatment for an Internet Addiction Disorder (IAD) and/or had a parent receiving treatment. Similar to the adolescents in Turkle's (2011) study, these males indicated they felt they had to compete with their parents' phone for parental attention. This was especially true with their mothers, who in this study had higher rates of phone use compared to fathers.

Implications of Parents Absorption on Child Development

It has been well established that parenting behaviors critically shape infants development (Swain, Lorberbaum, Kose & Strathearn, 2007). However, little research has explored the role of parent's mobile device distractions on child development. Insight can be gleaned from decades of research on children's television use, such as children's screen time increasing with parents screen time (Jago et al., 2012). Additionally, having a television on in the background decreases both the quality and quantity of parent-child interaction of 12-36-month-olds (Kikorian, Pempek, Murphy, Schmidt & Anderson, 2009), especially with a decrease in verbal interactions between parent and child (Mendelsohn et al., 2009). These decreased interactions are similar to the behaviors of parents who are engaged in mobile devices as previously discussed. Therefore, parent's behaviors while on their phone create areas of concern for child development, specifically related to the lack of parent's facial expressions parents, lack of eye contact, and the lack of parental sensitivity and the development of a secure mother-child attachment.

Lack of Facial Expressions. One area of concern regarding parent's phone use during parent-child interactions is the lack of facial expressions during most phone use such as texting, checking email and surfing the web are blank (e.g., no facial expression such as smiling, grinning, smirking, or eye contact with the other person). In their observational study, Radesky and colleagues reported parents' facial expressions as "looking at the phone, nodding a little when the child talks but not looking back at the child or responding with words" (p. 847). In another instance a parent was, "holding it [the phone] about 10 inches from her face, looking into it for long stretches during which she does not look up. She stops typing and is staring at the screen, touching it at points, holding it with her right hand while she leans her chin on her left hand, her facial expression is flat" ((Radesky et al., 2014b). ; p. 846)

Vacant expressions are generally associated with maternal depression which places children at a higher risk of developing insecure attachment styles (diminished bond with primary caregiver) (Gelfand & Teti, 1990; Cohn et al., 1990; Pickens & Field, 1993), and exhibiting depressive symptoms and behavior problems later in life (Martins & Gaffan, 2000; Weinstock, 2008). Depressed mothers smile at their infants less and interact in an overall withdrawn and neutral style (Cohen, Matias, Tronick, Conell, & Lyons-Ruth, 1986). These neutral facial expressions and muted interactions alter the infant's social experiences (Cohen et al., 1986). If parent's phone use during parent-child interactions creates the same environment as that of depressed mothers, then high levels of phone use may impact the nature of the mother-infant interactions.

Eye contact. Concerns surrounding the lack of eye contact are present in the lay literature (Gregoire, 2013; Shellenbarger, 2013). In a news article, one parent reflecting on her mobile device use and family life stated, “I realized several years ago that I had stopped looking in my children’s eyes and it was shocking to me” (Gregoire, 2013). This parent went on to say, “You’re not going to connect with someone who is distracted” (Gregoire, 2013). This demonstrated one parent’s awareness of other’s distractions but not a reflection on the impact of their own mobile device use on their communication skills or interpersonal relationships. Empirical studies investigating the lack of eye contact during phone use have not been conducted, however, some researchers have begun to express concern regarding mothers searching for information on their phone while breastfeeding and the development of a positive mother-infant bond during the first year of life (Flatow, 2011). In an NPR interview, Dr. Turkle, a psychoanalyst of human and technology interactions, specifically expresses concern regarding maternal phone use and infant care, stating “breastfeeding is a time when the bonding between mother and child is most intense and probably most consequential. More is happening in breastfeeding than milk delivery. That's a time when the child senses the mother's relaxation, senses the full attention of the mother” (Flatow, 2011).

Maternal eye contact during these early times of interaction has been connected to children’s positive socio-emotional development and a positive parent-child attachment (Ainsworth, 1979, Beebe et al., 2010; Blehar et al., 1977; Lavelli & Fogel, 2013). However, the lack of eye contact, mothers on their phones may be unaware of their infant’s bids for attention and the effect their non-responsive, empty facial expressions have on their infant’s current and future bids for attention. Therefore, the question of whether maternal technological distraction, the lack of animated face-to-face interactions and responsiveness to infants is necessary to explore given the connection to infants and later socio-emotional development (Beebe et al., 2010; Blehar et al., 1977; Lavelli & Fogel, 2013).

Maternal sensitivity. This lack of facial expressions and eye contact during mother-child interactions also demonstrates a lack of maternal sensitivity because parents scarcely acknowledge their child who is making a bid for their attention. Mother-child interactions marked by high maternal sensitivity and responsiveness contribute to the likelihood of an infant identifying the mother as a secure base (Ainsworth, 1979; Blehar, Lieberman & Ainsworth, 1977). This allows the infant to feel comfortable and safe when exploring their environment, knowing that mother will be there if the need arises (Ainsworth, 1979; Biringen, 2000; Coyl, Roggman, & Newland, 2002). Overall, maternal sensitivity and responsiveness to infant cues aid in the development of secure attachment styles and are associated with later optimal developmental trajectories (Ainsworth, 1979; Blehar, Lieberman & Ainsworth, 1977; Calkins, Propper & Mills-Koonce, 2013; de Ruiter & van Ijzendoorn, 1993; Feldman, 2007; Ranson & Urickhuk, 2008). From this, it can be inferred that child development could be placed at risk if mothers are distracted on the phone while caregiving.

Socio-emotional development. A recent study, conducted on rats explored the impact of good but disruptive maternal attention on rat pup development by modifying the environment and exploring the outcomes in adolescence (Molet et al., 2016). Some rat mothers and their babies were placed in cages without adequate material to make a nest, this caused the mother to run around looking for a more suitable nesting material to nest and as a result provided frequently disrupted attention to her babies. Babies in both environments were given sufficient food, water, light and had the same amount of time with their mothers. It was the quality of the mothers' are that differed. The rats in these modified environments had a reduced capacity to experience pleasure which was measured by their preference for sugar and how often they interacted with other rats. Although this study involved rats, it sheds some light on parents distracted phone use and potential outcomes for long-term development. The authors suggest the unpredictability of maternal attention could be crucial for emotional development and that infants need to be exposed to certain behaviors in order for their nervous system to typically develop. This is supported by parenting research which emphasized children's need for stability and consistency and that poor emotional development can lead to depression, anxiety and other mood disorders. Further research is needed and the researchers plan to extend the study to involve human mothers and infants and monitor baby's brains during parent-child interactions.

Language development. Parents who are on their phone, elicit not only a neutral facial expression and no eye-contact, but they are also not speaking to their children. Concern regarding the potential negative effects of parents' perpetual cell phone and children's language development have emerged (Fallows, 2013) but empirical investigations have yet been conducted. Existing research on children's language development suggests there is a critical window for children to learn to produce language. Research on children's language development shows that children who are spoken to have greater capacities for language (cite; cite). Based on this existing body of literature, parents lack of vocal interaction due to phone distractions could place children's' potential to produce language at risk.

All of this research has only begun to unravel the complex relationship between parent's phone use and the impact of distracted parenting on parent-child relationships and child development. Even with an understanding of parents' absorption in their phones, their skewed awareness and lack of facial expressions during use, the effects of mothers' phone use on mother-infant interactions remains unclear. To examine this issue, the current project will use the still face paradigm (Tronick et al., 1979) to explore whether mothers' lack of facial expression during phone use elevates infants' physiological levels of distress in a manner similar to infants' exposed to the well-established SF procedure. The SF paradigm and how it will be used in this study is described in the subsequent section.

Still Face Paradigm

The still face paradigm is one standardized way of assessing children's social competence and infant-parent interactions (Adamson & Frick, 2003; Mesman, van IlJzendoorn, & Bakermans-Kranenburg, 2009). The still face experiment was initially designed to measure infant's perception and social cognition, specifically exploring infant expectations of reciprocity in social interactions (Adamson & Frick, 2003; Cohn & Tronick, 1983, Ekas, Haltigan, & Messinger, 2013; Tronick, et al., 1979).

Although the experiment has been modified in a variety of ways, the typical still face procedure follows a three phase A-B-A design. Infants and their mothers are placed facing one another and engage in three separate sequential 2-minute episodes. The first episode sometimes referred to as the face-to-face (FF) episode, is a typical face-to-face interaction usually without toys or objects of play. The second episode is the still face episode (SF), where mothers cease all facial expressions, sound and physical interactions with their infants. In this episode, the only interaction is the mother maintaining eye contact with the infant. Finally, in the third episode, the reunion episode (RE), mothers are instructed to resume the positive interactions that took place in the FF stage (Tronick et al., 1979).

Much research has focused on the changes in infants behavior between each episode, comparing the FF episode to the SF episode, as well as comparing infants who were exposed to the SF compared to those who were not. In response to the SF episode, infants express a decrease in positive affect by crying, looking away, and attempting to re-engage the mother by screeching and reaching out for her (Cohn & Tronick, 1987; Ekas et al., 2013; Mesman et al., 2009; Tronick et al., 1978). In response to the RE phase, infants were likely to protest the interaction through demonstrating a lower positive affect in comparison to that exhibited during the FF episode. Infants are found to look hesitantly/warily at their mother, smile less, and look away more during the RE phase than in the initial FF phase (Cohn & Tronick, 1983; Cohn & Tronick, 1987; Ekas et al., 2013; Mesman et al., 2009; Tronick et al., 1978).

These results suggest infants have basic social awareness and social expectations through a sense of the connection between parental facial expressions and emotions (Tronick et al., 1978; Cohn & Tronick, 1987). Long term effects of exposure to a non-responsive, emotionless parent results in a decrease in infants bids for attention (Ekas et al., 2013) as well as decreased social skills, changes in the play behaviors, decreased the level of overall activity and disruptive sleeping patterns (Field, 1994).

The Still Face Effect. Despite the considerable variations to the typical 3-phase experiment, infants exposed to the still face (SF) phase of the experiment (where the mother makes no facial expression or vocal interactions, but simply stares at the infant) demonstrate what has been termed, the still face effect. The still face effect is classified by the infant's reduction in positive affect (less smiling, laughter and looking at parent) and increase their negative affect (crying, looking away) during the SF phase and sometimes the final phase of the experiment (Mesman et al., 2009).

Current SF Research. Recent research has applied the still face paradigm to explore the connection of non-responsiveness especially as a result of maternal depression and the still face Effect (Conradt & Ablow, 2010; Cohn & Tronick, 1983; Field, Diego & Hernandez-Reif, 2009;

Pelaez-Nogueras, Field, Hossain, & Pickens, 1996). Some studies involve mothers who are actually experiencing depression (Pelaez-Nogueras et al., 1996; Weinberg & Tronick, 1998), while others simulate the depressed mothers' non-responsiveness through the still/blank facial expression (Cohn & Tronick, 1983). These studies have varying results. For example, Field et al. (2007) found that infants of depressed mothers did not express as much distress during the still face experiment and had fewer interactions during the reunion phase. These results are also consistent with Pelaez-Nogueras and colleagues (1996) study, however, in this modified experiment mothers were instructed to touch their infants during the still face episode. With this modification, the infants expressed greater smiling and less crying. The effect of touch was not found to be true for infants of non-depressed mothers (Mesman et al., 2009). Yet, other studies suggest infants of depressed mothers show greater negative affect during the still face episode (Mesman et al., 2009). Although not conducted with depressed mothers, Field (1994) explored the differences between physical and emotional unavailability between mothers and infants to determine which results in greater stress on infants. Results indicate emotional unavailability, defined here as responsiveness to infants' cues, to be more stressful to infants than physical unavailability (Field, 1994).

Expansion of SF Research. Since these initial findings by Tronick and colleagues in 1978, many studies have used the still face experiment to test hypotheses relating to differences in perception and communication (Admson & Frick, 2003), attachment style (Braungart-Rieker, Garwood, Powers & Wang, 2001; Ekas et al., 2013; Fuertes, Santos, Beeghly & Tronick, 2006) and cultural differences, with studies being conducted on American infants (Segal et al., 1995) and Canadian and Chinese infants (Kisilevsky et al., 1998). Although most studies take place with predominantly Caucasian samples, the still face effect was found in all samples with no major differences in the still face effect have been found based on race or ethnicity (Mesman et al., 2009). The experiment has also been applied to investigations exploring atypically developing children, including infants diagnosed with autism (Nadel et al., 2000) or Down syndrome (Carvajal & Iglesias, 1997), infants prenatally exposed to cocaine (Bendersky & Lewis, 1998) and low birth weight infants (Erickson, MacLean, Qualls, & Lowe, 2013). Despite these risk factors, the infants still demonstrated the still face effect. still face research with deaf infants has demonstrated some differences in their reaction to the still face procedure (Koester, 1995; Mesman et al., 2009). Deaf infants reaction to the still face episode involve greater rhythmic leg and arm movements in an attempt to regain the mother's attention, longer periods of looking away and looking at the mother and less smiling, leaning and reaching for the mother (Koester, 1995).

The still face experiment has been conducted with infants ranging in age from 3 to 9 months, as well as toddlers (Adamson & Frick, 2003; Ellsworth, Muir, & Hains, 1993; Tronick, 1978; Weinberg, Beeghly, Olson, & Tronick, 2008). While infants express the still face effect (decrease in gazing at the mother, decrease in positive affect, increased crying, and reaching out to their mother), age differences did emerge, with infants older than 3months of age showing greater amounts of these reengaging attempts than 3-month-old infants (Mesman et al., 2009) and greater positive affect during the face-to-face interaction (Legerstee & Markova, 2007; Mesman et al., 2009).

Procedural differences. The actual procedure of the still face experiment has been modified in a variety of ways, including altering the duration of each of the 3 episodes to be either 1.5 minutes (Braungart-Ricker et al., 2001), 2 minutes (Cohn & Tronick, 1987; Conradt & Ablow, 2010; Erickson et al., 2013; Haley & Stansbury, 2003; Lewis & Ramsey, 2005;

Weinberg & Tronick, 1994)) 3 minutes (Cohn & Tronick, 1987; Ekas et al., 2013) and 5 minutes (Ellsworth et al., 1993. Some studies have also included a break between each episode (Tronick et al., 1978) instead of having each episode occur immediately after one another. In other modifications, the mother is told to remain in the seat with their body facing the infant but turn their head away for a moment between each episode (Tronick, et al., 1978). Other studies allow for mothers to touch and speak to the infant during the first and third phase of the experiment (Gusella, Muir, & Tronick 1988; Mesman et al., 2009) while most procedures involve mothers being told to rely on facial expressions during the positive paly interactions (Tronick et al., 1978). Additionally, instructions provided for the parents during the still face phase differ, with some parents being told to make direct eye contact (Tronick et al., 1978) and other parents being instructed to look directly above the infant's head with the intention to avoid eye contact (Haley & Stansbury, 2003). Despite all of these procedural modifications, infants demonstrate the still face effect (Mesman et al., 2009).

SF and Infant Age. The age of the children exposed to the still face experiment has also varied, with studies including children ranging in age from newborn to 2.5 years of age (Mesman et al., 2009; Tronick, 1978; Weinberg et al., 2008). Newborns did not exhibit the still face effect (Bertin & Stiano, 2006); however, the still face effect was evident in 2.5-year-olds (Weinberg et al., 2008). Furthermore, existing still face research demonstrates 3-month-old infants experience greater distress during the still face episode when the mother's eyes are closed compared to infant's whose mothers did not make any eye contact but were allowed to have vocal and physical interaction (Mesman et al., 2009). Although all infants between 1 and 9 months demonstrate the still face effect, the 3 to 4 month-old infants tend to show a more pronounced reaction (Mesman et al., 2009) and, therefore, this study will include 3-6-month-olds.

SF and Gender. As with most SF research, the present study will also only include mothers (Admson & Fick, 2003; Mesman et al., 2009). Additionally, both male and female infants will be included for although gender differences have emerged in a few studies (Haley et al., 2006), most research has not found any main interactions between the infants' gender and the still face effect (Tronick & Cohn, 1989; Mesman et al., 2009).

SF and Maternal Responsiveness. Recent research has examined maternal non-responsiveness during maternal depression and the still face effect (Conradt & Ablow, 2010; Cohn & Tronick, 1983; Field, Diego & Hernandez-Reif, 2009; Pelaez-Nogueras, Field, Hossain, & Pickens, 1996). These studies had varying results. For example, Field et al. (2007) found that infants of depressed mothers did not express as much distress during the SF phase of the experiment and had fewer interactions during the RE phase. Another study suggested infants of depressed mothers showed greater negative affect such as crying and turning away from the mother during the SF phase (Mesman et al., 2009).

SF and Maternal Eye Contact. With a greater understanding of maternal sensitivity, many SF experiments have been modified to explore what aspect of maternal sensitivity and responsiveness, specifically maternal eye contact/facial expression, maternal touch or maternal voice, plays a greater role in reducing the still face effect. However, instructions provided for parents' gaze during the SF phase differ. Some parents are told to make direct eye contact (Tronick et al., 1978), others are instructed to look directly above the infant's head with the intention to avoid eye contact (Haley & Stansbury, 2003) or make no eye contact by closing their eyes (Mesman et al., 2009). Results regarding mothers closing their eyes during the experiment are conflicting. Thomas (2002) found that 3-month-old infants experience greater distress during the SF episode when the mothers' eyes are closed compared to infants' whose mothers did not make any eye contact but were allowed to have vocal and physical interaction (in Mesman et al., 2009). However, another study found that when mothers were asked to close their eyes but continue vocal and physical interactions with their infant, the interaction dissolved because mothers could no long effectively respond to infant cues.

Murray and Trevathen (1985) explored infant distress from the SF phase to modified phase where parents turn away to speak to another person. Results suggested the SF is more stressful than the parent being distracted by another individual. Striano (2004) investigated mothers' intention in looking away from their infants and the SFE in 3-9 month-old infants. These infants were exposed to a stranger, the experimenter, or their mother. The study consisted of 2 parts with 4 modifications to the typical SF phase. In the first part of this study, the infants were exposed to the SF-toward phase, which involves the adult making a SF while looking toward the infant. These infants were also exposed to the SF-away phase, where the adult makes a SF while looking away from the infant either at a wall or at another person. In response to the SF-toward phase with mothers and strangers infants had a level of positive vocalizations similar to the play episodes. In response to the SF-away phase, infants exhibited the SFE with a decrease in gazing and positive vocalizations. In the second part of this study, infants were exposed to their mothers during 2 modified SF phases, the SF-sound and the SF-no sound. The SF-sound phase parents looked towards the sound they heard. In the SF-no sound phase, the parents looked at a marked spot on the wall. Infants exposed to the SF-sound and SF-no sound exhibited the SFE with a decreased gazing and smiles toward their mother.

SF and Maternal Touch. Although most studies involved mothers being told to rely on facial expressions during the positive play interactions, some studies allowed for mothers to touch and speak to the infant during the FF and RE phases of the experiment (Gusella, Muir, & Tronick 1988; Mesman et al., 2009). Other studies have explored the role of touch during the SF phase in reducing the still face effect (Gusella et al., 1988; Pelaez-Nogueras et al., 1996).

When examining the role of touch, Perlaez-Nogueras and colleagues (1996) examined how touch had a different effect on the SF interaction for children of depressed and children of non-depressed mothers. With this modification, the infants whose mothers were diagnosed with maternal depression expressed greater smiling and less crying; this effect of touch was not found for infants of non-depressed mothers (Mesman et al., 2009). The effect of touch during the SF phase has also been found in infants of mothers who were not diagnosed with depression, with the lack of touch during the SF phase producing the still face effect. This effect was greater for 6-month-old infants compared to 3-month-old infants (Gusella et al., 1988).

SF and Maternal Voice. Although no SF research has incorporated mobile devices, a unique approach to exploring the importance of maternal voice and touch during the SF experiment used televisions to compare infant reactions between physically-present mothers and mothers displayed on a television screen. Gusella et al. (1988) modified the traditional experiment, replacing the mother with a live projection of the mother on a television screen placed where the mother traditionally sat in the experiment. Infant-mother dyads were divided into four groups. Infants in the first group, SF/No voice were exposed to a prerecorded televised mother with a SF and no sound. In the second group, SF/Interactive voice, infants saw a prerecorded mother’s SF but heard her voice. The third group, Interactive face/No voice, were exposed to a live but muted televised mother and the final group of infants, Interactive face/Interactive voice, were exposed to a live televised interactive mother and could hear her voice. Consistent with prior research, results indicated that infants whose mothers exhibited greater sensitivity and responsiveness (interactive facial expressions and interactive voice) looked more at their mothers. This was also true for infants of mothers who exhibited interactive facial expressions but non-interactive voices indicating changes in the mother's facial expression alone could produce the SFE, regardless of whether the infant was exposed to the interactive voice of the mother. This demonstrated the importance of a lack of maternal facial cues over maternal voice in producing the SFE. This also shows the importance of considering the lack of facial expressions while on the phone, during parent-child interactions producing the infant stress associated with the SFE.

SF and Strangers. Researchers have also modified the still face experiment to compare infant reactions between their mother and a stranger (Melinder, Forbes, Tronick, Fikke, & Gredeback, 2010; Mesman et al., 2009). Infants respond with greater protest to the still face phase with the stranger than with their mothers (Melinder et al., 2010; Mesman et al., 2009), this was especially true for the 2-4-month-old infants compared to the 6-8-month-old infants (Melinder et al., 2010). Ellsworth and colleagues (1993) explored the behavior of infants towards their mothers and strangers as well as an interactive object (a hand puppet) in producing the still face effect. Both adults elicited the still face effect in the infants; however, the object did not elicit the effect, indicating that the infant was able to differentiate between a person and object for social interaction.

SF and Objects. Perhaps most related to the question to be addressed in this research is whether infants' have a similar response to mothers' lack of attention in the presence of strangers or objects, i.e. when strangers or objects distract their mothers from synchronous responding or responding to infant cues. Legerstee and Markova (2007) explored the potential for objects to elicit the still face effect and compared the still face effect between mothers expressing the still face, mothers who wore a mask but maintained visual and vocal contact with their 3-9-month-old infant and mother's drinking water from a bottle. Infants only demonstrated the still face effect in response to the still face mothers, not when their mothers wore the masks. Interestingly, infants did not react with greater negative affect in response to the bottle still face compared to the traditional still face despite the lack of engagement between mother and infant. This is the first study to explore an object's role in emitting the still face effect. Although, the mothers' use of a water bottle did not result in the still face effect, during this time the mothers were also maintaining eye contact with their infant. The present study will explore if parents use of an object (e.g., a smartphone or cell phone) will result in a still face effect without eye contact.

Furthermore, Murray and Trevathen (1985) explored infant's distress from the still face to parents turning away to speak to another person. Results suggest the still face is more stressful than the parent being distracted by another individual. These studies suggest that the infant's distress and the expression of the still face effect is not solely in response to the interaction from their mothers but that it is more likely to be a result of mother's non-responsiveness and eye contact.

SF and Physiological Stress Levels.

Chronic Stress and the Infants Stress Response System. Early life stress has been shown to affect the development of infants' stress response system (Haley & Stansbury, 2003; Gunnar, 1998; Lupien, McEwen, Gunnar, & Heim, 2009). Experiencing stress activates the hypothalamic-pituitary-adrenal (HPA) axis causing the adrenal glands to secrete an excess of glucocorticoids (stress hormones, such as cortisol). The resulting activation of the infants' sympathetic nervous system and the related physiological changes in hormonal secretions and repertory functions can affect infant' developing stress response system. The continued stability or allostatic load based on high sustained activation of the HPA-axis is associated with hypo and hypersensitive stress responses (Lupien et al., 2009). Chronic or acute stressors in the first year of life, which is a sensitive period for the developing neurological system's regulation of stress responses, can adversely affect later physical and emotional functioning (Loman & Gunnar, 2010; Lupien et al., 2009) and is specifically related to later neurobiological outcomes specifically memory, attention and emotion in childhood (Gunnar, 1998).

Additionally, research on infant exposure to other situations with nonresponsive parents, such as sleep training, has explored infants' inward and outward behavioral responses when being left alone to self-sooth. Infants exposed repeatedly to this stressful event cease exhibiting outward behavioral signs of stress, but still exhibit inward signs of distress demonstrated through increased cortisol levels (Middlemiss et al., 2012).

Continuous activation of infant's stress response system can have lasting effects on the development of infant's stress responses, such as having a heightened reaction to minimal stressor events and having a more difficult and longer cool down period after experiencing a stressor (Essex, Klein, Cho & Kalin, 2002). Interestingly, infants who have not had early life stress, but are later exposed to continuous stress and, therefore, continuous HPA activity did not have elevated cortisol levels (Essex, 2002) suggesting that early life stress plays a greater role on the developing of the stress response system.

Several studies have explored infant's physiological responses to maternal disengagement in the SF paradigm. Overall measures of infants heart rate (Conradt & Ablow, 2010; Haley & Stansbury, 2003), respiratory sinus arrhythmia (RSA; Conradt & Ablow, 2010), skin conductance (Ham & Tronick, 2006) and infant cortisol Crocket et al., 2013; Grant et al., 2009; Feldman, Singer & Zagoory, 2010; Haley, 2011; Haley et al., 2011; Haley & Stansbury, 2003). Results demonstrate considerable variation in infants' cortisol stress responses. Some infants do demonstrate a statistically significant difference in cortisol responses from baseline to stressor (Crocket et al., 2013; Feldman et al., 2010; Haley, 2011; Haley et al., 2011; Haley & Stansbury, 2003) while others demonstrate an increase from baseline to stressor (Erikson et al., 2013) and some demonstrate no difference (Feldman et al., 2010; Grant et al., 2009; Martinez-Torteya et al., 2015; Montirosso et al. 2013). In these studies where no difference was found between baseline and stressor samples, further exploration of individual differences revealed variations in infant responses (Grant et al., 2009; Martinez-Torteya et al., 2015; Montirosso et al. 2013). Therefore, individual differences will be explored in the present study.

Maternal sensitivity and infant stress response system. Less sensitive and responsive caregiving is associated with the development of insecure attachment styles, poorer developmental outcomes (Lyons-Ruth, 1996; Schneider, Atkinson, & Tardif, 2001) and heightened infant stress levels (Gunnar, 1998; Loman & Gunnar, 2010; Lupien, King, Meaney, & McEwen, 2000), However, infant brain plasticity and maternal sensitivity also mediates the relationship between stressful events and infant heightened stress response (Gunnar & Quevedo, 2007) even if the infant may be genetically predisposed to a greater stress response (Anisman, Zaharia, Meaney & Merali, 1998; Meaney, 2001). Securely attached infants have a lower stress response to a stressor event while the primary caregiver was present, compared to insecurely attached infants (Luijk et al., 2010; Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996; Ahnert, Gunnar, Lamb, & Barthel, 2004). The securely attached infants who experience a stressful event within the presence of their caregiver will not experience an increase in cortisol levels, while insecurely attached infants will experience elevated stress levels. This pattern was also found in infants exposed to a kind and sensitive stranger during a stressful situation without the presence of the primary caregiver. These infants did not experience a heightened stress response if the stranger was friendly and responsive (Gunnar, 1998; Loman & Gunnar, 2010).

SF and infants physiological responses. Infants stress response system is activated when exposed to the still face experiment. Although much research has explored infants cortisol responses to the still face procedure (Erickson et al., 2013; Field et al., 1988; Grant et al., 2009; Haley & Stansbury, 2003; Haley et al., 2006; Lewis & Ramsay, 2005; Mörelius et al., 2015; Tollenaar et al., 2011) not all have seen an increase in infant cortisol stress response to the (Grant et al., 2009; Haley & Stansbury, 2003; Haley et al., 2006). Other studies have explored additional physiological measures including heart rates (Conradt & Ablow, 2010; Field, 1994; Haley & Stansbury, 2003; Ham & Tronick, 2006) vagal tone (Moore et al., 2009) and skin conductance (Ham & Tronick, 2006). In attempt to reduce their autonomic arousal, infants engaged in several self-soothing behaviors, including averting their eyes (Beebe, 2000; Field, 1981), sucking their thumbs (Toda & Fogel, 1993), and seeking eye contact from caregiver (Braungart-Rieker, Garwood, Powers & Wang, 2001; Harman, Rothbart & Posner, 1997). Infants may also be slow to re-engage with their mothers during the final stage of the still face experiment (Weinberg & Tronick, 1996). However, as research on infant stress has demonstrated, the negative effects of increased infant stress only pose a threat to long-term development with prolonged exposure and HPA activation (Essex et al., 2002; Gunnar, 1998; Gunnar & Quevedo, 2007). This prolonged exposure to stress is associated with the negative impact of maternal depression on both infants' attachment status and socio-emotional well-being. Considering this, it is important to question whether the potential stress of maternal distraction with the high-level usage of technology during parent-infant interactions places infants' physiological and emotional development at risk.

APPENDIX B

EXTENDED METHODOLOGY

Participants

To be eligible to participate in the present study mothers needed to be 18 years of age or older, report to owning a cell phone or Smartphone, and be mothers of a healthy infant between 3 and 6 months of age. Infant health was based on mothers' report. During the initial contact mothers were asked if their infant had any health risk factors including low birth weight (less than 5 pounds), premature birth (born before 37 weeks gestation), hospitalization after birth, experience of prenatal or postnatal complications, or other characteristics that may impede infant development (e.g. increased stress due to maternal separation after birth or poorer motor and cognitive development). Mothers who answered yes to any of these health risks were not included in the study. Of the 69 total mothers who responded to the announcements about the study, 8 did not meet inclusion criteria (5 infants were older than 6 months; 2 infants were born premature, 1 mother was under 18 years of age), 3 moms did not attend their scheduled session, 1 declined participation after learning about the study, and 23 expressed interest but failed to respond to the informational e-mail/text message and/or check-in e-mail/text message from the researcher.

Demographic characteristics. A total of 34 mother-infant dyads participated in this study (Table 11). The majority of mothers were Caucasian (76%), married (85%) and college-educated (91%). Twenty-eight of the mothers were millennials (between18 and 34 years of age) which supports existing research that younger mothers are more likely to own mobile devices (BabyCenter, 2014) however, younger mothers are also more likely to have an infant between 3-6 months of age. Mothers' Smartphone ownership ranged from 1 to 12 years with an average of 6.5 years. Forty-four percent of moms (n = 15) owned a phone with Internet capability for 5 years or less, while 55.88% (n = 19) owned a phone with Internet for 6+ years. The number of mobile device applications (apps) on their phone was not related to how long they have owned their device, with the total number of apps ranging from 2 to 50 across the duration of phone ownership.

Of the 20 mothers who are not stay at home mothers, 17 reported to being required to answer their phone for work. Of these 17 mothers, only three reported never answering their phones even though required by their employers. The number of work-related phone calls varies, with mothers answering their phone during non-work hours anywhere from 2-10 times a week (n = 15), 11-20 times (n = 4), more than 20 times (n = 3).

Procedures

Informed consent procedures and treatment of participants were in compliance with the sponsoring institution's human subjects review board. Sessions were conducted either at the University of North Texas Educational Psychology Laboratory or at The Parenting Center. All data was collected between April 1 and November 9, 2015 and followed procedures approved by the University of North Texas Internal Review Board (Appendix E).

Recruitment. Recruitment was completed in four stages: (1) Informing mothers of the study; (2) Determining mothers' eligibility and providing additional information about the study and; (3) Setting up a participation appointment; and (4) Completing the informed consent (Appendix E) at the time of participation. For full recruitment process see Figure B.1.

Table B.1

Descriptive Information of Demographic Variables

Variable	Total (*n*=34) *n* (%)	Reactors (*n*=16) *n* (%)	Nonreactors (*n*=18) *n* (%)
Infant:			
Gender			
Male	18 (25.9%)	8 (50%)	10 (55.6%)
Female	16 (47.1%)	8 (50%)	8 (44.4%)
Age (months) *M*(*SD*)	4.4 (1.1)	4.5 (1.2)	4.3 (1.0)
3 months	10 (29.4%)	5 (31.3%)	5 (27.8%)
4 months	7 (20.6%)	2 (12.5%)	5 (27.8%)
5 months	10 (29.4%)	5 (31.3%)	5 (27.8%)
6 months	7 (20.6%)	4 (25%)	3 (16.7%)
Baseline µg/dL *M*(*SD*)	.264 (.156)	.244/.149	.281/.164
Stressor µg/dL *M*(*SD*)	.283 (.195)	.386/.211	.192/.126
Post-stressor µg/dL *M*(*SD*)	.267 (.168)	.355/.917	.188/.093
Mother:			
Age (years)	29.6 (4.5)	29.6 (5.2)	29.6 (4.03)
Race/Ethnicity			
Caucasian/white	26 (76.4%)	12 (75%)	14 (77.8%)
Hispanic	7 (20.5%)	4 (75%)	3 (16.7%)
African American	1 (2.9%)	0	1 (5.6%)
Educational Level			
Bachelor’s degree	13 (38.2%)	6 (37.5%)	7 (38.9%)
Master’s degree	7 (20.5%)	3 (18.8%)	4 (22.2%)
Some college credit	5 (14.7%)	3 (18.8%)	2 (11.1%)
Associate degree	3 (8.8%)	1 (6.3%)	2 (11.1%)
High school graduate	3 (8.8%)	1 (6.3%)	2 (11.1%)
Doctorate degree	2 (5.8%)	1 (6.3%)	1 (5.6%)
Vocational training	1 (2.9%)	1 (6.3%)	0
Employment			
Stay at home mom	13 (38.2%)	8 (50%)	5 (27.8%)
Employed outside home	12 (34.3%)	6 (37.5%)	6 (33.3%)
Self-employed	4 (11.7%)	2 (12.5%)	2 (11.1%)
Student	3 (8.8%)	0	3 (16.7%)
Military	1 (2.9%)	0	1 (5.6%)
Unable to work	1 (2.9)	0	1 (5.6%)
Relationship Status			
Married	29 (85.2%)	14 (87.5%)	15 (83.3%)
Engaged	5 (14.7%)	2 (12.5%)	3 (16.7%)
Phone Ownership (years) *M* (*SD*)	6.5 (2.7)	6.1 (3.0)	6.9 (2.6)

Note. µg/dL = micrograms per deciliter

Recruitment Stage 1. Informing Mothers of Study. Flyers advertising the study were placed around the community primarily at locations where mothers of infants frequented. Locations included The Parenting Center in Fort Worth, the Child Development Laboratory at the University of North Texas Denton campus, Tarrant County WIC office, Tarrant County YWCA, Department for Health and Human Services, Tanglewoodmoms.com, Facebook pages for local mom and baby groups (e.g. Fort Worth Babywearers Facebook group and Oh Baby Fitness Fort Worth TX), and churches located in the Dallas-Fort Worth area. An announcement of the study and contact information was published in the Denton Chronicle both online and in paper format. Many moms also shared the flyer on their personal Facebook page and with mommy groups on Facebook that were closed to the researcher. The flyer was printed on a 5 X 7 piece of paper containing basic information about the study that researchers were looking for mothers of 3-6-month-old infants. The flyer contained the following information: the website/mobile site link and a Quick Response (QR) code to the research study's website (www.wix.com/parentsandphones); the e-mail address mothers could use to contact the researcher, and the phone number mothers could use to contact the researcher. These flyers were meant to be taken with mothers to encourage participation. Flyers posted electronically were exactly the same excepting the QR code. Mothers who participated and requested flyers were given flyers to take with them and share with their friends and family members who met the eligibility requirements.

Most moms (n = 21) were recruited from various mother-child focused Facebook groups. Three moms were recruited from advertisements in the Denton Record-Chronicle. Five moms were from Tanglewoodmoms.com. Three moms were from The Parenting Center, 1 mom was recruited from a local church and 1 mom was recruited from One Safe Place of Tarrant County.

Recruitment Stage 2. Providing Information and identifying eligibility. With the flyer described above, mothers were invited to use website, email or text-based options to access information about the project. Email was the primary method of communication, with 37 moms emailing the researcher to express an interest in the study (11 used the "Participate" button on the website). Twenty-four moms used text messaging and eight moms used phone calls.

Considering the research suggesting mothers are a large group of mobile device users (BabyCenter, 2015) and that there is a preference for communicating technologically (Purcell, 2011), a website was developed as an additional resource to provide mothers study information. Mothers interested in finding out about the project could access the website using the link provided on the flyer or by scanning the QR code with a phone or a tablet. Once scanned, the mother was directed to the research study's website. From the "Home" page, mothers could access 3 other pages. The "About the Study" page outlined information presented on the Informed Consent form, i.e., reiterating that this project was for a research study, outlining mother's rights as a volunteer, etc. The "Contact Us" page allowed mothers to send an e-mail message with questions, comments, or concerns about the study to the researcher's e-mail (parentsandphones@gmail.com). The "FAQ" page included answers to questions such as, "Will this harm my child?" and "Will I be compensated for participating?" In the top right corner of all pages, there was a button that said: "Click to participate! Or Call/Text (940)-441-2198". This provided 2 methods to contact the researcher to indicate an interest in participating.

Mothers who chose to e-mail without accessing the website used the e-mail address located on the flyer. If the mother was on the website and clicked the "Click to participate! or Call/Text (940)-441-2198" button, a new window opened with an e-mail message with a predetermined subject line "Request for information to participate". The mother was then contacted via e-mail by the researcher unless they provided an additional or preferred method of contact. The primary investigator replied to all mother's inquiries within 24-48 hours.

If a mother chose to learn more about the study by calling or texting the researcher, they were directly connected to the primary investigator. A phone number was set up through Google Voice and was automatically connected to the e-mail described above. The project e-mail address and project phone number were created for the purposes of this study. However, the phone number forwarded participant queries to the researcher's personal phone (via Google Voice) to increase the speed of responses to calls/text messages. All information (phone numbers, the content of text messages and emails) were automatically saved into Google Voice and deleted from the personal device. If the researcher was not available to answer the phone, the mother was given the option to leave a voicemail (stored in Google Voice) and was contacted at the soonest possible time by the researcher.

Upon receiving the e-mail or phone call from the interested mother, the primary investigator whose personal phone was connected to the Google Voice account, contacted the mother. During this initial contact, the researcher informed the mother of the eligibility requirements and what the study entailed. The mother was asked if they are over 18, if they own a cellphone/smartphone, if they have a child between 3 and 6 months of age and if their child was born prematurely (born before 37 weeks gestation), had a low birth weight (less than 6lbs) or required hospitalization after birth. If the mother answers "yes" to the first three questions and "no" to the last question the mother and her infant were eligible to participate. To maintain consistency the researcher who contacted the mothers used the same question verbiage and order. Once the mother indicated she understood and was interested in participating, she was given a Parent Instruction Sheet via e-mail and a time to participation was established.

Recruitment Stage 3. Setting up a Participation Appointment. Mothers were informed that they had the option of completing their session at the Educational Psychology lab at the University of North Texas or at The Parenting Center (TPC) in Fort Worth. A location was chosen based on the mother's preference.

Recruitment Stage 4. Completing Informed Consent. When a participant first arrived for their scheduled session the Informed Consent form (Appendix E) was explained. The researcher went over the phone still face experiment, salivary sampling procedures, data handling procedures and the overall purpose of the study. Then the researcher asked for questions. Mothers who wish to continue with the study completed the Informed Consent form, signing two forms, one of which was retained for their personal records, the other remained with the researcher.

Compensation. All mothers received a $50.00 gift card upon completion of the study as compensation for their and their infant's time. The gift cards were funded through the Jerry M. Lewis Mental Health Research Foundation (formerly The Timberlawn Psychiatric Research foundation Foundation). Mothers who met at the EPSY lab also received a voucher for a 2-hour parking pass. Mothers who removed themselves or their infant from the study were not eligible to receive a gift card. If a session was ended early because the infant was too distressed to participate (n=1) another session was scheduled to complete the entire experiment.

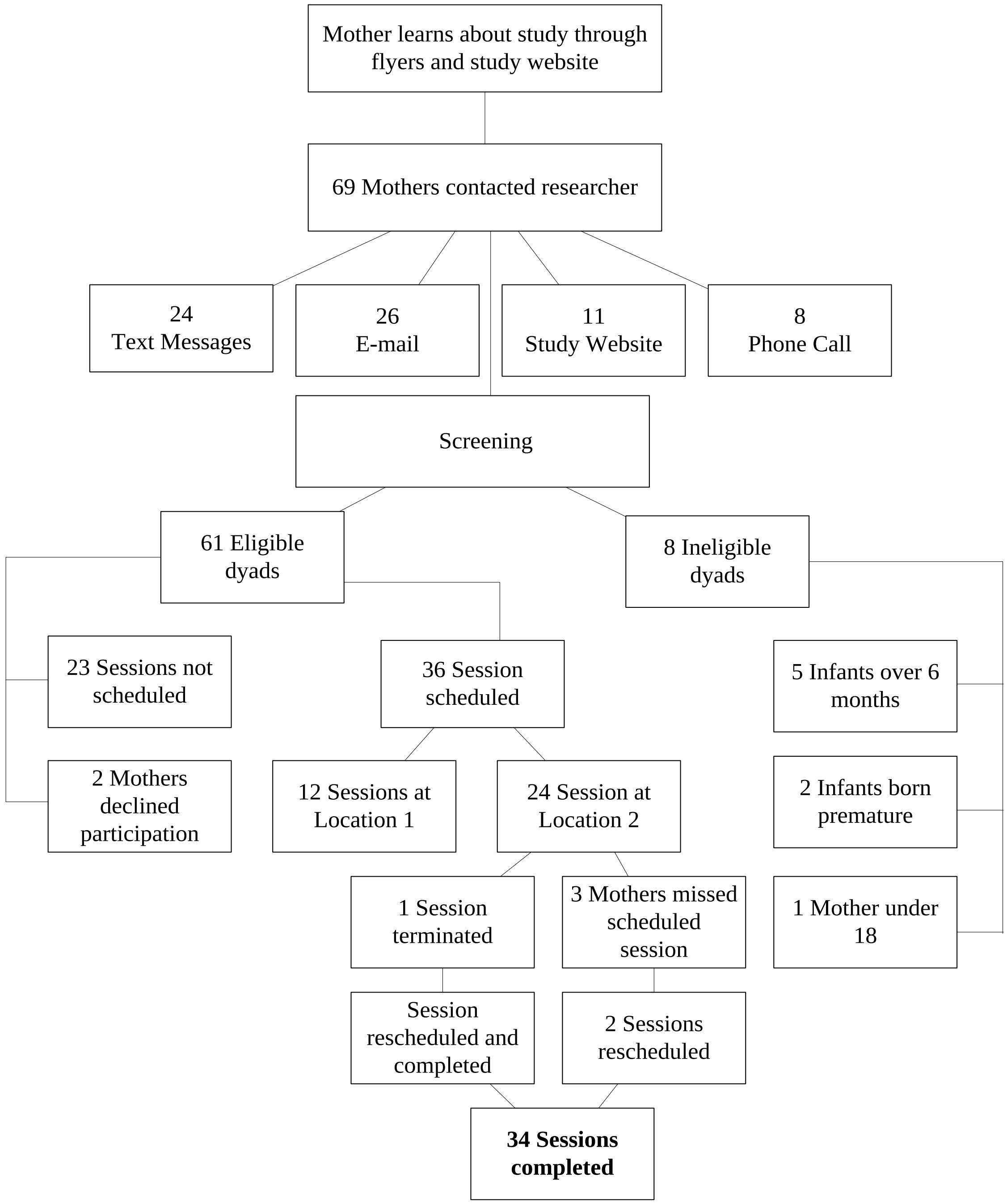


Figure B.1. Recruitment and participation flowchart.

Location. Mothers had the option to meet at either the University Educational Psychology Lab (EPSY lab) in Denton or at The Parenting Center (TPC) in Fort Worth. Ten sessions were conducted at the EPSY lab April through November 2015 and 24 sessions were conducted at the

TPC from October to November 2015. Two rooms were used at TPC with 12 sessions conducted in each room. The Educational Psychology lab at UNT contains two adjoining rooms separated by a one-way mirror. The room where the video interaction took place was set up to resemble living room with a couch, bookcases, and a small table. The other room contains a freezer where the samples were stored and a desktop computer where the participants took the online survey. At the Parenting Center, sessions took place in office spaces used for counseling and play therapy sessions. The rooms a desk and laptop computer for moms to take the survey and a table and chairs, one room contained shelves of toys.

Although mothers were told the session would take 1.5 and sessions were scheduled for this length of time, sessions were typically completed in an hour. The total time for each session was around 58 minutes. The final procedure was as follows: acclimation (20 minutes), baseline sample (2 minutes), face to face phase (2 minutes), phone still face phase (2 minutes), reunion phase (2 minutes), wait period 1/survey (20 minutes), stressor sample (2 minutes), Wait period 2 (10 minutes) and recovery sample (2 minutes).

Acclimation and Set-Up. Upon arrival, a timer was set for the 20- minute acclimation period. During this time mothers signed the Informed Consent and the infants played as part of their acclimation to the new surroundings and the presence of the researcher. Data was collected by 2 researchers, 32 sessions by researcher 1 and 2 sessions by researcher 2. To aid in the acclimation process, mothers were instructed to play with their infants, placing them in the infant seat for a few moments and picking them up again. Mothers were instructed to do this several times to get the infant accustomed to the infant seat before the experiment began. During this acclimation time, the researcher set up the rest of the environment, ensuring the infant seat was secure and making sure mother’s adjustable chair was 18-36 inches away from the infant seat and at infants’ eye level. During this time the cameras and tripods were put in place and adjusted for the mother’s and infants’ height.

Cortisol Test #1 (Baseline). Once the timer that had been set for the 20-minute acclimation period went off, the baseline cortisol sample (Baseline) was collected. This sample provided a baseline measure of salivary cortisol prior to initiation of the FF phase (Erickson et al., 2013). If an infant did not like the researcher holding the cotton swab or if the infant was distracted by the researcher’s gloves, the researcher guided the mother on how to hold to swab. All saliva sampling took place in the recommended 90 seconds or less.

After the baseline sample was collected and stored, the mother was asked to place her infant in the infant seat and then take her own seat, or if she was already in her seat, she was asked to turn toward her infant. Once the mother was facing the infant, the researcher started the video recording, for infant’s camera and then mother’s camera. Then the mother was instructed to begin the first play interaction and the timer was immediately set for 2 minutes.

The PSF protocol followed the SF protocol used by Tronick (2003), Weinberg and Tronick (1996), using the typical A-B-A model. This experiment modified the traditional SF phase to the PSF phase, which included mother’s texting on their phones without making any facial expression or eye contact with their infant. (Cohn & Tronick, 1983; Tronick et al., 1978). Mother’s phones were turned to silent during the experiment, and they were told only to text and not to talk on the phone or watch videos. Each phase occurred sequentially (FF, PSF, and RE) for 2 minutes, with no breaks between each phase.

Phase 1: FF Phase. The FF phase of the experiment began immediately after the baseline sample was collected when the mother sat in the seat facing their infant and engaged in a typical play interaction as instructed. This play interaction was the same for the FF phase, and the RE phase. During these interactions, each mother was allowed to touch, make eye contact with, and talk to her infant by playing a game, such as peek-a-boo. These interactions were not scripted; mothers were simply instructed to play with their infants as they usually do while remaining in the seats provided.

Phase 2 Phone Still Face Phase. The researcher sat where the mother, but not infant, could see her. In a manner not audible to the infant, the researcher quietly notified the mother after 2 minutes to switch her focus to her phone instead of her infant. During the PSF phase, mothers ceased all interactions of the FF phase and switched their full attention to their phone, which they were instructed to have nearby. In this phase, mothers were instructed to avoid all social exchanges with their infants. In order to maintain focus on their phone, mothers continually texted the alphabet as fast as they could, repeating until the 2 minutes passed. Mothers were told to remain quiet with a neutral face and not to look up for any reason. Unlike the play interaction of the FF phase, during this phase mothers were not allowed to engage in any physical or vocal interaction with the infant. Consistent with SF protocol, the PSF protocol was not completed if infants cried uncontrollably for 20 seconds either upon being placed in the infant seat at the beginning of the experiment or during the PSF period (Braungart-Rieker et al., 1998; Ellsworth et al., 1993; Haley & Stansbury, 2003; Lergerstee & Markova, 2007). Only 1 session was terminated due to the infants uncontrollable crying, the session as rescheduled and completed successfully.

PSF Procedural Errors. Although maternal videos were not coded for this study, mothers videos were viewed to ensure mothers followed procedure., specifically not talking to or touching their infant (*n*=3) as these interactions have been shown to decrease the still face effect (Adamson & Frick, 2003, Feldman, Singer & Zagoory, 2009; Muir & Lee, 2003). In these instances, mothers touched or laughed at their infant between 1 and 4 seconds. Additionally, toys were not permitted during the PSF phase, however, 2 sessions included toys. Analyses were ran with and without these sessions and no statistically significant differences were found, therefore all session were retained in subsequent analyses.

Phase 3: RE Phase. When instructed, mothers immediately switched from the PSF phase to the RE phase for 2 minutes. At the beginning of the RE phase, the mothers put their phones away and re-engaged their infant in typical play interaction. Again, mothers generally were not allowed to use any toys or remove the infant from the infant seat. A few mothers (*n* = 4) pulled their infants into a seating position during this phase. As in the FF phase, mothers were allowed to talk to and touch their infants during the play interactions. When the researcher signaled to mothers that the 2 minutes was up, the video recording stopped and the PSF experiment was over. At this point, the mother was able to stand up and remove her child from the infant seat. At the end of this phase, the researcher immediately set a timer for 18 minutes (a total of 20 minutes after the PSF phase), which signaled it was time to collect the second saliva sample, assessing the infants' reaction to their mother being engaged on their phone.

Survey. Following the PSF protocol, during the wait time for the second saliva sample, mothers completed a brief survey containing 18 basic demographic questions and 38 questions related to the frequency of and attitudes towards phone use.

Cortisol Test #2 (Stressor). When the timer signaled 18 minutes had passed, the researcher immediately set a timer for 10 minutes to signal timing of the final sample (Recovery) (described in Cortisol Test #3) and collected salivary samples from the infants. As outlined in Erickson et al. (2013), 20 minutes after the end of the PSF phase marks the time between the stressor event and the necessary elevation of cortisol in the infants' saliva. Although cortisol levels are evident in the bloodstream prior to this 20-minute period, they are not found in the saliva until 20 minutes after a stressor event. Therefore this sample was used to assess infant stress levels as a result of being exposed to the PSF phase.

Cortisol Test #3 (Recovery). The final cortisol sample was collected when the timer signaled the end of the last 10 minute period. This sample assesses the infants' recovery from the stressor event. The timer also indicated a total of 30 minutes after the end of the PSF phase had passed, a timeframe which is consistent with prior stress sampling research (Erickson et al., 2013).

Measures

Salivary Cortisol. This research followed the traditional pattern of cortisol sampling during SF procedures (Erickson et al., 2013; Haley, Handmaker & Lowe, 2006; H). Three samples were collected, a baseline sample (before stressor event), the stressor event (exposure to PSF) and recovery sample. Use of salivary cortisol sampling is an accepted, noninvasive means of assessing activation of the HPA-axis and level of the individual's response (Gunnar & Quevedo, 2007). The absorbent device technique using a swab specifically designed for infants was used to collect saliva in this sample. As outlined in the Salimetrics-SalivaBio handbook (2014) and typical infant stress sampling procedures, the SalivaBio Infant Swab (SIS) was placed in the infant's mouth for 60-90 seconds or until a third of the swab had absorbed saliva. A single swab typically holds 200-100 µL, however, modern immunoassays need less than 100 µL (Salimetrics-SalivaBio, 2013). To assure the quality of samples for the cortisol testing, it was advised to collect between 75 µL and 100 µL of saliva which can be collected in one, 60-90 second session (Salimetrics-SalivaBIo, 2013). In order to avoid contamination of saliva samples, saliva stimulants were not used and mothers were advised to not feed their infant 30 minutes prior their session. If an infant did eat right before (n=3), or spit up during the acclimation period or SF procedure (n=1), their mouth was washed out with a damp cloth by their mother, this is an accepted protocol for this concern (Haley et al., 2006).

Samples were collected by the primary investigator or by the mother under the guidance of the PI. Following sample collections, the saturated swab was immediately placed in a cryogenic vial marked with the participant identification number. The vial was then sealed, and placed in the Salimetrics-SalivaBio cryogenic storage container and stored in the freezer. Samples collected at The Parenting Center were transported in cooler to the freezer in the Educational Psychology laboratory. All samples were stored at -80ºC until the time of assay. Assays were completed by Salimetrics-SalivaBio, a highly reliable enzyme immunoassay in California. All saliva collection and transportation followed the procedures outlined in the Salimetrics-SalivaBio Saliva Collection and Handling Advice handbook (2013). Samples were shipped based on Salimetrics-SalivaBio criteria to maintain the viability of saliva samples. No samples were ruined in transportation process to Salimetrics.

All samples were sufficient for assay. Salimetrics conducted duplicate testing for each sample and provided a raw score for the first round, the second round and a mean of both testing rounds. No statistically significant differences between the testing times were observed (see Table B.2) and therefore the mean of both the first and second saliva analysis values was used for subsequent data transformation and analyses.

Table B.2

Descriptive Cortisol Samples

	Cortisol (μg /dL)	Mean (SD)
Round 1	Baseline	.391 (.69)
	Stressor	.348 (.37)
	Recovery	.346 (.42)
Round 2	Baseline	.369 (.68)
	Stressor	.319 (.20)
	Recovery	.316 (.20)
Mean	Baseline	.380 (.22)
	Stressor	.334 (.20)
	Recovery	.331 (.21)

Note. n = 34, μg/dL = micrograms per deciliter

The cortisol values at each assay point were then screened for outlying values. Typical studies exploring cortisol data define an outlier as any value greater than 3 *SD*s above the mean for a given time point (Gunnar et al., 1989; Lewis & Ramsay, 2005). With this method, one outlier was identified. To verify this, the Mean Absolute Deviation (MAD), an alternative method to detect outliers that is not as influenced by the presence of outliers are the SD and Mean, was also used (Leys et al., 2013). The same infant's samples were identified as outliers. Review of session notes revealed infant samples may have been contaminated. To maintain the sample size, the three outlying saliva samples were replaced by a value that was proportional to the non-outlying values relative to the mean values for the infants (Crockett et al., 2013). Analyses were computed using both the data and without the outliers, however, no statistically significant differences emerged in these subsequent analyses. Final baseline, stressor, and recovery cortisol levels are reported in Table B.3.

Table B.3

Means, SD for Cortisol Values

Measure	Raw values (µg/dL) M (SD)	Log10 values M (SD)
Baseline	.264 (.15)	-.645 (.24)
Stressor	.283 (.19)	-.644 (.29)
Recovery	.267 (.16)	-.645 (.24)

Note. n = 34, µg/dL = micrograms per deciliter

Due to positive skew for raw values of all three samples, cortisol values were subjected to a $\log_{10}$ transformation (Erickson et al., 2013; Grant et al., 2013; Haley & Stansbury, 2003), which successfully normalized the distributions. For subsequent analyses, the log10 values were used.

Cortisol responses are subject to the Law of Initial Values (LIV, Erickson et al., 2013; Haley et al., 2006; Lewis & Ramsay, 2005; Tollenaar et al., 2011), which demonstrates a negative relationship between the pre-stressor (baseline) and stressor cortisol response. Before being concerned about the LIV, two conditions should be met 1) there must be a statistically significant difference between the baseline cortisol sample and the stressor cortisol sample and 2) the baseline and stressor sample values must be highly positively correlated (Lewis & Ramsay, 2005). Although baseline, stressor, and recovery samples were positively correlated (Table 14), there were no statistically significant mean differences between baseline and stressor samples (p = .989) or between stressor and recovery samples (p = .989) therefore the necessary conditions were not met for this study (Haley et al., 2006) and there was no LIV effect either cortisol response.

Time of day. Cortisol levels vary naturally over a 24-hour period; however, levels tend to peak in the early morning hours just prior to waking and then decrease throughout the day. To encourage participation scheduling was based on mother's availability and preference given to their infants' individual schedules. All sessions were conducted between 8:00am and 7:00pm. Twenty sessions took place in the morning, and 13 sessions took place in the afternoon. One session took place in the evening and was removed from the following correlational analysis. Arrival times were recorded and examined for differences in cortisol responses as a function of time of day. As with other all other studies still face studies exploring infant stress responses with salivary cortisol (Erickson et al., 2013; Grant et al., 2009; Lewis & Ramsay, 2005; Provenzi et al., 2016; Thompson & Trevathan, 2008), there was no relation to arrival time and infants stress responses (baseline r = -.35, p = .846, stressor r = -.007, p = .966 and recovery r = -.028, p = .875). Therefore, time of day was not considered any further.

Location. Due to the time commitment of the present study, it was necessary to be flexible with participants to encourage study involvement and therefore sessions were scheduled at the convenience of the mothers. Although many SF experiments are conducted at the same location for all participants, some studies have used multiple locations (Erickson et al., 2013). To determine if study location was a source of variation in infant stress responses a correlational analysis exploring the relationship between location (TPC or EPSY lab) and high or low-stress responses as determined by the stressor event was conducted. As found in previous research (Erickson et al., 2013) no differences due to the location were found. Therefore, location was not considered any further.

Table B.4

Correlation Analysis of Experiment Time, Location and Infant Stress

Variables	1	2	3	4	5
1. Baseline	-	.631**	.380*	-.035	-.118
2.Stressor		-	.859**	.007	-.073
3. Recovery			-	-.028	-.067
4.Time				-	.288
5. Location					-

Note. *n* = 34 **p* = <.05, ***p* <.01, Morning sessions *n* = 20, afternoon sessions *n* =13. Location 1 *n* = 10, location 2 *n* = 23.

Infant Affect. Infant affect is typically measured by two components, 1.) infant vocalizations and 2.) infant facial expressions (Bigelow & Best, 2013; Erickson et al., 2013; Haley & Stansbrury, 2003; Legerstee & Markova, 2007). However, some studies only include one measure (Bertin & Striano, 2006; Lewis & Ramsay, 2005). To measure infant affect in the present study, both infant vocalizations and facial expression were included, using the scales provided in Tables B.5 and B.6 (Braungart-Rieker et al., 1998; Braungart-Rieker et al., 2001; Braungart-Rieker et al., 2014. Each second of each phase received one score from -3 to +3. When coding facial expressions, if coders were unable to see the infants face (infant turned away or blocked face with their hands) affect was coded as missing (Moore & Calkins, 2009). Infant vocalizations were scored using the following scale: -3 screaming (loud sharp cry/screech), -2 crying (negative murmuring, louder fussing), -1 mild fussing (soft negative murmuring, whimper), 0 neutral (no vocalizations), 1 cooing (soft positive murmuring), 2 quiet chuckle (more intense cooing, louder postive murmuring), 3 delight (loud positive scream/squeal). Similarly infant facial expressions were scored as follows: -3 large grimace (mouth open, furrowed brow, eyes may be closed), -2 frown (mouth slightly open, slight furrowed brow), -1 small frown (closed, downward turned mouth, pout) 0 neutral (no facial expressions), 1 half smile (upward turned mouth closed or slightly open/parted lips), 2 large smile (upward turned and open mouth), 3 wide smile (mouth open wide; Braungart-Rieker et al., 1998; Braungart-Rieker et al., 2001; Braungart-Rieker et al., 2014).

In order to achieve data reduction while representing the variations in infant affect during each 2-minute phase, positive and negative affect were calculated separately (Braungart-Rieker et al.,2001; Erickson et al., 2013). A total affect scores for each 2-minute phase was generated by averaging the vocalization scores and facial expression scores, resulting in 2 measures of infant affect, positive affect scores and negative affect scores (Braungart-Rieker et al., 2001). Means and standard deviations for affect are presented in Table B.5.

Table B.5

Means and Standard Deviations of Infant Affect by Phase

	Face-to-Face		Phone Still Face		Reunion	
	Mean	SD	Mean	SD	Mean	SD
Total Positive Affect	1.0255	.52561	.0992	.13217	.9662	.64719
Total Negative Affect	.1696	.31430	1.3076	.98523	.4314	.63697
Positive Vocalizations	.3552	.32988	.0296	.04957	.3377	.31045
Negative Vocalizations	.0617	.12830	.5164	.50646	.1945	.29505
Positive Facial Expression	.6703	.34287	.0696	.10535	.6284	.41866
Negative Facial Expressions	.1078	.19797	.7912	.53448	.2368	.35408

Note. n = 34

Infant Regulation. Infant regulatory behaviors were coded as being present or absent at 1-second intervals using the COPE scale (Braungart-Rieker et al., 1998; Braungart-Rieker et al., 2001). This scale included four aspects of coping behaviors: 1. Self-comforting behaviors (infant is sucking their thumb/finger, rubbing their face/hair, and wringing hands), 2. Object orientation (infant gazes at an object other than their mother, lowering gaze without closing eyelids, looking at mobile device), 3. Mother orientation (infant gazes at mothers face), and 4. Escaping the situation (infant makes an attempt to remove herself/himself from the infant seat, arching/twisting of back, gesturing to be picked up, pulling seatbelt). Two measures of infant attention patterns or gaze orientation were included due to research demonstrating that infants will look at an interesting stimulus such as their mother, but will look away when the mother stares at them blankly (Legerstee & Markova, 2007; Toda & Fogel, 2993), therefore both object orientation (looking away from mother) and mother orientation looking at mother) were included. Coding took place at 1-second intervals, and the behaviors were coded as either being present or absent. Proportion scores for each COPE variable were created by summing the number of intervals that the behavior was present for each phase, divided by the total number of intervals coded (120). Results are presented in Table B.6.

Table B.6

Means and Standard Deviations of Infant COPE by Phase

	Face-to-Face		Phone Still Face		Reunion	
	Mean	SD	Mean	SD	Mean	SD
Self-Comforting	.1397	.1745	.3373	.2769	.1181	.1524
Object Orientation	.1086	.1146	.5343	.2386	.1088	.1227
Mother Orientation	.7917	.1788	.2196	.2071	.7196	.2161
Escape	.0208	.0341	.0956	.1651	.0248	.0521

Note. *n* =24

Movement. Arm and leg movements were also coded, although not part of the infant affect or COPE measure, several other studies found that during the still face phase, infants demonstrate increased motor activity (Conradt & Ablow, 2010; Jamieson, 2004, Lamb, Morrison, & Malkin, 1987; Mesman et al., 2008; Stroller & Field, 1982; Tronick et al., 1978; Weinberg & Tronick, 1996). Coding of movement also took place at 1-second intervals and was coded as either being present or absent (Table B.7). Similar to COPE scores, movement scores were created by summing of the number of intervals that the behavior was present for each phase, divided by the total number of intervals coded (120).

Table B.7

Infant Movement by Phase

	Face-to-Face		Phone Still Face		Reunion	
	Mean	SD	Mean	SD	Mean	SD
Arm Movement	.2576	.1327	.5549	.1634	.2235	.1522
Leg Movement	.1811	.1483	.4311	.2234	.1627	.1216

Note. *n* = 34

Video Coding. The open source VCode/VData software (version 1.2.1, Hailpern & Hagedom, 2015) was used to code infant video data. Infant behaviors were coded for all FF, PSF, and RE phases. Coding of each infant COPE behavior, movement, vocalizations, and facial expressions took place during separate viewings (a total of 6 viewings; vocalizations, facial expression, orientation, self-comforting, escape and movement). The VCode software allowed the researcher to enter into the coding scheme used on all videos to ensure consistency of coding among coders. Using the continuous interval playback mode allowed the coder to play the video for N seconds then automatically stop. Providing enough time to correctly code the segment of video without having to pause and possibly rewind or fast forward as is done with traditional media players or VCRs. Using the skip interval playback mode also allows the video to be divided into desired segments (e.g. 1-second intervals). This is ideal for consistently annotating behaviors among coders.

As stated, video coding of infant affect, regulation and movement took place at 1-second intervals (Braungart-Rieker et al., 1998; Braungart-Rieker et al., 2001; Conradt et al., 2010; Erickson et al., 2013). Once coded, data was imported into Excel where it was cleaned and reorganized. Since coding took place at 1-second intervals, behaviors where the duration began or ended in between 2 seconds, was rounded up if it was .5 or above and rounded down if it was .49 or below. Then the excel file was exported to SPSS (IBM, 2013) for analysis.

Interrater Reliability. All coders were trained by the primary researcher. Each video was coded by 2 coders and disagreements were discussed and resolved until a 90% agreement was reached for all affect and cope behaviors. All coding took place independently and coders were allowed to pause and rewind the recordings as often as needed. IRR was assessed using a two-way, absolute, average-measures ICC to assess the degree that video coders provided consistency in their rating of infant affect and coping behaviors (Hallgren, 2012).

IRR Infant Affect. For infant affect Interclass Correlation Coefficients between coding pairs were computed: .92 (infant vocalizations) .90 (infant facial expressions), indicating that coders had a high agreement and that infant affect was rated similarly across coders. The high ICC suggest that a minimal amount of measurement error was introduced by the independent coders and therefore statistical power for the subsequent analyses was not reduced. Infant affect ratings were consequently deemed suitable for use in testing the hypotheses of the present study.

IRR and COPE. Additional IRR analyses were performed to assess the degree that coders consistently assigned categorical COPE ratings to the infants in the study. The marginal distributions of COPE scores did not indicate a prevalence or bias problem, suggesting that Cohen's (1960) kappa was an appropriate index of IRR. The resulting kappas indicate high agreement κ=. 94 (self-comforting), κ=.90 (object orientation), κ=.90 (mother orientation), and .96 (escape).

IRR and Movement. Similarly to the COPE behaviors, arm, and leg movements were coded as being present or absent. Coder agreement for these behaviors was also high with κ=. 85 (arm movement), κ=.88 (leg movement).

Demographic Questionnaire. Demographic information was collected using a brief 13-item demographic questionnaire (e.g., gender, race, income, about the infant participating in the study. None of the demographic characteristics were related to mother's phone use or attitudes towards her phone use. The survey was completed online via Qualtrics on a laptop supplied by the researcher. Mothers completed this survey after the 3 phase experiment while waiting the 30 minutes to collect the two remaining infant saliva samples.

Technology Use and Attitudes. The Media and Technology Usage and Attitudes Scale (MTUAS) was used to assess the mother's general attitudes and usage patterns for a variety of technology, including Smartphones (Rosen et al., 2013). In total, the survey assessing mother's technology use and attitudes is 45 items long and took under 15 minutes to complete.

Phone Use Frequency Questions. Twenty-Two frequency questions (Table B.8), were rated on a 10-point Likert scale (1=never, 2=once a month, 3=several times a month, 4=once a week, 5=several times a week, 6=once a day, 7=several times a day, 8=once an hour, 9=several times an hour and 10=all the time). Total phone use scores were created by averaging mothers responses to the 22 items and then sorted into high (scores above the mean, n = 21) and low use categories (scores below the mean, n = 13). Although the original measure consisted of 11 subscales include a smartphone use subscale, since this study is primarily concerned with mobile phone use during mother-child interactions, the original MTUAS questions were modified to specifically explore the frequency of mothers use while in the presence of their infants. Twenty-two items of the MTUAS scale were modified to include the phrase "on your mobile phone" if it was not already a part of the question and "when you are spending time with your infant". For example, question 1 was rephrased as "How often do you send, receive and read e-mails when you are spending time with your infant" instead of the original "How often do you send, receive and read e-mails". Modified questions included the following MTUAS subscales: smartphone use, internet searching, emailing, media sharing, phone calling, TV viewing, text messaging and gaming.

Phone Attitude Questions. Mothers also completed the attitudes scale of the MTUAS (Table B.9) using a 5-point Likert scale (1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree and 5=strongly agree).The attitudes scale consist of 16 items creating 4 subscales 1) positive attitudes toward technology (items 1-6). 2) Anxiety about being without technology/technology dependence (items 7, 8 and 9). 3) Negative attitudes towards technology (items 10, 11 and 12) and 4) preference for task switching (items 13, 14, 15 and 16). Scoring for item 15 was reversed with strongly agree = 1 and strongly disagree = 5 (Rosen et al., 2013). Average scores were created for each subscale and sorted into high/low categories with high scores being above the mean for each subscale.

According to Rosen and colleagues (2013), the MTUAS has good internal consistency with a Cronbach alpha coefficient report of .93 for the smartphone scale, .91 internet searching, .91 emailing, .71 phone calling, .84 text messaging and .83 gaming. In the present study, the Cronbach alpha coefficient was .89 for all modified smartphone use items. Cronbach alphas for the individual subscales are as follows: .78 smartphone scale, .91 internet searching, .81 emailing, .74 phone calling, .94 text messaging and .61 gaming. For the four Attitude subscales, Rosen and colleagues (2013) also reported strong Cronbach alphas: positive attitudes .87, technological dependence .83, negative attitudes, .80 and task switching preference .85 (Rosen et al., 2013). In the present study, the reliability of the attitude subscales were acceptable: positive attitudes (.79), technological dependence (.82), negative attitudes (.75), .80 and task switching preference (.91)

Table B.8

Descriptives for Use Questions

Variable	Mean	SD
1. Send, receive and read e-mails.	6.14	1.52
2. Check your personal e-mail.	6.41	1.28
3. Check your work or school e-mail.	4.55	2.90
4. Send or receive files via e-mail.	4.41	2.24
5. Send and receive text messages.	8.17	1.40
6. Check for text messages.	7.88	1.29
7. Make and receive phone calls.	6.52	1.41
8. Check for voice calls.	4.82	2.59
9. Use apps (for any purposes).	7.55	1.98
10. Get directions or use GPS.	4.38	1.85
11. Share your own media files.	4.05	2.52
12. Record a video.	4.73	2.27
13. Watch TV shows, movies etc.	4.50	3.16
14. Watch video clips	4.97	2.26
15. Browse the web.	6.47	2.03
16. Search the internet for information.	6.79	1.75
17. Search the internet for news.	5.32	2.55
18. Search the internet for videos.	4.02	2.51
19. Search the internet for images.	4.17	2.43
20. Play games by yourself.	2.64	2.46
21. Play games with other people in the same room.	1.97	1.85
22. Play games with others online.	1.20	1.03

Note. $n = 34$.

Table B.9

Descriptives for Attitudes Questions

	Mean	SD
1. I feel it is important to be able to find any online information whenever I want.	4.02	.797
2. I feel it is important to be able to access the Internet any time I want.	3.76	1.01
3. I think it is important to keep up with the latest trends in technology.	2.88	.946
4. Technology will provide solutions to many of our problems.	3.44	1.13
5. With technology anything is possible.	3.20	.913
6. I feel that I get more accomplished because of technology.	3.35	.981
7. I get anxious when I don't have my cell phone.	3.47	1.23
8. I get anxious when I don't have the Internet available to me.	3.05	1.17
9. I am dependent on my technology.	3.17	1.11
10. New technology makes people waste too much time.	3.52	1.07
11. New technology makes life more complicated.	2.97	1.05
12. New technology makes people more isolated.	3.91	.933
13. I prefer to work on several projects in a day, rather than completing one project and then switching to another.	3.35	1.15
14. When doing a number of assignments, I like to switch back and forth between them rather than do one at a time.	3.11	1.06
15. I like to finish one task completely before focusing on anything else.	3.05	1.07
16. When I have a task to complete, I like to break it up by switching to other tasks intermittently.	3.26	1.05

Note: $n = 34$

APPENDIX C

EXTENDED RESULTS

Infants Affect and COPE Responses to PSF

Research Question 1. Do infants exposed to the modified phone still face protocol without eye contact exhibit the pattern of changes in positive and negative affect as reported in the still face literature?

Prior to examining the research questions where infant affect and infant vocalizations were combined to create total affect, vocalizations and facial expressions were viewed independently (Ekas et al., 2013). Overall trends of individual facial expressions and vocalizations were consistent with increased negative vocalizations and increased negative facial expressions due to exposure to the modified PSF phase. Mean percentages of the total time that all infants (*n* = 34) spent engaged in vocalizations and facial expressions for each phase are presented in Figure C.1 and Figure C.2, specific vocalizations and facial expression for each phase are presented in Figure C.3 and Figure C.4.

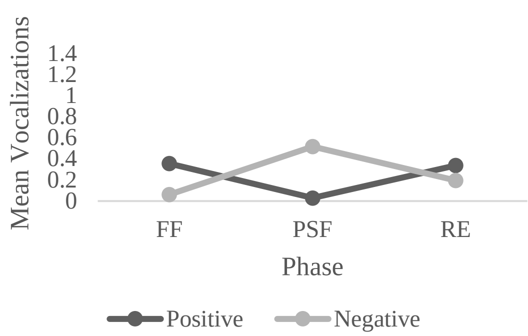


Figure C.1. Vocalizations by phase. FF = face to face phase, PSF = phone still face phase, RE = reunion phase. Total *n* = 34.

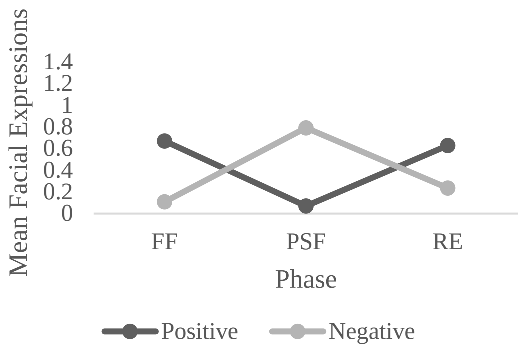


Figure C.2. Facial expressions by phase. FF = face to face phase, PSF = phone still face phase, RE = reunion phase. Total *n* = 34.

Repeated measures ANOVAs were conducted to examine infant expression and vocalizations in response to each phase. These ANOVAs indicate that mean proportions for all infant behaviors differed from the FF phase and the PSF phase and from the PSF phase to the RE phase (Table C.1).

Table C.1

Changes in Infant Vocalizations and Facial Expressions by Phase

	Face-to -Face			Phone Still Face			Reunion				
	MP	SD	N	MP	SD	N	MP	SD	N	F	η^2
Vocalizations											
Screaming	0.01	0.09	3	0.14	0.08	15	0.02	1.95	7	3.96*	.199
Crying	0.05	0.09	6	0.22	0.05	18	0.16	0.00	14	4.27*	.211
Fussing	0.13	0.05	16	0.58	0.02	33	0.23	11.91	27	25.93**	.618
Coo	0.32	0.02	32	0.04	3.44	14	0.21	5.82	32	16.15**	.502
Laugh	0.39	0.03	27	0.01	1.91	18	0.21	7.84	24	17.29**	.519
Delight	0.10	0.05	16	0.01	0.77	8	0.17	9.80	21	8.59**	.350
Facial Expressions											
Grimace	0.04	0.09	8	0.22	0.04	27	0.09	0.05	17	8.62**	.299
Frown	0.02	0.06	8	0.12	0.04	24	0.04	0.06	12	7.89**	.330
Small Frown	0.07	0.03	26	0.58	0.02	33	0.11	0.03	31	25.96**	.619
Half-Smile	0.43	0.02	34	0.04	0.04	22	0.38	0.02	33	32.53**	.670
Large Smile	0.38	0.02	33	0.03	0.06	76	0.29	0.02	32	26.75**	. 626
Wide Smile	0.07	0.04	20	0.00	0.17	1	0.09	0.05	21	11.02**	.408

Note. *n* = 34

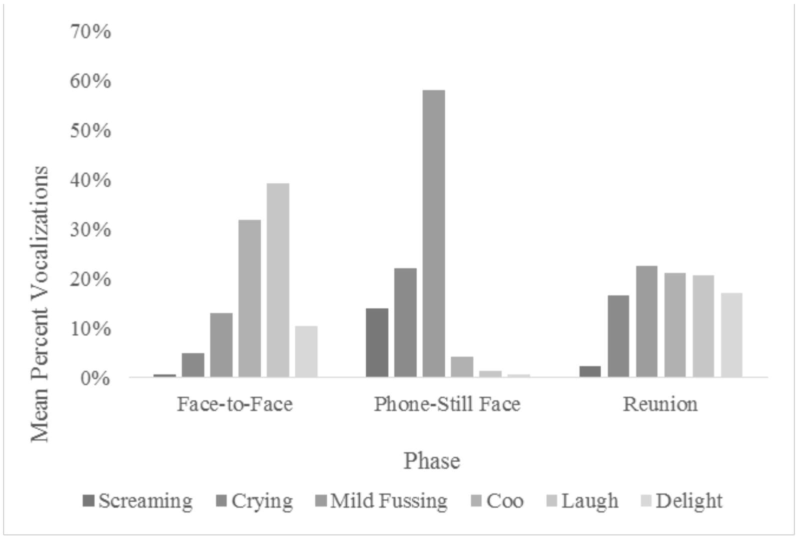


Figure C.3. Frequency of vocalizations.

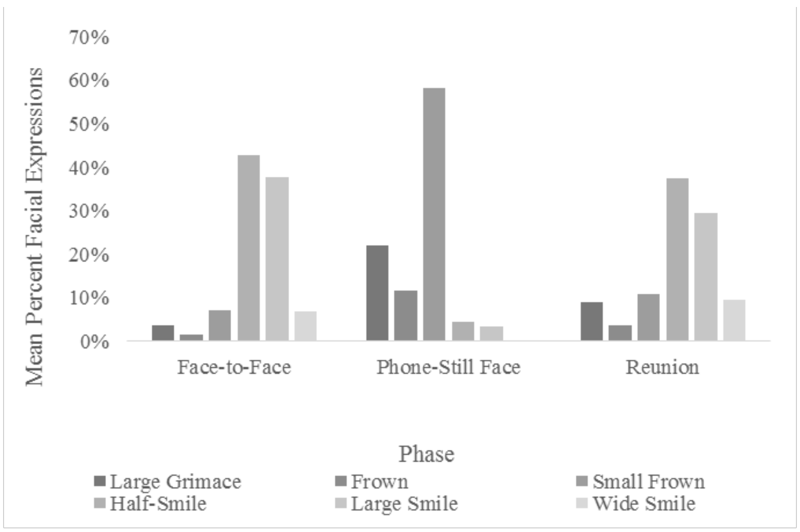


Figure C.4. Frequency of facial expressions.

Changes in Infant Affect. As previously described, infant vocalizations and facial expressions were combined to create a total positive affect score and a total negative affect score for each phase. To answer the current research question and determine if the modified phone still face procedure resulted in the same changes in infant affect responses similar to previous still face research, a repeated measures analysis of variance (ANOVA) was conducted with phase as the repeated factor. As seen in Figure C.5, there was a statistically significant effect for positive affect and phase (Wilks' Lambda = .250, F (2, 32) =47.99, p = <.0005, η_p^2 = .750). Post hoc tests show statistically significant differences among positive affect responses between FF phase and PSF phase (*p* = <.0005) and between the PSF phase and RE phase (*p* = <.0005) with infants decreasing positive affect from the FF (*M* 1.02, *SD* .52) to PSF phase (*M* .099, *SD* .132) and increased again during the RE phase (*M* .96, *SD* .64). As predicted infants demonstrated the patterns of change in positive affect associated with the SFE with affect in the FF and RE phases being more positive than affect during the PSF phase.

To evaluate infants' negative affect for each phase of the experiment, data were analyzed with a repeated one-way repeated measures analysis of variance (ANOVA). There was a statistically significant difference for phase at the *p* = <.0005 level. There was a statistically significant effect for negative affect and each phase (Wilks' Lambda=.324, *F* (2, 32) =33.4, *p* = <.0005, η_p^2 = .676) with post hoc tests revealing significant phase differences for FF phase to PSF phase (*p* = <.0005), FF phase to RE phase (*p* = .026) as well as between the PSF phase and RE phase (p = <.005). As expected infants demonstrated an increase in negative affect from the FF (*M* .16, *SD* .31) to the PSF phase (*M* 1.3, *SD* .98). Furthermore, although infant affect decreased from the PSF phase to the RE phase (*M* .43, *SD* .63) it did not return to the levels seen in the FF phase indicating a slight carry-over effect (Mesman et al., 2009; Tronick et al., 1978).

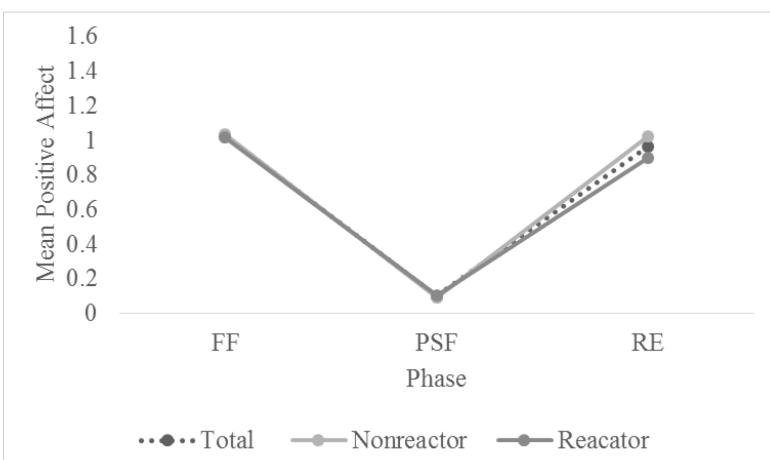


Figure C.56. Infant positive affect by phase. Nonreactors *n* = 16, Reactors *n* = 18 and Total *n* =

34. μg/dL = micrograms per deciliter. FF = face to face phase, PSF = phone still face phase, RE = reunion phase. Total n = 34.

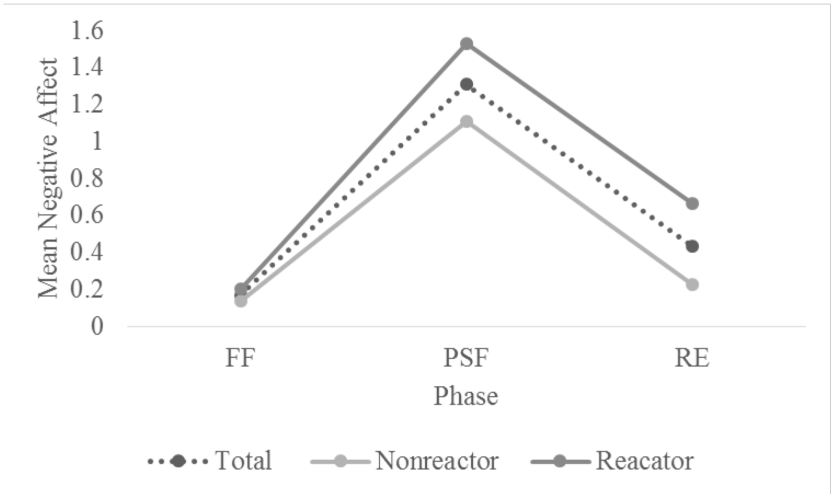


Figure C.6. Infant negative affect by phase. Nonreactors n = 16, Reactors n = 18 and Total n = 34. μg/dL = micrograms per deciliter. FF = face to face phase, PSF = phone still face phase, RE = reunion phase. Total n = 34.

As predicted, results revealed that infants do experience an increase in negative affect from the FF phase to the PSF face phase, indicating infants are upset with the lack of maternal involvement while she is texting on her phone. To further explore these differences a split plot (SPANOVA) was conducted with positive affect across phases with infant gender and infant age. There was no statistically significant interaction effect for phase and gender, Wilks' Lambda = .95, F (2, 31) =.793, p = .461, η_p^2 = .049. There was a main effect for phase and gender Wilks' Lambda =.247, F (2, 31) = 47.2, p = <.0005, η_p^2 = .753. However, the main effect comparing gender and positive affect across time was not statistically significant F (1, 32) = 1.8, p =.182, ηp^2 = .055) suggesting no difference response to the PSF procedure due to infant gender. Similarly, a SPANOVA was conducted to assess the impact of infants' age on infants' positive affect in response to the modified PSF procedure. There was no statistically significant interaction effect for phase and infant age, Wilks' Lambda = .86, F (6, 58) = .755, p =.608, η_p^2 = .072. There was a substantial main effect for phase and infant age, Wilks' Lambda = .241, F (2, 29) = 45.78, p = <.0005, η_p^2 = .759 with all groups showing a decrease in affect from the FF to the PSF phase, however, the main effect comparing infant age and positive affect across time was not statistically significant F (1, 30) = .627, p = .603, ηp^2 = .059) suggesting no difference response to the PSF procedure due to infant age. Further exploration of the data revealed no statistically significant differences among infant age or gender differences in infant negative affect.

Infant COPE effects. Separate repeated measures ANOVA were conducted to compare infants' behavioral responses during each of the 3 procedure phases, using the COPE scores generated from the video data. Results indicate statically significant differences in infant regulatory behaviors across the three phase.

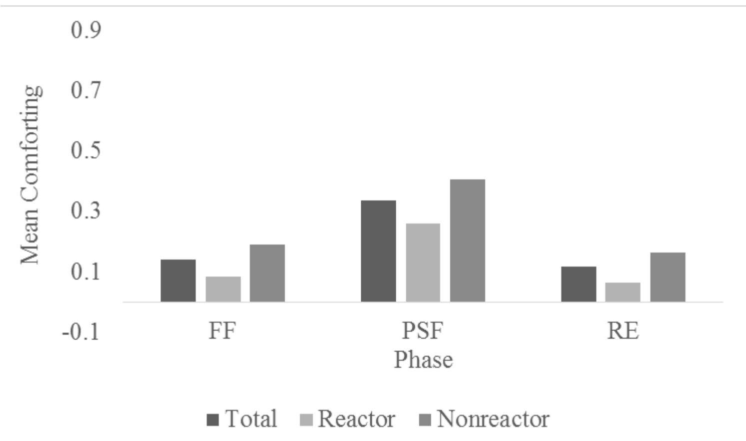


Figure C.7 . Infant Comforting by phases. Nonreactors n = 16, Reactors n = 18 and Total n = 34. µg/dL = micrograms per deciliter. FF = face to face phase, PSF = phone still face phase, RE = reunion phase. Total n = 34.

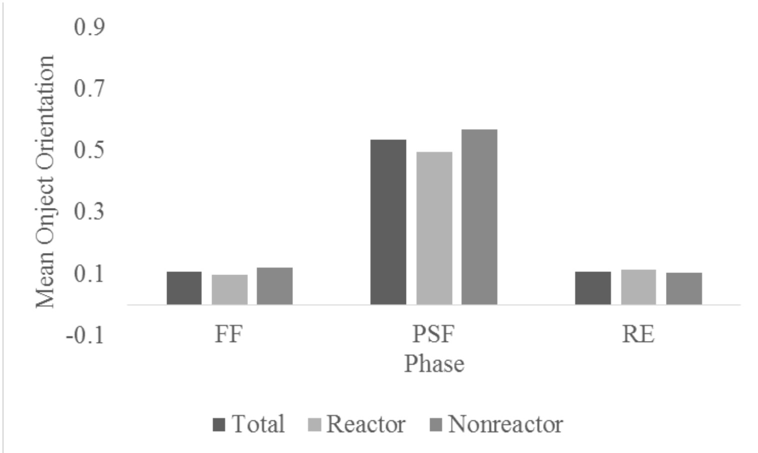


Figure C.8. Infant object orientation by phase. Nonreactors *n* = 16, Reactors *n* = 18 and Total *n* = 34. µg/dL = micrograms per deciliter. FF = face to face phase, PSF = phone still face phase, RE = reunion phase. Total *n* = 34.

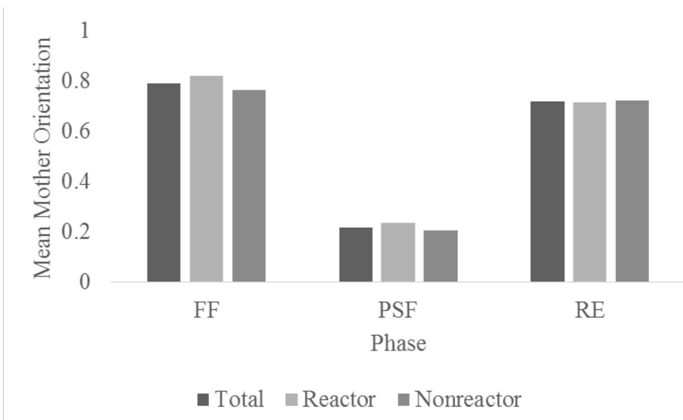
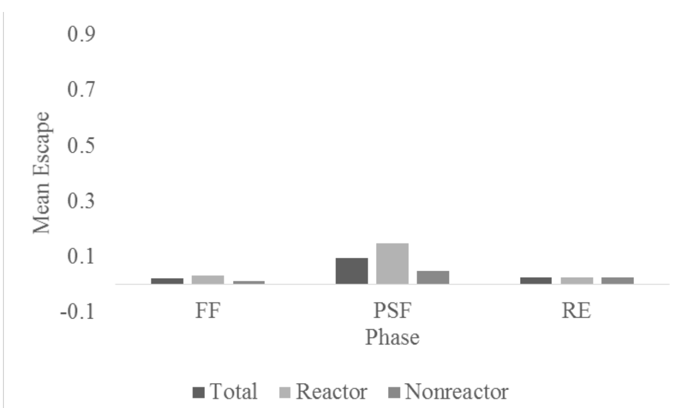


Figure C.97. Infant mother orientation by phase. Nonreactors *n* = 16, Reactors *n* = 18 and Total *n* = 34. µg/dL = micrograms per deciliter. FF = face to face phase, PSF = phone still face phase, RE = reunion phase. Total *n* = 34.



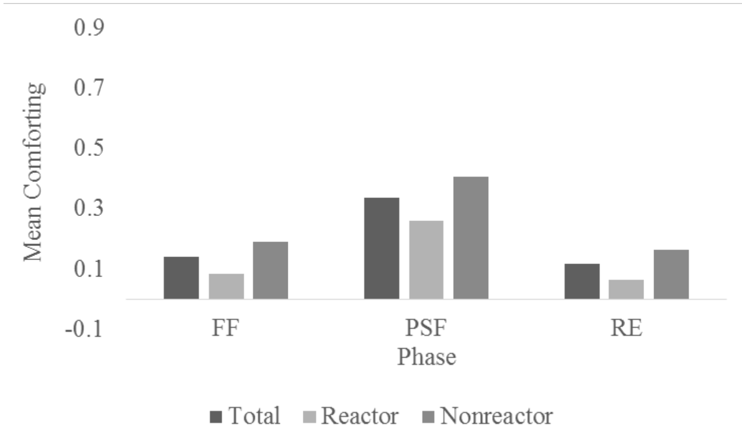


Figure C.10. Infant escape by phase. Nonreactors *n* = 16, Reactors *n* = 18 and Total *n* = 34. µg/dL = micrograms per deciliter. FF = face to face phase, PSF = phone still face phase, RE = reunion phase. Total *n* = 34.

Figure C.7 shows the proportion of each COPE behavior for the FF, PSF and RE phases. There was a reliable change in the proportion of time infants spent engaged in these behaviors. Repeated measures ANOVAS determined statistically significant differences in infant self-comforting behaviors (Wilks' Lambda = .581, *F* (2, 32) = 11.35, *p* = <.0005, η_p^2= .419) with post hoc tests revealing statistically significant differences between the FF phase and PSF phase (*p* = .001) and from PSF to RE phase (*p* = <.0005). Infants increased their comforting behaviors from the FF phase (*M* 16.76, *SD* 20.95) to the PSF phase (*M* 40.74, *SD* 33.23) and decreased their comforting in the RE phase (*M* 14.18, *SD* 18.29). Similar patterns were found for object orientation, Wilks' Lambda = .231, *F* (2, 32) = 53.38, *p* = <.0005, η_p^2= .769) with post hoc tests indicating statistically significant differences between the FF phase and PSF phase (*p* = .001) and from the PSF to RE phase (*p* = <.0005). Between these phases, infants increased their gaze towards anything other than their mother (include the cellphone) from the FF phase (*M* = 13.03, *SD* = 13.76) to the PSF phase (*M* = 64.12, *SD* = 28.63) and decreased object orientation during the RE (*M* = 13.06, *SD* = 14.73). Considering this study was interested in infants gaze towards mothers cellphone compared to other gaze orientations (ceiling or hands) infants gaze towards objects during the PSF varied, with infants spending more time during the phase looking at their mother's phone than anything else (Figure C.10).

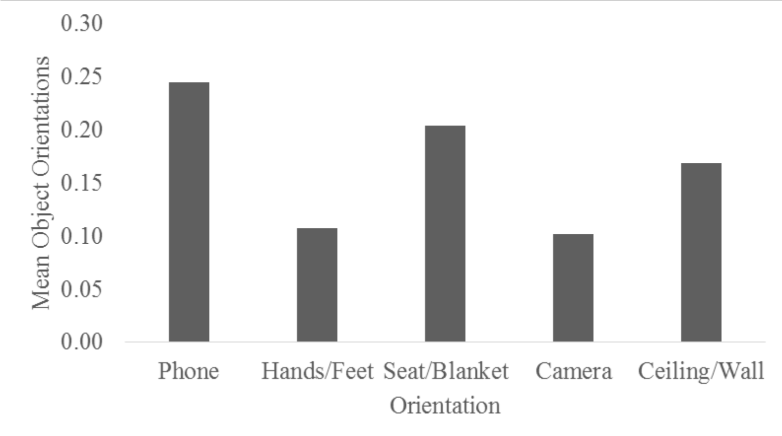


Figure C.11. Infant object orientation during PSF phase.

For mothers orientation (Wilks' Lambda = .127, F (2, 32) = 110.17, p <.0005, η_p^2 = .873) post hoc tests revealed significant differences between the FF phase and the PSF phase (p = <.0005) and from the PSF to the RE phase (p = <0005) with infants decreasing their gaze at their mother from the FF phase (*M* 2.50, *SD* 4.09) to the PSF phase (*M* 11.47, *SD* 19.81) and then increasing maternal gaze during the RE phase (*M* 56.35, *SD* 25.93). Unlike previous studies where infant escape behaviors were coded but observed so infrequently the were removed from analysis (Braungart-Rieker et al., 2001) infant escape behaviors were repeatedly observed in this study and were included in analyses. A repeated measures ANOVA determined that the mean for Escape behaviors differed statistically significantly (Wilks' Lambda = .747, F (2, 32) = 5.42, p = .009, η_p^2= .253) and post hoc tests revealed escape behaviors changes from the FF to the PSF phase (p = <.012) with infants increasing their escape attempts from the FF phase (*M* 2.50, *SD* 4.09) to the PSF phase (*M* 11.45, *SD* 19.81) and decreasing from the PSF phase to the RE phase (*M* 2.297, *SD* 6.25, p = .044).

Movement. Similar patterns as those described for COPE behaviors were found for arm movements (Wilks' Lambda = .212, *F* (2, 32) = 59.29, *p* = <.0005, η_p^2 = .788) and leg movements (Wilks' Lambda = .352, *F* (2, 32) = 29.48, *p* = <.0005, η_p^2 = .648). Post hoc tests indicate statistically significant mean differences for arm movements between the FF phase (*M* 30, *SD* 15) and PSF phase (*M* 66, *SD* 19, *p* = <.0005) and from the PSF to RE phase (*M* 26, *SD* 18, *p* = <0005). This was also found for leg movements with the same increase in movement from the FF phase (*M* 21, *SD* 17) and PSF phase (*M* 51, *SD* 26, *p* = <.0005) and from the PSF to RE phase (*M* 19, *SD* 14, *p* = <0005).

An SPANOVA was conducted to assess the impact of infants' age on arm movements in response to the modified PSF procedure. There was no statistically significant interaction effect for phase and infant gender, Wilks' Lambda = .869, *F* (2, 31) = 2.33, *p* =.113, η_p^2= .131. There was a substantial main effect for phase and infant gender (Wilks' Lambda = .194, *F* (2, 31) = 64.33, p = <.0005, η_p^2= .806 with all groups showing an increase in movement from the FF to the PSF phase, however, the main effect comparing infant gender and arm movement across time was not statistically significant *F* (1, 30) = .673, *p* = .148, ηp^2 = .021) suggesting no difference arm movement to the PSF procedure due to infant gender.

An additional SPANOVA was conducted to assess the impact of infants' gender on leg movements in response to the modified PSF procedure. There was no statistically significant interaction effect for phase and infant gender, Wilks' Lambda = .964, *F* (2, 31) = .578, *p* = .567, η_p^2= .036. There was a substantial main effect for phase and infant gender (Wilks' Lambda = .350, *F* (2, 31) = 28.79, *p* = <.0005, η_p^2 = .650 with all groups showing an increase in leg movement from the FF to the PSF phase, however, the main effect comparing infant gender and leg movement across time was not statistically significant *F* (1, 30) = 3.369, *p* = .076, η_p^2= .095) suggesting no difference in leg movement due to infant gender. Analyses were also conducted exploring infant age and arm and leg movements, both of which demonstrated phase differences but no interaction effects for age and arm movements (p = .474, η_p^2= .079) or leg movements (p = .217 , η_p^2= .120).

In summary, infants were sensitive to the changes in the PSF procedure. Infants consistently decreased looking at their mothers during the modified phase while increasing their escape attempts and comforting behaviors when their mother was engaged texting on her phone.

Relationship between Emotional, Behavioral and Cortisol Responses. To explore infants' cortisol responses and their behavioral and emotional response during the modified phase correlational analyses were conducted. Baseline stress measures were not associated with any affect or regulatory behaviors. Infant stress responses to the PSF phase was strongly negatively correlated with object orientation during PSF phase (r = -.463, p = .006) with greater levels of object orientation being associated with lower stressor responses, this was also found for recovery responses (r = -.48, p =.007). As anticipated with the SFE, infant affective and COPE responses were related. Infants positive affect during the FF phase was positively correlated with mother orientation in the FF phase (r =.346, p = .045) with greater positive affect being associated with greater maternal gaze, this was also found for maternal orientation during the RE phase (r = .37, p = .029). Infants comforting behaviors during the PSF phase were negatively correlated with their negative affect in this phase (r = -.426, p = .012) with greater levels of comforting behaviors being associated with lower negative affect. Infant Stress Responses

Research Question 2. Does the modified phone still face elicit a cortisol response?

A one-way repeated measures ANOVA was conducted to compare infant cortisol response scores for baseline (pre-stressor), stressor (response to PSF) and recovery (response to

Reunion phase). The means and standard deviations are represented in Table 24. There was no significant effect for cortisol responses (Wilk's Lambda = .955 *F* (2, 32) = .75, p = .47, η_p^2=.045) indicating no significant change in cortisol responses between each phase.

Table C.2

Descriptive Statistics for Infant Cortisol Responses

	Mean	SD
Baseline	-.645	.243
Stressor	-.644	.299
Recovery	-.645	.247

Note. n = 34

Age and gender differences. Although most prior research exploring infants cortisol responses to the SF procedure demonstrate no significant differences for infant gender or age (Haley & Stansbury, 2005) a few studies have demonstrated age and/or gender differences in infants cortisol responses (Haley et al., 2006) a split plot or mixed between-within subjects analysis of variance (ANOVA) with revealed no statistically significant differences between saliva samples and infant age (*p* = .998). A second split plot (ANOVA) with Pillai's Trace correction (due to a violation of homogeneity of variance because of small sample size) revealed no statistically significant differences between saliva samples and infant age (*p* = .997; Tabachnick & Fidell, 2007).

Individual differences in Infant Cortisol Responses. As with other studies (Grant et al., 2009; Lewis & Ramsay, 2005), the infants as a whole did not demonstrate a consistent change in cortisol responses from baseline to stressor samples. Reviewing the raw, untransformed cortisol data suggested infants had considerable variations in their responses to the PSF phase. Some infants demonstrated an increase from baseline to stressor (*n* = 16) while others had a decrease (*n* = 18). Additionally, infants expressed variations from stressor to recovery with an increased cortisol response (n = 17) or decreased response (n = 17). To evaluate these differences cortisol responses to the PSF phase, a difference score was created by subtracting cortisol values of the baseline sample from the stressor sample (Erickson et al., 2013; Haley et al., 2006; Lewis & Ramsay, 2005). Infants with a higher cortisol value at the stressor were categorized as "reactors" indicating that they had an increased response to the PSF phase (Grant et al., 2009, Ham & Tronick, 2006; Montirosso et al., 2013) and infants with a lower cortisol level were classified as "nonreactors" indicating they did not have an increased response to the PSF phase. As seen in Figure 16 reactors showed no statistically significant differences for baseline samples among reactors (M = - .67, SD = .23) and nonreactors (M = -.61, SD = .25; t (32) = -.663, p = .51, η^2 = .01) however group differences did emerge for stressor (t (32) = 3.6, p = .001, η^2 = .29) and recovery samples (t (32) = 3.5, p = .001, η^2 = .28) both suggesting a large effect. No differences were found between reactor and nonreactor stress responses based on infant characteristics (age, gender) or maternal characteristics (Table 22).

Figure 8. Infant stress responses. Nonreactors n = 16, Reactors n = 18 and Total n = 34. µg/dL = micrograms per deciliter.

Table C.3

Reactor and Nonreactor Means and Standard Deviations of Stress Responses

		Baseline		Stressor		Recovery	
	n	M	SD	M	SD	M	SD
Reactor	16	.24	14	.38	.21	.35	.19
Males	8	.20	.08	.30	.16	.32	.18
Females	8	.28	.19	.46	.23	.38	.20
3 months	5	.28	.19	.55	.24	.54	.21
4 months	2	.37	.30	.46	.24	.33	.10
5 months	5	.17	.07	.24	.12	.25	.14
6 months	4	.22	.14	.31	.10	.26	.06
Nonreactor	18	.28	.16	.19	.12	.18	.09
Males	10	.33	.18	.25	.14	.23	.09
Females	8	.21	.10	.12	.04	.12	.03

3 months	5	.28	.22	.17	.13	.19	.08
4 months	5	.15	.06	.09	.01	.11	.01
5 months	5	.36	.05	.26	.08	.19	.06
6 months	3	.33	.16	.27	.19	.30	.12

Note. Total *n* = 34, total males = 18 and total females = 16.

Reactors and Nonreactor, Affective and Behavioral Responses. SPANOVA were conducted to compare infant COPE behaviors and affect responses for reactors and nonreactors (means and standard deviations are presented in Table 223). Main effects were only found for comforting behaviors F (2, 31) = 4.9, p = .033, η_p^2= .134 indicating a large effect. This suggests that nonreactors have higher levels of self-comforting behaviors compared to reactors in response to the PSF phase, which could explain their lower stress response to the stressor event. No additional main effects for reactors and nonreactors were found for object orientation (F (2,31) = .641, p = .429, $\eta_p^2 =$ .020) mother orientation (F (2, 31) = .291, p = .594, $\eta_p^2 =$ .009) escape behaviors F (2, 31)=2.6, p =.112, η_p^2 = .007, positive affect (F (2,31) = .156, p = .696, $\eta_p^2 =$ .005) or negative affect (F (2,31) = 2.64, p =.114, $\eta_p^2 =$ .076).

Table C.47

Infant Affect and COPE by Phase

	Total *n* =34			Reactors *n* = 16			Nonreactors *n* = 18		
	FF *M*(*SD*)	PSF *M*(*SD*)	RE *M*(*SD*)	FF *M*(*SD*)	PSF *M*(*SD*)	RE *M*(*SD*)	FF *M*(*SD*)	PSF *M*(*SD*)	RE *M*(*SD*)
COPE Behavior									
Comfort	.13 (.17)	.33(.27)	.11(.15)	.08(.08)	.26(.25)	.06(.08)	.18(.21)	.40(.28)	.16(.18)
Object	.10(.11)	.53 (.23)	.10(.12)	.09(.11)	.49(.27)	.11(.12)	.11(.11)	.56 (.19)	.10(.12)
Mother	.79(.17)	.21(.20)	.71(.21	.82(.15)	.23(.24)	.71(.22)	.76(.19)	.20(.16)	.72(.21)
Escape	.02(.03)	.09(.16)	.02(.05)	.03(.04)	.14(.22)	.02(.05)	.01(.01)	.05(.05)	.02(.05)
Affect									
Positive	1.02(.52)	.09(.13)	.96(.64)	1.0(.60)	.10(.14)	.89(.72)	1.0(.45)	.09(.12)	1.0(.58)
Negativ e	.16 (.31)	.16(.31)	.43(.63)	.20(.34)	1.5(1.2)	.66(.73)	.13(.28)	1.1(.62)	.22(.45)

Note. FF = face to face phase, PSF = phone still face phase and RE = reunion phase.

Mothers Attitudes and Phone Use and Infant Stress

Research Question 3. What role does mother's frequency of phone use play in infants' stress responses after exposure to the phone still face protocol?

Mother's demographic information was examined in relation to their overall level of phone use (high/low), as research has demonstrated a connection between phone use and certain demographic variables, such as occupation and education (Smith, 2013), as well a connection between employed mothers requirement to maintain contact with their employer when away from work (Madden & Jones, 2008). Although the prior literature has shown a minimal connection, this information was explored in relation to infants affect and regulatory behaviors in response to the phone still face procedure, no relationship was found between infants response and mothers demographic information.

Mothers Phone use and Infant Stress Responses. A split-plot analysis of variance (SPANOVA) was conducted to explore the possible relationship between of mother's frequency of phone use and infant stress after exposure to the PSF phase (means and SD's are presented in (Table 24). To determine the level of phone use a composite score of all 22 phone use items from the Media and Technology Usage and Attitudes Scale (MTUAS; Rosen, 2013) was used. This Likert scale ranges from 1 – 10, with higher scores indicating higher levels of phone use around their infant. For the purpose of analysis, high use was determined as scores above the mean (4.86, n = 21) while low scores (n = 13) were below the mean. Changes in stress responses were measured using the baseline, stressor and recovery samples.

There was no statistically significant interaction effect between mothers level of phone use and the three infant stress samples, Wilks' Lambda= .966, F (2, 31)= .551, p =.582, η_p^2= .034). There was also no main effect for infant stress response and mothers level of phone use, Wilks' Lambda= .998, F (2, 31) = .027, p = .974, η_p^2= .002, indicating mothers uses of technology does not affect infants stress responses to the PSF procedure.

Mother's Attitudes towards Device Use and Infant Stress. Prior to exploring mothers attitudes and infant stress responses, correlational analyses between attitude subscales and demographics were conducted, revealing a strong relationship between mothers technological dependency and length of phone ownership (r= .456, p = .007). A one way An ANOVA was conducted to examine the impact of length of phone ownership (short 1-4 years, medium 5-8 years or a long time, 9-12 years) on mothers technological dependency, revealing statistically significant differences in the three ownership lengths and technological dependence F (2, 33) = 3.49, p = .043). Post hoc analyses revealed mothers technological dependency and length of ownership differed between short-term owners and long-term owners (p =.039, η^2 = .18) indicating a large effect, suggesting that the longer mothers own a phone the greater their self-reported device dependence is.

Separate split-plot analysis of variance (ANOVA) were conducted to explore the possible relationship between the 4 subscales of mother's attitudes towards phone use and infant stress responses to the PSF procedure (means and standard deviations are presented in (Table 24). There was no statistically significant main effects between infants stress response and mothers positive attitudes towards phone use F (1, 33) = .045, p = .83, η_p^2 = .001), negative attitudes towards phone use F (1, 32) = 1.33, p = .25, η_p^2= .04), mothers technological dependency F (1, 32) =1.62, p = .21, η_p^2 = .04) or mothers task switching preferences F (1, 32) = .036, p =.85, η_p^2 = .001). Therefore, mother's attitudes towards phone use did not appear to play a role infant stress responses to the modified PSF procedure.

Although it was predicted that infants of mothers with higher levels of phone use would have a dampened response to the PSF (due to habituation), results suggest no relationship between infants responses and mothers level of device use. Although mothers with higher levels of use have more positive attitudes towards technology use (r = .337 p = .028) it was thought that their infants would have lower levels of stress response and negative affect during the Phone SF, however, this was not supported

Table 8

Infant Stress Response and Mothers Phone Use and Attitudes

	Total *n* = 34				Reactors *n* = 16				Nonreactors *n* = 18			
	Baseline	Stressor	Recovery		Baseline	Stressor	Recovery		Baseline	Stressor	Recovery	
	M(*SD*)	*M*(*SD*)	*M*(*SD*)	*n*	*M*(*SD*)	*M*(*SD*)	*M*(*SD*)	*n*	*M*(*SD*)	*M*(*SD*)	*M*(*SD*)	*n*
Device Use												
High use	.26 (.16)	.30 (.21)	.27 (.17)	21	.23 (.16)	.39 (.22)	.35 (.18)	12	.29 (.16)	.21 (.14)	.20 (.11)	9
Low Use	.27 (.13)	.25 (.16)	.25 (.16)	13	.26 (.08)	.35 (.18)	.36 (.22)	4	.27 (.16)	.17 (.11)	.17 (.07)	9
Attitudes												
Low Positive	.27 (.15)	.27 (.14)	.25 (.15)	13	.22 (.09)	.31 (.17)	.30 (.20)	6	.31 (.18)	.24 (.12)	.20 (.08)	7
High Positive	.25 (.16)	.28 (.22)	.27 (.18)	21	.25 (.17)	.43 (.22)	.38 (.18)	10	.26 (.15)	.15 (.12)	.17 (.10)	11
Low Negative	.24 (.12)	.25 (.17)	.23 (.15)	20	.24 (.15)	.34 (.19)	.31 (.18)	9	.24 (.10)	.17 (.10)	.16 (.07)	11
High Negative	.29 (.19)	.32 (.22)	.31 (.18)	14	.25 (.15)	.43 (.23)	.40 (.20)	7	.33 (.22)	.22 (.16)	.22 (.11)	7
Low Dependence	.25 (.15)	.34 (.23)	.32 (.19)	16	.26 (.18)	.43 (.23)	.39 (.21)	10	.23 (.08)	.18 (.07)	.20 (.07)	6
High Dependence	.27 (.16)	.23 (.14)	.21 (.16)	18	.20 (.06)	.30 (.12)	.29 (.14)	6	.30 (.19)	.19 (.14)	.18 (.10)	12
Low Switching	.28 (.17)	.29 (.24)	.26 (.19)	16	.28 (.20)	.40 (.27)	.34 (.24)	8	.27 (.16)	.17 (.14)	.19 (.11)	8
High Switching	.24 (.13)	.27 (.14)	.26 (.14)	18	.20 (.06)	.36 (.13)	.36 (.14)	8	.28 (.17)	.20 (.11)	.18 (.07)	10

APPENDIX D

ADDITIONAL MATERIALS

Approved Informed Consent

UNT
A green light to greatness.

THE OFFICE OF RESEARCH INTEGRITY AND COMPLIANCE

September 10, 2015

Supervising Investigator: Dr. Wendy Middlemiss
Student Investigator: Cory Kildare
Department of Educational Psychology
University of North Texas

RE: Human Subjects Application No. 14362–R16

Dear Dr. Middlemiss:

The UNT Institutional Review Board has reviewed and approved the extension you requested to your project titled "Infants Perceptions of Mothers Phone Use." Your extension period is for one year, September 16, 2015 **through September 15, 2016. Federal policy 45 CFR 46.109(e) stipulates that IRB approval is for one year only.**

Enclosed is the consent document with stamped IRB approval. Please copy and **use this form only** for your study subject.

It is your responsibility according to U.S. Department of Health and Human Services regulations to submit annual and terminal progress reports to the IRB for this project. The IRB must also review this project prior to any modifications. If continuing review is not granted before September 15, 2016, IRB approval of this research expires on that date

Please contact Shelia Bourns, Research Compliance Analyst, 940-565-4643, if you wish to make changes or need additional information.

Sincerely,

Chad Trulson, Ph.D.
Professor
Department of Criminal Justice
Chair, Institutional Review Board

CT:sb

UNIVERSITY OF NORTH TEXAS
1155 Union Circle #310979 Denton, Texas 76203-5017
940.369.4643 940.369.7486 fax www.research.unt.edu

University of North Texas Institutional Review Board

Informed Consent Form

Before agreeing to participate in this research study, it is important that you read and understand the following explanation of the purpose, benefits and risks of the study and how it will be conducted.

Title of Study: Infants Perceptions of Mothers Phone Use

Investigator: Wendy Middlemiss, Ph.D., University of North Texas (UNT) Department of Educational Psychology

Student Investigator: Cory Kildare, Doctoral Candidate, University of North Texas (UNT) Department of Educational Psychology

Purpose of the Study: You and your infant are being asked to participate in a research study. The purpose of this study is to better understand infant perceptions of maternal cellphone use.

Study Procedures: You will be asked to allow for a 6 minute interaction between you and your infant to be video recorded. To help understand your infants' response to what is called a Still-Face (neutral or blank facial expressions), we will collect 3 saliva samples from your infant using a small piece of absorbent material. Then you will be asked to complete a survey relating to your frequency and attitudes towards your own cellphone use. The entire experiment and survey completion should take about 1 hour and 30 minutes, providing 30 minutes for your infant to get used to the presence of the researcher and research location, as well as time to conduct the 6 minute video recorded interaction, collect the 3 saliva samples and for you to complete the survey.

Foreseeable Risks: No foreseeable risks are involved in this study.

Benefits to the Subjects or Others: This study will not directly benefit you or your infant; however, it is expected to help in understanding how infants experience mother's cellphone use. Information gained from this study may be published and made available to family life educators and practitioners. Videotaped material, either in whole or segments will not be used in any method of sharing results, including conference presentations. The confidentiality of your and your infant's personal identifying information will be maintained in any publications or presentations regarding this study.

Compensation for Participants: All participants who sign this informed consent form and complete the study will be compensated with a $50.00 gift card at the end of the 1.5 hour session.

APPROVED BY THE UNT IRB
FROM 9/16/15 TO 9/15/16

Procedures for Maintaining Confidentiality of Research Records:

Electronic Files, Video Files/Hardcopy Information: All information from questionnaires, video coding sheets, data files and copies of e-mail correspondence will be stored on electronic files. These files will be encrypted and stored on a password protected office computer on the UNT campus. This information will not contain your name, only your ID number. The collected research data will be destroyed 3 years after the end of the study.

E-mail: All e-mails received from you will be saved in the "Contacts" folder of the e-mail created for this research study (parentsandphones@gmail.com). Your contact name will be replaced with your participant ID number. After you have completed your participation in the experiment all e-mail correspondence involving you will be permanently deleted. Only the Supervising Investigator and Student Investigator will have access to the e-mails.

Text Message via e-mail. You also may text the Student Investigator instead of e-mailing to ask questions prior to participation and to establish a time to conduct the experiment. A Google Voice (text message) account is connected to the e-mail account used to contact the Student Investigator (parentsandphones@gmail.com). The text messages you send will automatically go to the Google Voice phone number (940) 441-2198. You will not receive any other text messages or phone calls from this number, unless it is in response to your own text messages. Standard texting rates apply and you will be responsible for paying any fees associated with receiving these text messages. Text messages will be permanently deleted after completion of the study.

Infant Saliva Samples: The three saliva samples collected from your infant will be stored in a freezer in the locked Educational Psychology lab at UNT in Matthews Hall room 322-C. The samples will be marked by the participant ID number and will contain no personal identifying information. All samples will be immediately stored after collection until they are mailed to the Salimetrics lab in Pennsylvania to be analyzed. Your infants samples will be mailed after all the samples from all of the infants in the study have been collected. Only the Supervising Investigator and Student Investigator will have access to the samples while they remain at UNT, at the Salimetics lab trained technicians will have access to the samples. Once the samples have been analyzed at Salimetrics, they will be discarded.

The Parenting Center Data Collection: Once the data has been transported to the EPSY lab from The Parenting Center, all data be stored as described above. Only the Primary and Student Investigators will transport the data. Transportation of infant saliva samples will take place per Salimetrics guidelines. Transportation of electronic data will be done using an encrypted external hard drive. Only the Primary Investigator and Student Investigator will know the password. Once at the EPSY lab the files will be backed up to the EPSY lab computer.

Questions about the Study: If you have any questions about the study, you may contact the student investigator, Cory Kildare at Cory.Kildare@UNT.edu

Review for the Protection of Participants: This research study has been reviewed and approved by the UNT Institutional Review Board (IRB). The UNT

COMPREHENSIVE REFERENCE LIST

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