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MATERNAL SENSITIVITY TO INFANT DISTRESS:

EXAMINING POTENTIAL PREDICTORS IN A LOW-INCOME SAMPLE

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ABSTRACT

The aim of the current study was to build understanding of potential factors linked with a mother's behavior towards her distressed infant. Infant crying is emotionally and physiologically arousing for mothers and may challenge or interfere with a mother's ability to respond sensitively to infant distress. The current study builds upon previous research by examining potential links between maternal sensitivity in a distress context and maternal emotional and physiological responses to one's own infant's distress (i.e., self-reported emotional reactions and a physiological measure of vagal regulation, respiratory sinus arrhythmia [RSA]), as well as two important predictors of sensitivity (i.e., parenting goals and mind-mindedness). Direct links as well as interactions were examined. Participants included 100 mothers and their 6-month old infants. The racially and ethnically diverse sample was selected to include low-income households. When considered all together, the demographic control variables of income, education, and race accounted for 21% of the variance in maternal sensitivity to distress. None of the interactions were significant, but maternal goals were significantly associated with sensitivity to distress, even after accounting for the influence of demographic factors. No significant links were found between maternal sensitivity and maternal emotions, maternal vagal regulation, or maternal mind-mindedness within this sample. It is important for researchers to better understand sensitivity to distress, including the predictors of sensitivity, across diverse groups, and the current study contributes to this growing and greatly needed body of literature.

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Chapter 1

Introduction

Sensitive parenting in early childhood is among the most important predictors of positive child development, including social behavior and emotion regulation (Mesman, van IJzendoorn, & Bakermans-Kranenburg, 2012). Considerable research has indicated that infants develop healthy relationships, emotion regulation, social skills, and behavioral competence in the context of early sensitive interaction with their mothers (Ainsworth, Blehar, Waters, & Wall, 1978; Braungart-Rieker, Garwood, Powers, & Notaro, 1998; van den Boom, 1994). Sensitive responding to infant distress is of particular importance. When examined simultaneously, maternal sensitivity to distress is more predictive of infant attachment security, social competence, behavioral adjustment, and affect regulation than is maternal sensitivity to non-distress, such as during play (Davidov & Grusec, 2006; del Carmen, Pederson, Huffman, & Bryan, 1993; Leerkes, Blankson, & O'Brien, 2009; McElwain & Booth-LaForce, 2006). Given this evidence of the importance of maternal sensitivity to infant distress, the focus of the current study was to examine predictors of maternal sensitivity to infant distress, with an emphasis on exploring mothers' cognitive, emotional, and physiological responses to her own infant's distress. The current study contributes to the growing and greatly needed body of literature on maternal sensitivity in low-income families. The aim of the current study was to build understanding of potential factors that may contribute to mother's behavior towards her distressed infant in this context of demographic risk.

Background

The construct of sensitivity was developed by Mary Ainsworth (Ainsworth, Bell, & Stayton, 1971, 1974; Ainsworth et al., 1978) based on John Bowlby's theory of attachment.

Attachment theory was developed to explain the child's emotional bond and relationship to the parent (Bowlby, 1969,1982). Ainsworth developed the construct of sensitivity based on intensive observations of infant's interactions with mothers, and she sought to identify specific aspects of parenting that were relevant for mother-infant attachment. Sensitivity is defined as maternal behavior that includes the following essential elements: (a) awareness of infant signals, (b) accurate interpretation, (c) appropriate response, and (d) prompt response (Ainsworth et al., 1974). The construct of maternal sensitivity was empirically tested and found to be associated with later infant attachment, as assessed by the Strange Situation Procedure (SSP; Ainsworth, et al., 1978). Bowlby later incorporated Ainsworth's findings on the relation between maternal sensitivity and infant attachment into his writings on attachment theory (1969, 1973, 1982). Maternal sensitivity is one of the central constructs of attachment theory and research. Ainsworth's conceptualization and descriptions of maternal behavior continue to be central to studies of maternal sensitivity today.

Maternal sensitivity in early life is important for child outcomes, beyond the role it plays in the development of attachment (Mesman, Oster, & Camras, 2012). Theoretically, when mothers respond sensitively and contingently to infant cues, the infant experiences co-regulation of emotion and assistance in modulating physiological arousal. With time, the infant learns to self-regulate emotion and modulate arousal more independently (Bowlby, 1969; Carlson & Sroufe, 1995; Kochanska, 2001; Tronick, 1989). Recent research supports this theory. A number of studies have demonstrated links between maternal sensitivity and emotion regulation in young children (Gloggler & Pauli-Pott, 2008; Jahromi, Putnam, & Stifter, 2004; LeCuyer & Houck, 2006; Manning, Davies, & Cicchetti, 2014; Mount, Crockenberg, Barrig-Jo, & Wagar, 2010; Pauli-Pott, Mertesacker, & Beckmann, 2004). Given the links between maternal

sensitivity and infant emotion regulation, it is not surprising that low maternal sensitivity has also been linked to later childhood psychological disorders, including internalizing (Crockenberg & Leerkes, 2006; Mount et al., 2010) and externalizing problems (Shaw, Lacourse, & Nagin, 2005; Shaw, Owens, Giovannelli, & Winslow, 2001; Spinrad et al., 2007).

Sensitivity to Distress

Although research has shown that sensitivity is linked to a variety of positive developmental outcomes, (Ainsworth, et al., 1978; Braungart-Rieker, et al., 1998; Mesman et al., 2012b), studies also indicate that maternal *sensitivity to distress* (infant fussing or crying) is a central factor in infant attachment outcomes (del Carmen, et al., 1993; Leerkes et al., 2009; Leerkes, Parade, & Gudmundson, 2011; Thompson, 1997) and emotion regulation (Davidov & Grusec, 2006; McElwain & Booth-LaForce, 2006). The phrase "sensitive caregiver" is used in the literature, suggesting that sensitivity is a stable attribute, however, a particular caregiver can vary in the degree of sensitivity shown across different contexts. A variety of factors, including whether or not the infant is crying, have been linked with the degree of maternal sensitive responding (Krink, Muehlhan, Luyten, Romer & Ramsauer, 2018; Leerkes, 2010; Mills-Koonce et al., 2007). In fact, sensitivity to infant distress and sensitivity to non-distress have been shown to be distinct constructs with differential effects on children's outcomes (Leerkes et al., 2009; McElwain & Booth-LaForce, 2006). These findings challenge the idea of sensitivity as a stable trait of a caregiver, and emphasize the need to conceptualize sensitivity as a dyadic construct that considers the infant's changing affective state (Mills-Koonce, et al., 2007; Thompson, 1997; van den Boom, 1997). The current study focused on maternal sensitivity during infant distress, exploring potential links among maternal cognitive, affective, and physiological processes and observations of maternal behavioral sensitivity at times when the infant was fussing or crying.

Mothers' ability to respond sensitively to infant distress may involve different processes than sensitive responding in non-distress interactions. Studies suggest that infant distress cues, compared with positive social cues, may trigger different cognitive and emotional processes in parents (Leerkes, 2010; Mills-Koonce et al., 2007). The current study examined cognitive and emotional processes theorized to contribute to a mother's ability to respond sensitively to her infant at times of infant distress. It is unclear exactly how infant distress may impact a mother's ability to provide sensitive care, however studies have begun to examine how infant distress may influence different components underlying behavioral sensitivity, such as (a) emotional reactions to infant distress, (b) regulating negative emotion, (c) goals in responding to infant's distress cues, and (d) holding the infant's perspective in mind in order to attend to infant's needs (Leerkes, 2010; Leerkes, et al., 2011, 2015; Mills-Koonce et al., 2007).

Sensitivity, Socioeconomic Status, Racial, and Ethnic Identity

The current study was based on a larger, longitudinal study focused on parenting in racially diverse, low-SES families. Therefore, it is important to note that the vast majority of studies assessing parental sensitivity have been conducted in ethnic majority, middle-class samples (Mesman et al., 2012b). Although Ainsworth's (1967, 1977) initial work on attachment was based in Uganda, early work on maternal sensitivity emerged from seminal research with primarily White samples in Baltimore (Ainsworth et al., 1978) and in Minnesota (Sroufe, Egeland, Carlson & Collins, 2005). For decades, sensitivity has been hypothesized to be a "universal" aspect of parenting that is related to positive child development (Ainsworth et al., 1974; Mesman et al., 2012b; 2018), however, some have questioned the relevance of the construct of sensitivity across diverse samples (Keller, 2012; Keller et al., 2018), particularly when SES is low (Cassidy et al., 2005; Woodhouse, Scott, Hepworth, & Cassidy, 2019). The

degree to which the construct of sensitivity is "universal" or "culture-bound" is a source of current debate in the literature, and a brief overview is described below.

Meta-analytic results have shown that sensitivity is relevant for child development in ethnic minority families and is related to positive child outcomes in several domains including cognitive, social, and behavioral development (Mesman et al., 2012b). Conclusions from this line of research suggest that while there may be variability in the ways in which sensitivity is expressed, the construct itself is "universal" (Mesman et al., 2012b, 2016, 2018). Critics of this "universal" view argue that the construct of sensitivity is not applicable in some cultures across the world where "non-Western" norms, customs, and attitudes exist (Keller, 2012; Keller et al., 2018). The specifics of the debate will not be elaborated here, as the current study is based in the "Western, industrialized" culture of the United States. However, the questions of cultural-specificity and universality are particularly relevant to the current study, in the sense that the construct of sensitivity, which has been well-researched in White, middle-class samples, is being examined in a racially and ethnically diverse sample of low-income families. It is important for researchers to better understand sensitivity, including the predictors of sensitivity, across diverse groups, and the current study contributes to this growing and greatly needed body of literature.

Maternal Emotion in Response to Infant Distress

Research has indicated that there is substantial variability in maternal emotional reactions to infant crying, ranging from empathy to mild irritation, anxiety to extreme hostility, or helplessness (Frondi & Lamb, 1978; Lester & Boukydis, 1985; Murray, 1985; Vecchio, Walter, & O'Leary, 2009). Theory suggests that negative reactions to crying are likely to impact behavioral sensitivity to infant distress (Dix, Gershoff, Meunier, & Miller, 2004; Leerkes, 2010). Leerkes (2010) suggested that mothers who find crying aversive are unlikely to respond

sensitively because these negative emotions undermine the ability to focus on the infant's needs. Most research that has explored the relation between maternal emotional reactions to crying and maternal sensitivity to distress has relied on prenatal assessment, using video-recordings of standardized infant crying (Leerkes, 2010; Leerkes et al., 2011, 2015). In this paradigm that assesses maternal emotional responses to infant distress in the prenatal period, maternal sensitivity to distress is later measured with the mother's own infant at 6 months of age (Leerkes, 2010; Leerkes et al., 2011, 2015). These studies by Leerkes and colleagues (2010, 2011, 2015) report mixed results about the relation between negative emotion in response to infant distress (assessed prenatally), and later sensitivity to distress with one's own infant.

To date, few studies have examined mothers' emotional responses to her *own* infants' crying, in relation to sensitivity to distress (Leerkes, 2010; Leerkes et al., 2015; Leerkes, Su, Calkins, Supple & O'Brien, 2016). Leerkes (2010) found that sensitivity to distress was predicted by maternal empathic response (infant-focused negative emotion). Mother's self-focused negative emotion (e.g., anger, anxiety), however, was not a significant predictor of sensitivity to distress, as theoretically predicted (Leerkes, 2010). For this reason, more research is needed to understand maternal emotional responses to her own infant's distress, and how such responses may be linked with providing sensitive care when one's infant is distressed. Theory suggests that in order to respond sensitively, mothers must first be able to regulate one's own emotional and physiological response to the infant's cues (Ablow, Marks, Feldman, & Huffman, 2013; Dix, 1991, 1992; Groh & Roisman, 2009; Mills-Koonce et. al., 2007; Moore & Calkins, 2004; Tronick & Cohn, 1989). One way to assess maternal self-regulation during interaction with her infant, is through heart rate variability, an index of parasympathetic influence on the heart (Porges, 2011). Heart rate variability, or vagal tone, has been linked to self-regulation and

the ability to engage the source of stimulation or take distance from it (Calkins, 1997; Porges, 2011). In this study, maternal physiological response to infant crying was indexed by vagal tone, based on the theoretical framework of Porges' polyvagal theory (1995, 2003, 2007, 2011).

Vagal Regulation and Parenting Behavior

As part of the broader caregiving system, *vagal regulation* in response to infant distress signals may be considered a physiological support for effective parenting behaviors (Mills-Koonce et al., 2007; Porges, 2007, 2011). One commonly used index of vagal regulation and autonomic functioning is *heart rate variability* (Berntson, Cacioppo, & Quigley, 1993; Porges, 2003). Heart rate variability is often operationalized as respiratory sinus arrhythmia, (RSA; Berntson et al., 1997; Porges, 1996, 2007). Respiratory-linked heart rate variability (RSA) is associated with vagal influence on the heart, and for this reason RSA is used as an approximation of the influence of the parasympathetic nervous system on the heart via the vagus nerve. A decrease in RSA from baseline levels (i.e., vagal withdrawal) is believed to reflect the parasympathetic influence of vagal regulation, as the withdrawal of parasympathetic control of the heart allows for sympathetic activity and thus increases in heart rate and cardiac output (Porges, 1996). Effective vagal withdrawal has been examined as in index of self-regulation (Butler, Wilhelm, & Gross, 2006; Porges, 2007, 2011).

Research has begun to explore the role of maternal RSA in the context of parenting, with some studies assessing the role that maternal self-regulation plays in support of positive interactions with one's child (Hill-Soderlund et al., 2008; Moore et al., 2009; Lorber, 2007; Lorber & O'Leary, 2005; Skowron, Cipriano-Essel, Benjamin, Pincus, & Van Ryzin, 2013). Growing evidence supports physiological regulation as an important component in positive caregiving behaviors (Hill-Soderlund et al., 2008; Mills-Koonce et al., 2007; Moore et al., 2009;

Sethre-Hofstad, Stansbury, & Rice, 2002). Existing theory and research have suggested that RSA withdrawal indicates effective regulation during challenging situations, and research has indicated that interacting with distressed infants is typically associated with decreases in RSA (Mills-Koonce et al., 2007; Moore et al., 2009). Some mixed findings in the research literature suggest that the implications of RSA withdrawal and augmentation may be context specific (Butler et al., 2006; Conradt, Measelle, & Ablow, 2013; Healy, Treadwell, & Reagan, 2011; Lorber & O'Leary, 2005; Moore et al., 2009). More work is needed to identify specific patterns of vagal regulation during parenting interactions, particularly in the context of infant distress. The current study included measures of maternal RSA during infant distress to examine relations between maternal vagal regulation and observed sensitivity to infant distress.

Theory suggests that infant crying may impact maternal behavior because when negative emotion is activated, attentional systems shift (Gross, 1998), events may be appraised differently (Dix, 1991), and various motivational systems are harnessed (Solomon & George, 1996) to meet the situational demands. Caregiving is considered to be one of several competing motivational systems (e.g., attachment, affiliative, and exploratory) and when stress is high (due to the socio-ecological context and/or situational demands of attending to a distressed infant) emotional and attentional resources available for caregiving may be compromised (Booth, Macdonald & Youssef, 2008). Measures of cognitive processes are included in the current study to examine how infant distress may relate to maternal goals and the ability to keep the infant's perspective in mind.

Maternal Goals

Parenting goals are believed to guide parenting behavior as they reflect what the parent hopes to achieve through interaction with the child (Dix 1991, 1992; Leerkes, 2010). Parenting

goals can be infant-focused or parent-focused. Theory suggests that mothers with infant-oriented goals in relation to crying are more sensitive to infant distress because emotions are valued highly, infant's needs are prioritized over one's own, and there is a desire to help one's infant regulate distress (Dix, 1991; Leerkes, 2010). In contrast, Leerkes (2010) suggests that mother-oriented goals are likely to undermine sensitivity because they prioritize the mother's needs over those of the infant, which may promote intrusive maternal behavior or withdrawal from the infant.

Maternal Mentalization

Holding the infant's perspective in mind has been described as a key element underlying a mother's ability to be sensitive with her infant (Ainsworth, 1969; Oppenheim & Koren-Karie, 2013). Ainsworth's descriptions of sensitive mothers included not only maternal behavior, but also internal processes that contribute to sensitivity such as the mother's capacity to "perceive things from [the child's] point of view" (Ainsworth et al., 1971, p. 43). Mind-mindedness (Meins, 1997) is a construct that describes the ability to take the infant's perspective and view the infant as an individual with a mind "rather than merely a creature with needs that must be satisfied" (Meins, Fernyhough, Fradley, & Tuckey, 2001, p. 638). Crucial to the definition of both cognitive constructs (maternal goals and mind-mindedness) is mentalization, an ability that allows one to understand and hold the perspective of another in mind (Sharp & Fonagy, 2008). The benefit of assessing mind-mindedness and goals is that these constructs provide insight into the underlying reasoning or motives for a mother's observable response to a particular situation. For example, some mothers engage in comforting behaviors because they want the infant to feel better, while others engage in comforting behaviors because they find the crying aversive and

want it to stop (Leerkes et al., 2011). The current study examined both parenting goals and mind-mindedness during a distress episode in relation to maternal sensitivity to distress.

Empirical Rationale for Study

Infant crying is emotionally and physiologically arousing for mothers and may challenge or interfere with a mother's ability to respond sensitively to infant distress (Leerkes, 2010; Leerkes & Crockenberg, 2003; Mills-Koonce, et al., 2007). The present study examined two important predictors of sensitivity: parenting goals and mother's ability to maintain her infant's point of view (mind-mindedness). Infant-oriented parenting goals and mind-mindedness have consistently predicted maternal sensitivity across studies (Leerkes, 2010; Leerkes et. al, 2015; Meins, Centifanti, Fernyhough, & Fishburn, 2013; Meins et al., 2001, 2003, 2012). Mind-mindedness, however, has not yet been examined specifically in the context of infant distress. Rather, it is typically coded during a free-play task, which may or may not include times of infant distress (Meins, et al., 2001, 2003, 2012, 2013). It is unclear if the relation between mind-mindedness and sensitivity would hold up in the context of distress when mothers need to regulate one's own emotions in order to hold the infant's perspective in mind. The present study furthers research in this area by examining predictors of sensitivity to distress at multiple levels (cognitive, emotional, and physiological) during a time when the mother was responding to her own infant's distress.

Previous research has indicated that prenatal assessment of maternal reactions to standardized cries is not a valid index of maternal reactions to one's own infant's distress (Leerkes, 2010). Leerkes (2010) found maternal emotional reactions to infant distress in general (standardized recordings) and emotional reactions to one's own infant's distress are not significantly correlated. These findings indicate that it is not valid to substitute one construct for

the other. In fact, it is possible that emotional responses to standardized video-recorded cries may involve different processes than emotional responses when experiencing the distress of one's own infant (Leerkes, 2010). The current study examined maternal negative emotion in response to one's *own infant's* distress. In addition, this study examined the intensity as well as the valence and focus of maternal emotion experienced in response to her own infant's distress. Although theory suggests that mother-focused negative emotions in response to her infant's distress may undermine a mother's ability to focus on the infant's needs (Dix et al., 2004; Leerkes, 2010), this has not been shown consistently in the research (Leerkes et al., 2011, 2015). It may be that intense negative reactions to infant crying interfere with sensitive responding to distress, whereas mild to moderate negative reactions are managed in such a way that sensitivity can still be provided during infant distress. Thus, examining the intensity of maternal emotion during mothers' own infant's distress, allows for further exploration of how mother-focused and infant-focused negative emotions may impact sensitive responding to one's own infant's distress.

The current study builds upon previous research by examining potential interactions between maternal responses to one's own infant's distress (emotional reactions and vagal regulation) and known cognitive predictors of sensitivity (parenting goals and mind-mindedness). The examination of interactions is supported by theory (Ainsworth et al., 1974, 1978; Dix, 1991) and research (Leerkes, 2010; Leerkes et al., 2015; Mills-Koonce et al., 2007) that indicates sensitive behavior involves complex combinations of cognitive, affective, and regulatory capacities in response to specific infant cues. By examining predictors of maternal sensitivity to distress in a low-income sample of racially and ethnically diverse mothers, the aim of the current study was to build understanding of potential factors that may contribute to mother's behavior towards her distressed infant in the context of demographic risk.

The following research questions were explored in the current study. How does maternal negative emotion during infant distress relate to a mother's ability to provide sensitive responding to that distress? How does the pattern of maternal vagal regulation during infant distress and the reunion with one's infant correspond with a mother's capacity to respond sensitively to her distressed infant? Are cognitive constructs, assessed during interaction with one's distressed infant, associated with observed maternal sensitivity to infant distress? Specifically, do maternal goals predict sensitivity to distress, as has been demonstrated in previous research? Does maternal mind-mindedness predict sensitivity in the context of infant distress? How do the constructs of maternal goals and mind-mindedness interact with maternal negative emotions and vagal regulation to predict sensitivity to infant distress?

Chapter 2

Literature Review

Sensitive caregiving is important for child development. Considerable research evidence has indicated that infants develop healthy relationships and skills, such as emotion regulation and social competence, in the context of early sensitive interaction with mothers (Ainsworth, et al., 1978; Braungart-Rieker et al., 1998; van den Boom, 1994). Sensitive responding to infant distress is of particular importance for developing social-emotional functioning. When examined simultaneously, maternal sensitivity to distress has been found to be more predictive of infant-mother attachment security, social competence, behavioral adjustment, and affect regulation than was sensitivity to non-distress (Davidov & Grusec, 2006; del Carmen et al., 1993; Leerkes et al., 2009; McElwain & Booth-LaForce, 2006). Given that sensitivity to distress is important for positive child development outcomes, identifying the factors that promote maternal sensitivity to infant distress has implications for interventions aimed at enhancing infant well-being (Leerkes et al., 2015).

Most of the current research on predictors of sensitivity to distress has focused on maternal responses to standardized infant cries during the prenatal period (Leerkes, 2010; Leerkes et al., 2011, 2015). This research has shown links between sensitivity to distress and prenatal assessments of maternal responses to standardized infant cries (Leerkes, 2010; Leerkes et al., 2011, 2015). While these findings are interesting and helpful from a prevention perspective, it is critical to note that prenatal measures of maternal responses to standardized cries are not significantly correlated with maternal responses to one's own infant's cries (Leerkes, 2010). For this reason, it is important to examine maternal responses to her own infant's cries to explore how these factors may predict sensitivity to her own infant's distress,

which was the aim of the present study. The focus of the current study was to examine predictors of maternal sensitivity to infant distress, in a sample of low-income mothers, with an emphasis on exploring mothers' cognitive, emotional, and physiological responses to her own infant's distress.

Origin of the Sensitivity Construct

The construct of sensitivity was developed by Mary Ainsworth based on John Bowlby's theory of attachment. Attachment theory was developed to explain the child's emotional bond and relationship to the parent (Bowlby, 1969, 1982). Bowlby posited that the primary purpose of the caregiving-attachment system is the promotion of survival and safety through the coordination of parental caregiving behaviors with the infant attachment system. Based on his studies of parent-child separations, Bowlby identified the following principles of attachment theory. Infants are born with a collection of behaviors (attachment behaviors) designed to promote proximity seeking to others (attachment figures) to protect them from threats to safety, and help ensure survival (Bowlby, 1969, 1982). Key features of attachment behavior in infants involves proximity maintenance, separation distress, and returning to the attachment figure for safe haven (Ainsworth, 1967; Ainsworth & Bell, 1974; Bowlby, 1969, 1982). The corresponding caregiving system involves acting as a secure base from which child can explore his or her environment, as well offering a safe haven to which the child can retreat when distressed and in need of comfort, support, reassurance, and protection (Ainsworth, 1967; Bowlby, 1958, 1977).

Ainsworth developed the construct of sensitivity based on intensive observations of infant's interactions with mothers. She sought to identify specific aspects of parenting that were relevant for mother-infant attachment. In her seminal study in Uganda, after observing and

recording many different aspects of parenting (feeding, shared caregiving, sleeping arrangements, quantity of contact with caregiver), Ainsworth concluded that the *quality* of mother-infant interactions was critical in differentiating infants with secure and insecure attachment (Ainsworth, 1967). Based on the observations of 26 mother-infant dyads in the US, Ainsworth developed the Maternal Sensitivity scale (Ainsworth et al., 1974), which is described in more detail in the following sections. It is important to note, however, that the definition of maternal sensitivity, which emerged from the Maternal Sensitivity scale, includes four essential components: (a) awareness of infant signals, (b) accurate interpretation, (c) appropriate response, and (d) prompt response (Ainsworth et al., 1974).

In a study examining the association between sensitivity and attachment, Ainsworth found that maternal sensitivity ratings, based on the Maternal Sensitivity Scale (Ainsworth et al., 1974), were strongly correlated with infants' attachment classifications, assessed at 12 months with the Strange Situation Procedure (SSP; Ainsworth et al., 1978). The SSP is a 20-minute laboratory task, conducted in a playroom with the infant, mother, and a stranger. The procedure involves a series of separations and reunions between the infant and the mother, which are designed to be increasingly stressful in order to activate the infant's attachment system. A Strange Situation classification system was developed by Ainsworth and colleagues (1978) to describe attachment quality based on individual differences in infants' responses to maternal separations and reunions during the procedure. The original SSP classification scheme included three categories of attachment security: secure, insecure-avoidant, and insecure-resistant.

The Strange Situation classification of *secure* includes infants that demonstrate positive behavior towards the attachment figure and use the attachment figure as a secure base to explore the environment and a safe haven to return to for comfort and reassurance. In the *secure*

category, infants are comfortable seeking proximity to attachment figure and show a clear preference for the attachment figure over the stranger in the room. The *insecure-avoidant* classification is characterized by infant behavior that appears detached from the attachment figure such as gaze aversion, lack of proximity seeking, or even behavioral avoidance of the attachment figure. In the *insecure-avoidant* category, infants typically do not use the attachment figure as secure base or safe haven, while caregivers tend to encourage independence and discourage expression of negative emotions like crying (Ainsworth et al., 1978). The *insecure-resistant* classification has been defined by infant's tendency to react to the attachment figure with anger, ambivalence, or reluctance when the attachment figure returns from separation. In the *insecure-resistant* category, infants are typically difficult to soothe, and may seek proximity to attachment figure but then angrily resist caregiving. In this category, caregivers are typically inconsistent in response to the infant's needs (Ainsworth et al., 1978). A fourth attachment category, termed *disorganized*, was later identified and added to the classification system by Main and Solomon (1990). The *disorganized* classification is characterized by a lack of organized attachment strategies during Strange Situation procedure, meaning that the infant's behavior is often disoriented, contradictory or bizarre. In the disorganized category, caregivers may be frightened or frightening, maltreating, neglecting, or intrusive (Main & Solomon, 1986). The Strange Situation Procedure and the attachment classifications described above continue to be the standard measurement of attachment in young children (Mesman & Emmen, 2013).

Bowlby incorporated Ainsworth's findings on the relation between maternal sensitivity and infant attachment into his later writings on attachment theory (1973, 1977, 1982). He theorized that sensitivity leads to secure attachment through the following pathways. First, a sensitive caregiver will adequately detect and offer child-centered responses to physical and

emotional needs of the infant, including attachment needs for safety. Sensitively providing for attachment needs includes acting as a secure base in support of child exploration, as well as acting as a safe haven to which the child can return when distressed (Bowlby, 1982, 1988). Then, over time, sensitive caregiving in response to infant signals allows the infant to learn that he/she can depend on the caregiver for support in times of need, and this becomes the basis for secure attachment. Experiencing sensitive care in a consistent way allows the infant to build expectations about how the caregiver will respond to his/her cues in commonly occurring circumstances. A mental representation, termed "internal working model" is created from repeated experiences of interacting with the caregiver (Bowlby, 1982). For an infant who has received consistent sensitive care, the caregiver is represented as someone who is accessible and responsive when the infant wants or needs her. This is the basis of feeling secure in relationship with the caregiver (Ainsworth, 1977).

Meta-analytic work has shown a consistent link between sensitivity and later attachment across a large number of studies (De Wolff & van IJzendoorn, 1997). For this reason, maternal sensitivity remains one of the central constructs of attachment theory and research. Ainsworth's conceptualization and descriptions of maternal behavior continue to be central to studies of maternal sensitivity today. Researchers have spent decades examining the antecedents of secure attachment, including the construct of maternal sensitivity, because early attachment has been found to play a primary role in later socio-emotional development (Thompson, 1997; Weinfield, Sroufe, Egeland, & Carlson, 1999). A large body of research has shown links between attachment security and later positive developmental outcomes in a variety of domains (Sroufe et al., 2005). In addition to the role that sensitivity plays in the development of attachment patterns,

recent empirical evidence has also linked sensitivity to other important child development outcomes, including social behavior and emotion regulation (Mesman et al., 2012b).

Importance of Sensitivity

Maternal sensitivity in early life has been shown to be important for later child outcomes, beyond the role it plays in the development of attachment patterns. Theoretically, when mothers respond sensitively and contingently to infant cues, the infant experiences co-regulation of emotion and assistance in modulating physiological arousal. With time, the infant learns to self-regulate emotion and modulate arousal more independently (Bowlby, 1969; Carlson & Sroufe, 1995; Kochanska, 2001; Tronick, 1989). Recent research supports this theory. A number of studies have demonstrated links between maternal sensitivity and emotion regulation in infancy. Sensitive responding to infant distress has been linked to decreases in infant distress (e.g., Jahromi et al., 2004), suggestive of a co-regulation pattern in early infancy. Maternal sensitivity, measured at 4 and 8 months has been shown to be a significant predictor of infant 12-month negative emotionality (Jahromi et al., 2004).

Sensitivity in early life has also been linked to emotion regulation in toddlerhood. High sensitivity has been related to lower negative emotionality and frustration at the end of the first year (Pauli-Pott et al., 2004). High levels of maternal sensitivity in infancy have been linked to greater regulation of fear in infants at 12 months and 30 months of age (Gloggler & Pauli-Pott, 2008) as well as less symptoms of anxiety in 36-month-old children (Mount et al., 2010). Toddlers who experience limit-setting by mothers in a sensitive fashion have been shown to demonstrate more social competence and greater self-concept at age three (LeCuyer & Houck, 2006). In families with parental conflict and violence, maternal sensitivity was found to buffer the risk posed to children growing up in violent homes in terms of externalizing behavior and

pro-social development. In this study, sensitive parenting was linked to lower levels of children's' angry reactivity to inter-parental conflict (Manning et al., 2014).

In addition to the research cited above, studies have shown that the infant's physiological systems that help regulate emotion are rapidly developing in early life and are influenced by various caregiving behaviors (Calkins, 1994; Gunnar & Donzella, 2002; Tronick, 1989). Studies have empirically examined links between sensitivity and elements of the infant's developing regulatory systems including both branches of the autonomic nervous system (sympathetic and parasympathetic) and cortisol from the HPA-axis (which is part of the endocrine response to stress). The following studies used the same challenge task to elicit a stress response from the infant, called the Still-Face Paradigm (SFP; Tronick, Als, Adamson, Wise, & Brazelton, 1978), which involves the parent looking away from the infant with a "still, emotionless face" for one or two minutes, depending on the child's age. Infants of sensitive mothers showed greater evidence of stress regulation through modulation of heart rate and negative affect at 6 months of age (Haley & Stansbury, 2003). Greater maternal insensitivity was associated with greater sympathetic activation, less parasympathetic activation and greater cortisol output, which are considered a "maladaptive stress responses" (Enlow et al., 2014). Maternal sensitivity has also been linked to infant cortisol reactivity and recovery in response to a series of stressors (Atkinson et al., 2013). Given the links between maternal sensitivity and infant self-regulation described above, it is not surprising that low sensitivity has also been empirically linked to later childhood disorders, including internalizing problems (Crockenberg & Leerkes, 2006; Mount, et al., 2010) and externalizing problems (Shaw et al., 2005; Shaw et al., 2001; Spinrad et al., 2007).

Importance of Sensitivity to Distress

Theoretically, sensitivity to distress or in response to bids for safety and protection should be more predictive of attachment security than global measures of sensitivity, because attachment relationships serve the purpose of protection (Goldberg et al., 1999; Leerkes et al., 2009; Schore, 2010; Thompson, 1997). Consistent with this theory, when multiple dimensions of sensitivity have been measured, across different contexts, sensitivity to distress has emerged as the only significant predictor of attachment security in young infants (del Carmen, 1993; Leerkes et al., 2009; McElwain & Booth-LaForce, 2006). These findings challenge the idea of sensitivity as a stable attribute of a caregiver and emphasize the importance of conceptualizing sensitivity as a dyadic construct that takes into account the infant's changing affective state (Mills-Koonce et al., 2007; Thompson, 1997; van den Boom, 1997). Although the phrase "sensitive caregiver" is used in the theoretical literature, a variety of factors, including whether or not the infant is crying, have been linked with the degree of maternal sensitive responding (Leerkes, 2010; Mills-Koonce et al., 2007). The current study focused on maternal sensitivity during infant distress, and the existing research on sensitivity to distress is described below.

Sensitivity to distress is defined broadly to include sensitivity to infant distress cues that indicate fear, sadness, anger, or other non-differentiated distress, such as fussing or crying (Leerkes et al., 2009; McElwain & Booth-LaForce, 2006). Sensitivity to non-distress includes the sensitivity with which mothers respond to infant neutral or positive affect cues (Leerkes et al., 2009; McElwain & Booth-LaForce, 2006). Bowlby's (1969, 1982) theories about attachment highlighted the importance of shifts between positive and negative affect as the primary mechanism of communication for infants. It is thought that infant positive affect promotes affiliation and competence thought play and exploration, while shifts to negative affect signals

distress and the need for comfort (Bowlby, 1969, 1982). Sensitivity is a relational construct and is assessed based on appropriate responding to infant cues, such that sensitivity to distress centers around providing comfort and protection, whereas sensitivity to non-distress is related to social reciprocity, exploration, and learning (Ainsworth et al., 1974; Grusec & Davidov, 2010). Although sensitivity is important across a variety of contexts, theory indicates that sensitivity to distress in particular may be critical for certain aspects of child development, such as building trust and safety with the caregiver and developing an internal working model that one is worthy of care (Bowlby, 1969, 1982; Leerkes, Weaver, & O'Brien, 2012).

Consistent with the principles of attachment theory reviewed above, empirical research indicates that maternal sensitivity to distress is particularly important for infant attachment outcomes (del Carmen et al., 1993; Leerkes et al., 2009, 2011; Thompson, 1997). During observations of mothers with infants as early as three months of age, mother's effective soothing and comfort during distress has been linked with a greater likelihood of infant secure attachment at 12 months (del Carmen et al., 1993). Greater maternal sensitivity to distress at 6 months has been empirically linked with a greater likelihood of secure attachment at 15 months, while in comparison, sensitivity to non-distress did not contribute to attachment security in this study (McElwain & Booth-LaForce, 2006). In addition, sensitivity to distress has been found to be associated with emotion regulation, over and above the contributions of sensitivity to non-distress (Davidov & Grusec, 2006; McElwain & Booth-LaForce, 2006). Results from a study by Leerkes and colleagues (2009) provide evidence that maternal sensitivity to infant distress was uniquely related to positive adjustment, and this effect was independent of how mothers responded to non-distress cues. In this study, sensitivity to distress was negatively associated with behavior problems at 24 and 36 months of age, and positively associated with social

competence at 24 months (Leerkes et al., 2009). Sensitivity to non-distress was not predictive of behavior problems or social competence (Leerkes et al., 2009). These results are consistent with findings from a large-scale longitudinal study reporting that maternal sensitivity to distress was the most predictive dimension of sensitivity in relation to socio-emotional outcomes for children (NICHD, 1998).

Even though sensitivity to distress and non-distress are related to one another in some samples (Leerkes et al., 2009; McElwain & Booth-LaForce, 2006), the fact that they predict infant outcomes differently suggests that they are different constructs and may have different origins. Maternal ability to respond sensitively to infant distress may involve different processes than sensitive responding in non-distress interactions. Some researchers have found that infant negativity reduces sensitive parenting (Atkinson et al., 2013; Cox, Owen, Henderson, & Margand, 1992; Kochanska, 2001; Thompson, 1997; van den Boom, 1997). These studies suggest that infant distress cues, compared with positive social cues, may trigger different emotional and cognitive processes in parents (Leerkes, 2010; Mills-Koonce et al., 2007). Taken together, these findings suggest that sensitivity to distress and sensitivity to non-distress may indeed be distinct dimensions, such that research would benefit from assessing these dimensions separately and studying the unique origins of each dimension.

Another important difference between sensitivity to distress and sensitivity to non-distress, which is particularly relevant to the current study, is that demographic risk factors have been more strongly associated with sensitivity to non-distress than sensitivity to distress. In the large-scale, racially diverse NICHD sample, maternal demographic risk (low income-to-needs ratio, younger, less educated, unmarried mothers) was more strongly correlated with sensitivity to non-distress ($r_{(395)} = -.41$, $p < .01$) than with sensitivity to distress ($r_{(395)} = -.30$, $p < .01$) and

the difference was significant (Z = 3.04, $p < .01$). In addition, maternal demographic risk was a significant predictor of sensitivity to non-distress (*ß* = -.23, $p < .01$) but not sensitivity to distress (*ß* = -.02, *ns*) when the shared variance between the two types of sensitivity was controlled (McElwain & Booth-LaForce, 2006). Leerkes (2010) also reported findings to support the theory that low-SES has a differential effect on different types of sensitivity. Results from Leerkes (2010), based on a racially diverse sample of 101 mothers, demonstrated that demographic risk was a stronger predictor of maternal sensitivity during the non-distressing free play task than during the distress-eliciting tasks. These studies suggest that the effect of low-SES on maternal sensitivity may be more prominent in non-distress situations, such that differences in maternal behaviors when infants are not distressed may be more apparent than when infants are in need of comfort or safety (Bornstein, Putnick, & Suwalsky, 2012). The current study focused on maternal sensitivity to distress, with a sample selected for low-socioeconomic status, and examined various factors that may underlie maternal behavioral sensitivity to her infant's distress.

Although questions have been raised about universality of sensitivity (Keller et al., 2018) and importance of social context in understanding development (e.g., Booth et al., 2018; Taraban & Shaw, 2018), nevertheless, findings show that, overall, sensitivity is an important predictor of key outcomes (Gloggler & Pauli-Pott, 2008; Jahromi et al., 2004; LeCuyer & Houck, 2006; Manning et al., 2014; Mount, et al., 2010). Much of the existing research has focused on middle class White families (Mesman et al., 2012b). Thus, it is important to examine predictors of sensitivity in this racially and ethnically diverse sample. Some research has found that race is linked to sensitivity (Malda & Mesman, 2017; Mesman et al., 2012a; Mesman et al., 2012b), but others have noted that race tends to be confounded with socioeconomic status (Chaudhuri,

Easterbrooks & Davis, 2009; Bakermans-Kranenburg, van IJzendoorn & Kroonenberg, 2004). In the present study an attempt was made to limit variability in socioeconomic status by recruiting primarily from agencies that tend to serve low-income families. It is important to note that the goal of the present study is not to compare sensitivity across mothers based on race or socioeconomic status, but rather to better understand cognitive, emotional, and physiological predictors of sensitivity within a racially and ethnically diverse, primarily low-income sample.

Measurement of Sensitivity

In the long history of empirical research on the construct, sensitivity has been conceptualized and measured in a wide variety of ways. The Maternal Sensitivity scale, developed by Ainsworth and colleagues (1971, 1974, 1978), was based on intensive and naturalistic home visits with mothers and infants and provided the basis for a clearly defined construct of sensitivity. The Maternal Sensitivity scale (Ainsworth et al., 1974) operationalized measurement of the construct through detailed descriptions of mother-infant interactions and provided an explicit definition of sensitivity. New measurements of sensitivity have emerged as researchers have become interested in assessing the construct with children of different ages, different caregivers, in different observational settings, and from different theoretical perspectives (Mesman & Emmen, 2013). The following sections describe the development of the original Maternal Sensitivity scale (Ainsworth et al., 1974), as well as current measures of sensitivity, and conclude with a rationale for the measure of sensitivity selected for the current study.

Initial conceptualization and measurement. Ainsworth's conceptualization of the construct of sensitivity originated in her observational research in Uganda (1967) and became more defined in her subsequent Baltimore study (Ainsworth & Bell, 1969). Descriptions of

mother-child interaction from *Infancy in Uganda* (1967) include the first explicit conceptualization of maternal sensitivity: "Sensitivity in response to signals implies that signals are perceived and correctly interpreted, and that the response to signals is prompt and appropriate. The signals may be of need and distress or they may be social signals. Sensitivity to signals tends to ensure that the care the mother gives the baby, including her playful interaction with him, is attuned to the baby's state and mood—at the baby's own timing, not the mother's timing. Routine care may be undertaken with little interaction. It is the interaction that seems to be most important, not mere care, and particularly conspicuous in mother-child pairs who have achieved good interaction is the quality of mutual delight which characterizes their exchanges" (Ainsworth, 1967, p. 397). Elements of this original description of sensitivity were later incorporated into an explicit measure and definition of the construct.

The first measure of sensitivity was the Maternal Sensitivity scale, developed by Ainsworth and colleagues (1971, 1974) through a "back-and-forth" (Bretherton, 2013, p.463) process of examining infant's attachment classifications (based on the Strange Situation Procedure) in conjunction with mother's sensitivity ratings during home visitation. The Maternal Sensitivity scale was developed to differentiate between mothers of secure and insecure infants and is one of four Maternal Care Scales developed by Ainsworth and colleagues (1971). The other three Maternal Care Scales: Cooperation-Interference, Acceptance-Rejection, and Accessibility-Ignoring, are considered auxiliary scales, which were developed to further differentiate mothers of insecure-avoidant from those of insecure-ambivalent infants (Ainsworth et al., 1971). All four scales are summarized in Ainsworth et al. (1971) but only the full text of the Maternal Sensitivity scale was ever published in Ainsworth, Bell, and Stayton, (1974). Ainsworth and colleagues (1974) focused primarily on maternal sensitivity because this

construct emerged as the single best predictor of the attachment security (Bretherton, 2013). Maternal sensitivity is defined in terms of four essential components: (a) maternal awareness of infant signals, (b) accurate interpretation of infant signals, (c) prompt response to those infant cues, and (d) appropriate response to the infant (Ainsworth et al., 1974).

The Maternal Sensitivity scale (Ainsworth et al., 1974) measures mothers' prompt and appropriate responsiveness to infant's accurately perceived signals and communications. The *Sensitive* end point describes mothers who are (a) able to see things and feel things from the infant's point of view, (b) are understanding of infant's idiosyncratic ways of signaling and specific preferences, and (c) respond promptly and appropriately. In contrast, the *Insensitive* end point is defined as mothers who gear interactions with the infant almost exclusively to her own wishes, moods, and activities. Mothers at this end of the scale interpret infant's communications in line with her own wishes or defenses, or do not respond to them at all. The scale is rated on 9 points, and the midpoint (score of 5) indicates a mix of sensitive and insensitive behaviors, termed *inconsistently sensitive* (Ainsworth et al., 1971).

The iterative process of developing the Maternal Sensitivity scale was based upon repeated observations of mother-infant dyads, highly descriptive summaries of the observation, and qualitative analysis of the written summaries to identify meaningful patterns of behavior and communication between mother and infant (Bretherton, 2013). This process of measure development included three important elements, which are central to the rationale for the current study. First, it is important to note that the observation of home visits (which provide the foundation for the Maternal Sensitivity scale) focused on the interactive *behavior* of the mother and infant, but also recorded what the mother *said to her infant and about her infant* in the course of the home visit. These notes about maternal statements made during the home visits

allowed for significant insights that could not be appreciated from observations of maternal behavior alone. Ainsworth (1969) noted discrepancies between what mothers said and did, as well as mismatches between what mothers said and the observers noticed (e.g., apparent misinterpretations of the infant's signals). Ainsworth (1969) attributed these discrepancies or mismatches in the mother's comments to the mother's defensive operations, which point to Ainsworth's training in clinical diagnostics and her appreciation for dynamic theory (Bretherton, 2013). Although not frequently highlighted in summary descriptions of sensitivity, nor included in current measurement of the construct, it is important to note mother's comments were recorded and used to understand elements of the mother-infant relationship that could not be assessed from observation of caregiving behavior alone. Thus, the present study attends to maternal statements made to and about her infant during a time of infant distress, which may offer insight into how mothers are perceiving and interpreting infant's cues and needs. These maternal comments, which are described below, were examined in relation to observed maternal sensitivity during infant distress.

Secondly, it is important to highlight that Ainsworth's (1974) Maternal Sensitivity scale addressed maternal and infant emotion in the rating descriptions. High ratings on the Maternal Sensitivity scale are given to mothers with insight into one's own mood and its effect on the infant (Ainsworth et al., 1974; Bretherton, 2013). Over and above intellectual awareness of infant signals, Ainsworth (1970) proposed that a mother must empathize with her baby's feelings, or "feel things from his point of view," in order to respond appropriately. Current theory supports Ainsworth's (1974) description of the role of emotion in responding to infant cues, and suggests that in order to respond sensitively, mothers must first be able to manage one's own emotional and physiological response to infant's cues (Ablow et al., 2013; Groh &

Roisman, 2009; Mills-Koonce et al., 2007; Moore & Calkins, 2004; Tronick & Cohn, 1989). Thus, the present study also considered the role of maternal emotion as it relates to maternal sensitivity to distress.

Finally, is important to highlight that the construct of sensitivity, as described by Ainsworth (1974, 1948), has a strong dyadic or relational quality (Bretherton, 2013). This means that a mother's behavior cannot be rated as independently or uniformly sensitive, but rather needs to be evaluated in the context of the infant's current state and signals (Mesman et al., 2012a, 2012b). The present study focused exclusively on the context of infant distress, which allows for an examination of maternal sensitivity *in relation to* a specific type of infant cue. Rather than assessing maternal sensitivity in a global fashion, across different contexts, narrowing the focus allows for the examination of relational and dyadic qualities of maternal behavior. The importance of focusing on the context of infant distress is presented in more detail below.

In summary, the present study attended to maternal statements, maternal emotions and relational context in the examination of factors that contribute to behavioral sensitivity to infant distress. Ainsworth and colleagues (1971, 1974, 1978) attended to these elements during home visit observations and included such information in narrative accounts of mother-infant interactions. It is important to emphasize that the home visits and narrative summaries that contributed to the development of the Maternal Sensitivity scale were intensive and naturalistic observations of mothers and infants across the first year of life (Ainsworth et al., 1978). Specifically, in the last quarter of the infant's life (9-12 months) each dyad participated in at least five home visits lasting four hours each (Ainsworth et al., 1978). Such intensive, naturalistic observations are rare in current research, and the original Maternal Sensitivity scale is rarely

used empirically, with a few exceptions (Fearon et al., 2006; Gonzalez, Jenkins, Steiner, & Fleming, 2012; Pederson, Bailey, Tarabulsy, Bento, & Moran, 2014; Spangler, Johann, Ronai, & Zimmermann, 2009). Over time, new measures of sensitivity have emerged as researchers have became interested in assessing the construct in different observational settings, using shorter observation periods, and with children of different ages (Mesman & Emmen, 2013). Some aspects of mother-infant interaction, which were fundamental in the conceptualization of the sensitivity construct (discrepancies in mothers' comments and behavior, emotional awareness in self and infant, and the dyadic nature of sensitivity), have not been captured fully in subsequent measures. After reviewing current measurement approaches to sensitivity, a rationale is given for the measure that was used in the current study.

Current measurement of sensitivity. A recent review (Mesman & Emmen, 2013) identified over 50 observational measures of sensitivity used in empirical studies and discussed similarities and differences between the most commonly used instruments. Newer observational measures of sensitivity vary in how similar they represent the construct of sensitivity, with some including new elements or excluding certain aspects. Current measures of sensitivity also vary in the amount of time used for observations, and the units of measurement used for coding (e.g., global rating scales, summing multiple sub-scales, micro-level frequency counts). Different contexts of measurement may also impact measures of sensitivity, for example, observation in the lab versus the home, or during different tasks such as teaching, free-play, or routine care (Mesman & Emmen, 2013).

After reviewing over 50 observational measures of sensitivity, Mesman and Emmen (2013) concluded that the sensitivity scales developed for the National Institute of Child Health and Human Development study of Early Child Care and Youth Development (NICHD-

SECCYD; Owen, 1992) are most closely related to Ainsworth's Maternal Sensitivity scale. Given that these sensitivity scales were developed in the context of a large longitudinal study, they have been widely used in research publications. The measure includes two global scales, one for sensitivity to distress and one for sensitivity to non-distress. The focus of the observational scales is the caregiver's *appropriate responsiveness*, judged on the basis of the *effectiveness* of the caregiver's responses. In the case of infant distress, this means that the infant is soothed, and in the case of non-distress that the child is engaged and content. The NICHD scale descriptions clearly reflect an attachment framework and the main elements of Ainsworth's sensitivity scale. The NICHD sensitivity scales have been found to relate to infant attachment quality (Bakermans-Kranenburg et al., 2004; McElwain & Booth-LaForce, 2006).

In summary, sensitivity is a quality of caregiving that is important for healthy child development. Sensitivity is defined as a mother's ability to perceive and interpret her infant's cues, and then to appropriately and promptly respond to the infant (Ainsworth et al., 1974). Maternal sensitivity has been measured in a variety of ways, primarily through observations of maternal behavior in relation to her infant (Mesman & Emmen, 2013). However, Ainsworth's descriptions of sensitive mothers included not only maternal behaviors, but internal processes underlying sensitivity as well, including awareness of infant signals, accurate interpretation, and the capacity to "see things from the child's point of view" (Ainsworth, 1969; Oppenheim & Koren-Karie, 2013). Sensitivity during infant distress is particularly important for attachment outcomes and the development of emotion regulation (del Carmen et al., 1993; Leerkes et al., 2009; McElwain & Booth-LaForce 2006). It is unclear exactly how infant distress may impact a mother's ability to provide sensitive care, however, studies have begun to examine how infant distress may impact different components underlying behavioral sensitivity, such as

interpretation of infant's cues, holding the infant's perspective in mind, and regulating emotion in order to attend to infant's needs (Leerkes et al., 2011, 2015; Mills-Koonce et al., 2007). The current research on each of these components is reviewed below.

Factors Associated with Sensitivity

A number of predictors of sensitivity have been examined in the research literature, including demographic factors, parenting goals, as well as the ability to hold the infant's perspective in mind. Less research has been done linking these predictors to sensitivity to distress in particular. The main focus of this study is an examination of factors that are associated with maternal sensitivity during infant distress. For this reason, maternal emotional reaction to infant crying and vagal regulation during infant distress were also explored as predictors of sensitivity to distress. This study assessed four factors in relation to maternal behavioral sensitivity to distress: (a) maternal emotional reaction to infant crying, (b) maternal vagal regulation during infant distress, (c) maternal goals in response to infant distress, and (d) holding the infant's perspective in mind. Examining these aspects of maternal response to infant distress in relation to observed sensitivity to distress could shed light on underlying patterns of maternal sensitivity, which are undifferentiated at the level of behavioral observation. The existing literature on cognitive factors associated with maternal sensitivity is reviewed next, followed by a rational for considering maternal emotion in relation to maternal sensitivity to distress.

Maternal goals. Parenting goals are believed to guide parenting behavior as they reflect what the parent hopes to achieve through interaction with one's child (Dix 1991, 1992; Dix et al., 2004; Leerkes, 2010). Assessing parenting goals as a means of tapping into a parent's capacity for mentalizing was introduced by Dix and colleagues (2004) and Leerkes (2010) based on the

work of Gottman and colleagues (1996) in the field of marriage and family psychology. Gottman and colleagues (1996) identified a need in the parenting literature to include emotion in the analysis of parenting behaviors and developed the concept of parental meta-emotion philosophy (PMEP). Parental meta-emotion philosophy refers to an organized set of feelings and thoughts about one's own emotions and one's children's emotions. Different types of meta-emotion philosophies have been identified, such as emotion-coaching, emotion-dismissing, and laissez-faire (Gottman et al., 1996). Parents with an emotion-coaching philosophy are aware of low-intensity emotions in one's self and one's own children, view child's negative emotion as an opportunity for intimacy or teaching, validate and assist in labeling the child's emotion, and problem-solve with the child during emotionally-challenging situations.

The PMEP work of Gottman and colleagues is based on parents of preschool-aged children, who are old enough to be coached through emotion experiences. To make the concept more applicable to the infancy period, Leerkes (2010) adapted the assessment of parental meta-emotion philosophy by focusing on a mother's stated goals when interacting with her infant. Tailoring the concepts to apply to the infancy period, Leerkes (2010) suggests that mothers with infant-oriented goals in relation to crying are more sensitive to infant distress because they value emotions, prioritize infant's needs over one's own, and want to help infants regulate distress. Leerkes (2010) theorizes that these mothers with infant-oriented goals would be likely to engage in soothing and supportive behaviors. In contrast, Leerkes (2010) suggests that mother-oriented goals are likely to undermine sensitivity because they focus on a mother's needs such as getting the infant to conform to her will or ending the aversive sound of infant crying which may promote intrusive behavior or withdrawal from infant. The overlap with Fonagy's concept of reflective functioning, described above, is clear in that both share a philosophical basis in the

notion of 'meta'-processing of cognitions or emotions (Sharp & Fonagy, 2008). Parenting goals were assessed in the current study because previous studies have demonstrated that this construct is indicative of parental behavior during interactions with infants and young children (Dix et al., 2004; Leerkes, 2010).

It is important to note that parenting goals are influenced by cultural values and beliefs about what is best for infant development. Keller (2007, 2012) describes differences in socialization goals in two prototypical contexts to highlight different cultural beliefs and values in child-rearing. One prototype is characterized by agrarian, subsistence-based environment with low levels of formal education, early onset of reproduction, and multigenerational households while the other context is represented by urban, information-based environments with high levels of formal education, later onset of reproduction and nuclear-family households. Cross-cultural studies indicate that low levels of formal education, subsistence-based environments, and multigenerational households cluster with socialization goals that emphasize relatedness and interdependence (Keller, 2007, 2012). In contrast, socialization goals in environments that are information-based and characterized by higher levels of formal education and nuclear families tend to be linked with themes of autonomy and independence. Although autonomy (independence) and relatedness (interdependence) have historically been viewed as dichotomous constructs, and the contrast of two prototypes helps to illuminate the differences, it has been noted that all cultures value both autonomy and relatedness (Keller & Otto, 2014; Tamis-LaMonda et al., 2008). Rather than considering autonomy and relatedness as dichotomous characteristics of parenting goals, the various types of goals may be better understood in terms of how parents emphasize these aspects of autonomy and relatedness across various situations and

developmental periods (Tamis-LaMonda et al., 2008). The existing research on links between maternal goals and observed maternal sensitivity is reviewed next.

Parenting goals and observed maternal sensitivity. Dix (1991, 1992) hypothesized that parents who prioritize child concerns (child-oriented goals) would be more sensitive. Empirical studies with toddlers and children have shown that child-oriented goals are related to more adaptive parenting than maternal-oriented goals (Sigel & McGillicuddy-DeLisi, 2002; Hastings & Grusec, 1998; Hastings & Rubin, 1999). Two separate studies (Leerkes, Crockenburg & Burrous, 2004; Leerkes, 2010) have found that mothers with infant-oriented goals in relation to crying were more sensitive to infant distress than those with maternal-oriented goals. The goals coding scheme for infants, developed by Leerkes and colleagues (2004), is based on interview transcripts with mothers and includes 18 goal categories that fit into the two broad dimensions of infant-orientation and mother-orientation. Infant-oriented goals is the sum of eight categories including: wants to soothe infant, wants secure relationship/attachment with infant, wants infant to be happy, wants child to understand and value emotions, views crying as a means of communication, wants to contribute to infant social competence, wants to contribute to infant coping skills, and wants to contribute to infant positive adjustment (self-esteem). Mother-oriented goals is the sum of ten categories: wants to minimize crying, wants crying to stop because it upsets her, wants crying to stop because it bothers others, wants crying to stop because it interferes with her productivity, wants infant to control emotions without assistance, wants infant to conform/behave, wants to be seen as a good parent, emphasis on physical needs over emotions, does not want to spoil infant, and emphasis on cognitive development over emotions.

Maternal Mentalization. Holding the infant's perspective in mind has been described as a key element underlying a mother's ability to be sensitive with her infant (Ainsworth, 1969;

Oppenheim & Koren-Karie, 2013). As noted earlier, Ainsworth's accounts of sensitive mothers included not only maternal behaviors, but also internal processes such as the mother's capacity to "perceive things from [the child's] point of view" (Ainsworth et al., 1971, p. 43). Theory suggests that in order to respond sensitively, mothers need to be able to hold the infant's perspective in mind during times of infant distress (Ainsworth, 1969; Leerkes, 2010; Meins, 1997; Oppenheim & Koren-Karie, 2013; Slade, 2005). Researchers have conceptualized and measured this construct of seeing things from the infant's point of view in several different ways including reflective functioning (Fonagy & Target, 2005; Slade, Grienenberger, Bernbach, Levy, & Locker, 2005), parenting goals (Dix, 1991, 1992; Leerkes, 2010), and maternal mind-mindedness (Meins, 1997; Meins et al., 2012). Each of these constructs (reflective functioning, parenting goals, and mind-mindedness) is related to the notion of mentalizing. Mentalization refers to the capacity to attribute thoughts, feelings, ideas, and intentions to one's self as well as others (Sharp & Fonagy, 2008). In the past two decades, research has begun to focus on the mentalizing capacity of parents and how it relates to parenting behavior and child development (Fonagy, Steele, Moran, Steele, & Higgitt, 1991; Gottman, et al., 1996; Leerkes, 2010; Meins, 1997; Sharp, Fonagy, & Goodyear, 2006).

One of the first studies to explore mentalizing in parents, carried out by Fonagy and colleagues (1991), led to the development of the construct of *reflective functioning.* Reflective functioning is rooted in the psychoanalytic tradition and defined as the capacity to "hold, regulate, and fully experience one's own and others' emotions in a non-defensive way" (Sharp & Fonagy, 2008, p. 740). *Parental reflective functioning* is assessed through the analysis of the Parent Development Interview (PDI; Aber, Slade, Berger, Bresgi, & Kaplan, 1985), which is a clinical interview intended to examine parents' representations of one's own children and the

relationships with one's own children. Reflective functioning refers to mentalizing that takes place 'off-line,' meaning that the construct taps into a parent's mental representation of one's child based on multiple interactions that have occurred over time, rather than mentalizing during a specific interaction occurring in the moment (Sharp & Fonagy, 2008). In contrast to the off-line quality of reflecting upon one's child during an interview, constructs that capture 'on-line' mentalizing tap into the parent's capacity to hold the child's perspective in mind while interacting with the child (Sharp & Fonagy, 2008). Given that the current study explored specific, in the moment, processes that contributed to maternal sensitivity in a distress context, the 'online' mentalization constructs are of primary interest.

Mind-mindedness. Mind-mindedness is a construct that emerged from Meins' (1997) work in cognitive development and is based in attachment theory as well as Vygotskian theory. Mind-mindedness describes the ability to take the infant's perspective, respond to the infant's mental state, and view the infant as an individual with a mind "rather than merely a creature with needs that must be satisfied" (Meins, 1997, p. 638). MM entails more than just treating an infant as an *intentional* agent, which means to acknowledge that the infant is capable of expressing a desire through a particular mode of communication. MM includes treating the child as a *mental* agent, which involves a further understanding that the child is capable of having representations of the world and different perspectives that make be taken toward reality (Meins, 1997). This construct is based on Ainsworth's descriptions of a sensitive mother as one who is capable of seeing things from the infant's point of view and respecting the child "as a separate person" (Ainsworth et al., 1971, p. 43).

One assessment of mind-mindedness used in Mein's studies was developed based on the question, "Can you describe [child's name] for me?" (Meins & Fernyhough, 1999; Meins,

Fernyhough, Russel & Clark-Carter,1998). While it could be argued that this measure reflects off-line mentalizing and is thus similar to parental reflective functioning described above, Meins and colleagues have also developed a measurement of mind-mindedness that reflects more on-line or real-time mentalizing (Meins et al., 2002, 2003). In this on-line interaction-based approach, mind-mindedness is assessed using any statements generated spontaneously by the mother during an interaction with the child (typically a 20-minute free play). The mother's statements made during the interaction are compared to a video recording of the interaction to note whether the mother's mind-related comments are accurately reflecting the child's internal state, based on the infant's observable cues (Meins et al., 2002, 2003). Mind-mindedness is related to reflective functioning and parenting goals as much as each considers the mother's capacity to treat the child as a psychological agent. These constructs differ in operationalization in that parenting goals and mind-mindedness assess on-line mentalizing in relation to observed parent-child interactions, whereas reflective functioning taps into the metacognitive representations that the mother holds about the child and her relationship with the child.

The benefit of focusing on goals and MM is that each of these constructs allows for an insight into the motives or intentions underlying a mother's behavioral response in a specific parenting context. Directly assessing a mother's ability to see things from the child's point of view during her interactions with her child compliments behavioral measures of sensitivity (Meins, 2013; Oppenheim & Koren-Karie, 2013). As Ainsworth (1974) described in her observations, a mother may fail to comply with her infant's cue for different reasons. For example, the mother may believe that the infant is "too excited, over-imperious, or wants something he should not have" (Ainsworth et al, 1974, p. 131). This is quite a different motive than if the mother finds "it is inconvenient or she is not in the mood for it" (Ainsworth et al.,

1974, p. 133), yet the observable behavior of the mother may be the same. Rather than exploring how a general representation of the child influences behavior towards the child (as with constructs such as reflective functioning), this study focused on capturing the mother's ability to treat the infant as a mental agent in real-time, during a specific interaction, by assessing maternal goals and MM upon reunion with her distressed infant. The existing research on goals and MM in relation to maternal sensitivity are reviewed next.

***Mind-mindedness and observed maternal sensitivity*.** Mind-mindedness has been found to be positively correlated with sensitivity in recent studies (Meins et al., 2001, 2003, 2012, 2013) reviewed below. MM is coded based on what the mother voices out loud about what might be going on in her child's mind. MM has two indices: (a) *appropriate* mind-related comments are those that appear consistent with the infant's current behavior, and (b) *non-attuned* mind-related comments which appear to be a misinterpretation of the infant's state or behavior. It is important to note that a behavior rated as sensitive may be paired with appropriate or non-attuned mind-related comment, and a behavior rated as insensitive may be paired with appropriate or non-attuned mind-related comment. Research conducted by Pawlby and colleagues (2010) with mothers with severe mental illness, found that appropriate mind-related comments were commonly linked with insensitive behavior. Appropriate mind-related comments have been positively correlated with sensitivity in a number of recent studies (r = .39, Meins et al. 2012 & 2013; r = .40, Meins et al., 2001). This same research has indicated that appropriate and non-attuned mind-related comments are unrelated (r = .07), and that non-attuned mind-related comments are not related to sensitivity (r = .04).

Mind-mindedness has not yet been examined in the context of infant distress, specifically. In the three studies linking mind-mindedness to sensitivity, both constructs are

measured during a free-play activity, which is typically a relaxed setting and may or may not include times of infant distress (Meins et al., 2001, 2012, 2013). The present study measured mind-mindedness and sensitivity during an episode of infant distress to examine whether the situational context of mother-infant interactions, such as infant distress, may influence the nature and strength of the relation between mind-mindedness and sensitivity that has been established in the literature.

The main element in both of these cognitive constructs (parenting goals and mind-mindedness) relates to understanding and prioritizing the infants' needs. Parenting goals have been part of the research literature related to child development and socialization, and taps into how a parent would respond to a child's state relevant to what a parent would like to promote for one's child (Dix 1991, 1992). Mind-mindedness, which assesses a parent's ability to understand things from the child's point-of-view, emerged from the research on reflective functioning and is based in Ainsworth's theory of sensitivity (Fonagy et al., 1991, Meins et al., 2001). Both of these constructs allow for the examination of subtle differences in parenting behavior that may not be observable, yet may be meaningful to infants. For example, some mothers engage in comforting behaviors because they want the infant to feel better, while others engage in comforting behaviors because they find the crying aversive and want it to stop (Leerkes et al., 2011). In addition to exploring these mentalizing constructs involved in holding the infant's perspective in mind, it is important to understand how maternal emotional responses to distress may relate to sensitivity, given that infant crying is affectively evocative for parents and often stressful.

Maternal emotion. Individual differences in general emotional characteristics have been linked with parenting behavior. For example, positive trait emotions have been linked with

responsive parenting (Adam, Gunnar, & Tanaka, 2004; Prinzie, Stams, Dekovic, Reijntjes, & Belsky, 2009); depressive symptoms have been linked with less sensitive maternal behavior (Musser, Ablow, & Measelle, 2012); and adaptive emotion regulation has been linked with the use of appropriate discipline (Lorber, 2012). Empirical studies have also examined parental negative emotion in response to child behavior. Studies with older children have shown links with parental negative emotion and quality of parenting. Negative emotional response to toddler misbehavior has been linked to harsh discipline (Lorber & O'Leary, 2005). Maternal anger and anxiety in response to children's behavior have been linked with less supportive and more negative parenting behavior (Dix et al., 2004).

A few studies have examined the link between maternal negative affect and infant attachment security, yet the findings are mixed. Maternal negative affect, as measured by observer-ratings during interactions with her infant, has been linked with less attachment security in one study (Main, Tomasini, & Tolan, 1979) and greater attachment security in another (Pauli-Pott & Mertesacker, 2009). Mother's self-reported experience of negative emotions has been linked with less attachment security, while in the same study, an openness to displaying negative emotions in front of one's infant was linked with greater attachment security (Izard, Haynes, Chisholm & Baak, 1991). One way to reconcile these different findings related to attachment security is to consider the different contexts in which maternal display of negative emotions are occurring. One hypothesis is that mothers' display of negative emotions may be adaptive in some contexts, as it teaches valuable lessons about emotion expression, but the display of negative emotions in contexts where the infant is distressed and reliant on maternal assistance to self-regulate may be less adaptive (Leerkes et al., 2011). This theory is consistent with empirical findings that highlight the importance of context (i.e., the context of child distress vs. non-

distress) when examining relations among parenting behaviors and child outcomes (Davidov & Grusec, 2006; del Carmen et al., 1993; Leerkes et al., 2009; McElwain & Booth-LaForce, 2006). A particular maternal behavior may have different meanings to a child, depending on whether the child is distressed or not distressed.

Another way to understand these mixed findings regarding maternal negative emotion and infant attachment outcomes is to consider different types or qualities of maternal negative emotion. Similar to the differentiation made in the section above on parenting goals, theory suggests that parental negative emotion that is self-focused (e.g., anger, anxiety) interferes with parents' ability to respond appropriately to children's cues (Dix, 1991). Whereas, emotional reactions that are that are negative and child-focused (empathic) increase the likelihood that a parent will respond appropriately (Dix, 1991). In fact, infant-focused (empathic) emotional reactions have been empirically linked with maternal sensitivity in one-year-olds (Dix et al., 2004; Koren-Karie, Oppenheim, Dolev, Sher, & Etsion-Carasso, 2002). In addition, in studies of mothers with toddlers, emotional reactions that are self-focused and negative (e.g., anger, anxiety) have been linked with less adaptive maternal behaviors such as withdrawing or responding intrusively (Cassidy, 1994; Lorber & O'Leary, 2005; Martin, Clements, & Crnic, 2002). Recent studies have explored maternal negative emotion in response to infant distress and have taken into consideration the differentiation between negative emotion that is mother-focused versus infant-focused. This research on negative maternal emotion in relation to maternal sensitivity is examined next.

Maternal negative emotion in response to infant distress. Research has indicated that there is substantial variability in maternal emotional reactions to infant crying, ranging from sadness and empathy to mild irritation or anxiety, to extreme hostility (Vecchio et al., 2009). As

reviewed above, theory suggests that negative reactions to crying may impact behavioral sensitivity to infant distress (Dix et al., 2004; Leerkes, 2010). Leerkes (2010) suggested that mothers who find crying aversive are unlikely to respond sensitively because these negative emotions undermine one's ability to focus on the infant's needs. Most of the research which has explored the relation between maternal emotional reactions to crying and maternal sensitivity has been structured such that emotional reactions to crying are measured prenatally, using standardized video-recordings of crying infants (not the mothers' own infants). Maternal sensitivity to distress is measured with the mother's own infant at 6 months of age (Leerkes, 2010; Leerkes et al., 2011, 2015).

In three studies by Leerkes and colleagues (Leerkes, 2010; Leerkes et al., 2011, 2015), mother's negative emotional reactions to standardized presentation of infant crying have been coded using a method developed by Dix and colleagues (2004) that categorizes emotional responses as mother-focused or infant-focused. Mother-focused negative emotional responses include irritated, angry, annoyed, frustrated, worried, nervous, and anxious responses that are focused on the mother's needs or concerns. Example statements include: "*I was irritated by the sound of the baby's cry*," and "*All that crying made me feel nervous like I am supposed to know what to do*." Infant-focused negative emotional responses include, sympathy, sadness, irritation, anger, frustration, concern, worry, and anxious. Example statements include: "*I felt sad for the baby*," "*I was angry that someone put the baby in that situation*," and "*I was anxious because I wanted to do something for the baby*."

In a sequence of three studies using paradigm described above, with *prenatal* measurement of maternal negative emotions to standardized infant distress and *postnatal* sensitivity to distress toward the mother's own infant at 6 months, Leerkes and colleagues

(Leerkes, 2010; Leerkes et al., 2011, 2015) have found mixed results. When examining maternal prenatal empathy (i.e., infant-focused negative emotion) in response to standardized infant crying, and mothers' later sensitivity to distress with own's own infant at 6 months, Leerkes (2010) reported there was no significant link between mothers' empathy to standardized infant distress and later sensitivity to distress with her own infant. In contrast, Leerkes et al. (2015) reported that mothers' infant-focused negative emotions (empathy) in response to standardized presentation of crying *were* positively correlated with sensitivity to distress with the mothers' own infants at 6 months ($r = .16$, $p < .05$). When examining mother-focused negative emotional responses (i.e., anger and anxiety) to standardized infant distress (in the prenatal period) in relation to mothers' later sensitivity to distress with one's own infant at 6 months, Leerkes (2010) reported a significant negative correlation ($r = -.22$, $p < .05$), such that, greater levels of maternal anger and anxiety (self-focused negative emotion) in response to standardized distress was associated with less sensitivity with one's own infant at 6 months of age. This inverse relation was maintained when included in regressions with other predictors of sensitivity to distress ($ß = -.23$, $p < .05$).

Leerkes and colleagues (2011) aimed to explore this significant association in more detail by examining maternal anxiety and anger separately. Using the same sample and data coding as Leerkes (2010), Leerkes and colleagues (2011) created separate scores for maternal anger and anxiety, the two types of maternal self-focused negative emotion. When analyzed separately, however, neither anger nor anxiety in response to standardized infant distress in the prenatal period was associated with sensitivity to distress with own infant at 6 months. Using a new sample, Leerkes and colleagues (2015) were unable to replicate the association found in the 2010 study between prenatal mother-oriented negative emotion in response to standardized infant

distress and sensitivity to distress with one's own infant at 6 months. In summary, when using standardized video-recordings of infant distress, one study found empathic (infant-focused) negative emotion to be linked with sensitivity to distress with own infant (Leerkes et al., 2015), while another study does not find a significant link (Leerkes, 2010). One study found that anger and anxiety (mother-focused negative emotions) were related to sensitivity to distress with own infant (Leerkes, 2010), while another two studies did not find a significant link (Leerkes et al., 2011, 2015). Results are mixed as to whether responses to standardized infant distress are related to sensitivity to distress in mother's own infant. The focus of the current study, however, was to explore how mothers felt about her *own infant's distress* and how this emotional reaction may be linked with sensitive behavior towards her infant's distress.

Maternal negative emotion and observed maternal sensitivity to distress. To date, only one study (Leerkes, 2010) has assessed mothers' emotional responses to her own infants' crying in relation to mothers' sensitivity to her own infants' distress. This (Leerkes, 2010) study, of the three by Leerkes and colleagues, is most relevant to the present study given that it specifically examined sensitivity to distress and also assessed mother's negative emotional responses to her own infant's distress. The findings of Leerkes (2010) are presented in more detail here. Negative emotion that was infant-focused (i.e., empathic) was a significant predictor of sensitivity to distress in one's own infant ($r = .34$, $p < .01$; $ß = .28$, $p < .05$). This finding supports Ainsworth's (1974) idea that maternal empathic emotion allows the mother to feel things from her infant's point-of-view and respond to infant distress in a soothing and compassionate way. Unexpectedly, Leerkes (2010) found that mother's self-focused negative emotion (e.g., anger, anxiety) in response to her own infant's distress was positively correlated with sensitivity to distress, ($r = .23$, $p < .05$). This was an unexpected finding because theory

suggests that self-focused negative emotion such as anger or anxiety would interfere with a mother's capacity to respond in a sensitive, infant-centered way (Dix, 1991; Dix et al, 2004; Leerkes, 2010). It is important to note, however, that this unexpected relation was not significant in the regression analysis when other predictor variables (including cue detection and parenting goals) were controlled.

Leerkes (2010) assessed maternal emotional response to both standardized infant distress (prenatally) and one's own infant (at 6 months of age), and found that the prenatal and postnatal scores were not significantly correlated. The very low correlation between prenatal responses to standardized infant crying and postnatal responses to the mother's own infant crying suggests that emotional responses to standardized video-recorded cries may involve different processes and elements than emotional responses when experiencing the distress of one's own infant in vivo. Prenatal and postnatal responses may differ because of greater investment in and knowledge of one's own child (Leerkes, 2010). In addition, a mother's emotional and cognitive responses to distress may change as a result of the actual parenting experience (Holden, 1988). These results illustrate that maternal emotional reactions to infant distress in general (standardized recordings) and emotional reactions to one's own infant's distress are not interchangeable, and it is not ecologically valid to substitute one construct for the other.

The present study builds upon previous research on maternal negative emotions and sensitivity to distress by examining the emotion experienced by mothers in response to *her own* infant's distress. In addition, the present study examined the *intensity* as well as the valence and focus of maternal emotion experienced in response to her own infant's distress. Although theory suggests that mother-focused negative emotions in response to her infant's distress may undermine a mother's ability to focus on the infant's needs (Dix et al., 2004; Leerkes 2010), this

has not been shown consistently in the research (Leerkes, 2010; Leerkes et al., 2011, 2015). It may be that intense negative reactions to infant crying interfere with sensitive responding to distress, whereas mild to moderate negative reactions are managed in such a way that sensitivity can still be provided during infant distress. Thus, examining the intensity of maternal emotion during mothers' own infant's distress, allows for further exploration of how mother-focused and infant-focused negative emotions may impact sensitive responding to one's own infant's distress.

Measurement of emotion. The measurement of emotional experience during interpersonal interactions poses a number of challenges, primarily because assessment of moment-to-moment variations in emotion experience cannot occur during the interaction without significantly disrupting it (Gottman & Levenson, 1985; Lorber, 2007). The studies exploring emotion and parenting interactions reviewed above have used various approaches to measuring emotional experiences while parenting. Many current methods used in the research literature involve the use of video-recording and retrospective self-report in order to capture emotion experience during parenting interactions. Three of these video-based methods, as well as the strengths and weaknesses of each, are reviewed below. The research most closely related to the current study, conducted by Leerkes and colleagues (Leerkes, 2010; Leerkes et al., 2011, 2015) involved video-replay at the end of the lab procedures. Mothers viewed an interaction with her own infant and then rate how strongly they felt 17 emotions (e.g., sad, irritated, concerned) on a 4-point scale ranging from 1 (*not at all*) to 4 (*very strongly*). The benefit of this method is that it allows mothers to identify a range of discrete emotions that they experienced while interacting with her own infant. Mothers were then asked to describe why they felt each of the emotions, which gives the opportunity to rate each emotion as mother- or infant-focused. The limitation of this method is that it does not capture moment-to-moment variation in emotion experience.

Gottman and Levenson (1985) developed and validated a creative measure that allows social partners to continuously rate one's emotional experience moment-by-moment using a video-recall technique. The measure was created to study marital interactions, in which real-time measurement of emotion would be too cumbersome or disruptive to the interaction itself. Participants watch a video-recording of the original experience and continuously rate one's emotional experience using a dial to express how they were feeling moment-by-moment during the interaction. This method is used in a set of studies by Lorber and colleagues to explore the role of emotion in parenting toddlers (Lorber & O'Leary, 2005; Lorber, 2007, 2012). The drawback of the video-recall dial method is that it limits self-report to two dimensions, such as positive or negative emotion.

A hybrid technique, introduced by Rosenberg and Ekman (1994) has been developed to address the limitation of the video-recall, and involves pausing the video when the participant moves the dial so that the participant can use Likert-scale for ratings of discrete emotion terms before resuming the video playback. This hybrid technique has been used in parenting studies conducted by Dix and colleagues (2004, 2007, 2009), which explore maternal emotion in relation to supportive parenting. The studies by Dix and colleagues (2004, 2007, 2009) also asked mothers to describe why they felt each emotion after rating it, and these responses were coded for mother- and child-focused concerns.

The current study was designed to measure both the intensity of moment-to-moment emotion as well as discrete emotions experienced when interacting with infants. However, a hybrid version of the video-recall measure was not chosen for the current study in order to avoid interruption of ongoing moment-by-moment emotion ratings. Instead, the current study used the original video-recall procedure (Gottman & Levenson, 1985). In addition, after completing the

dial rating, mothers are interviewed and asked for descriptions of her emotional experience during the interaction with her infant. This procedure allows for the measurement of moment-to-moment emotional intensity, which has been well validated in previous studies (Gottman & Levenson, 1985; Lorber, 2007). Gottman and Levenson (1985) and Lorber (2007) provided compelling empirical evidence that participants' autonomic activity during the video-recall session patterned the autonomic activity evident during the actual, original interpersonal interaction, suggesting that viewing the video was sufficient to recreate the affect experienced during the original episode. Studies using the hybrid measure (Rosenberg & Ekman, 1994; Dix et al., 2004, 2007, 2009) have not explored how pausing and rating/discussing each discrete emotion may impact the validity of the original measure. Another benefit of using the original video-recall measure is that it allows participants to rate one's emotional experience without the need to use words to express themselves. Emotion theory (Izard, 1993) suggests that it is important to measure emotion at this level to capture the non-verbally mediated aspects of emotional experience. For example, asking a participant to describe emotional experience involves a cognitive process that may filter or dampen the intensity of the experienced emotion (Izard, 1993). For this reason, the current study separately measured (a) non-verbally mediated dial ratings, which captured moment-by-moment intensity of emotional experience, and (b) verbal descriptions of the emotions experienced during interaction with one's own infant, which were coded as mother- or infant-focused. Given the importance of mother's emotional reactions to infant distress and the evocative nature of infant crying, it is important to review the research literature on maternal physiological regulation during infant distress, and its relation with sensitive responding to distress. A number of researchers have examined vagal regulation as a predictor of parenting behavior during challenging interactions with children. The research on

vagal regulation and parenting behavior is reviewed below.

Maternal vagal regulation. The autonomic nervous system (ANS) consists of the sympathetic and parasympathetic branches (SNS and PNS, respectively). Generally speaking sympathetic responses correspond to states of heightened arousal when there is a need for immediate action, such as fight or flight**,** whereas parasympathetic activity typically occurs during moments of rest, digestion, and social attention (Porges, 1996, 2011). The parasympathetic nervous system influences the heart directly via communication between a parasympathetic brain region (the nucleus ambiguous) and the 10th cranial (vagus) nerve. The influence of the nucleus ambiguus on the heart can be measured through what is known as heart rate variability (HRV), or the degree of change in heart rate (Berntson et al., 1997; Porges, 1996, 2011; Helm, Sbarra, & Ferrer, 2014). Heart rate typically varies in connection with respiration, speeding up when the person breathes in and slowing down when the person breathes out. Yet heart rate also varies due to changes in the degree of PNS activation of the heart (Berntson et al., 1997; Porges, 1996, 2011).

HRV is often operationalized as respiratory sinus arrhythmia, (RSA; Berntson et al., 1997; Porges, 1996, 2011). Respiratory-linked heart rate variability (RSA) is associated with vagal influence on the heart, and for this reason RSA is used as an approximation of the influence of the parasympathetic nervous system on the heart via the vagus nerve. More specifically, RSA reflects vagal efferent activity to the sino-atrial node, which is part of the electrical conduction system of the heart that is the impulse-generating (pacemaker) tissue, and thus the generator of sinus rhythm (Berntson et al., 1997; Porges, 1996, 2011). The RSA pattern arises from a dynamic interplay of cardiovascular and respiratory factors that serve as a gate-keeper for vagal influences on the heart (Berntson et al., 1997; Porges, 1996, 2011). Vagal

modulation of the heart rate fluctuates in coordination with respiration. Specifically, exhalation excites vagal neurons (vagal activation), which, in turn, exert an inhibitory effect on the heart, such that vagal activation slows heart rate, and introduces greater variation in the time between heart cycles (heart rate variability). Conversely, inhalation dampens vagal activity (vagal withdrawal), effectively blocking the influence of the vagus nerve on the heart (Berntson et al., 1993). Vagal withdrawal allows the sympathetic system to speed up heart rate. In sum, higher RSA indicates greater PNS stimulation (vagal activation), which results in both a lowering of heart rate (HR) and greater variation in the time between heart cycles

In the context of social relationships, RSA has been largely conceptualized through Porges' polyvagal theory (Porges, 1995, 1996, 2011) and Thayer's neurovisceral integration model (Thayer, Hansen, Saus-Rose, & Johnsen, 2009). Polyvagal theory integrates the evolution of the vagal system and social engagement across a variety of species (Porges, 1995, 1996, 2003). Humans (and many mammalian species) have a myelinated vagal nerve that modulates heart rate, leading to the pattern of RSA in heart rate described above. According to polyvagal theory, RSA should increase as individuals engage socially with one another and feel safe within the immediate environment (Porges, 1995, 1996, 2011). Conversely, decreases in RSA occur in concert as fight-or-flight responses become more dominant (Butler et al., 2006; Porges, 1996). These patterns of RSA suggest that vagal activity reinforces social engagement because it enhances feelings of positivity and safety (Porges, 2003).

The neurovisceral integration model describes the relations among heart rate variability and cognitive, affective, and autonomic regulation (Thayer et al., 2009). This integration model suggests that vagal tone (RSA at rest) indicates the individual's level of cognitive and affective flexibility, as well as capacity to efficiently organize physiological resources meet the demands

of the environment (Thayer & Lane, 2000). The myelinated vagus nerve serves to quickly modulate the heart, resulting in either a reduction in RSA to increase heart rate *without* a change in the sympathetic system, or an increase in RSA to enhance attention to highly relevant stimuli. Individuals with greater vagal tone have a greater capacity to control this fluctuation, and because the channel flows through a myelinated path, the modulations occur rapidly in response to changes in the environment. Therefore, those with higher vagal tone tend to show greater cognitive, attentive, and autonomic regulation.

In the past two decades, RSA has received much attention for its role in emotion regulation (Butler et al., 2006; Segerstrom & Nes, 2007). Porges (1995, 2007, 2011) and others (Appelhans & Luecken, 2006) have argued that the physiological regulatory function provided by the ventral vagal complex may mediate regulation following emotional arousal. Decrease in RSA from baseline (withdrawal) has been associated with attention to threat (Porges, 2007) and efforts at active coping (Porges, 1995), whereas an increase in RSA (augmentation) has been associated with emotion regulation, particularly in social contexts (Butler et al., 2006). Based on this body of theory and research, many have interpreted RSA withdrawal in response to challenge as a marker of effective regulation. However, recent research suggests that the implications of RSA withdrawal and augmentation may be context specific (Conradt et al., 2013; Moore et al., 2009). For example, in social contexts and situations of relatively neutral affect, children and adults typically show RSA augmentation (Butler et al., 2006; Lorber & O'Leary, 2005). However, when affect is highly negative, evidence suggests that less RSA withdrawal is associated with better cognitive functioning (Healy et al., 2011). RSA withdrawal and augmentation may also reflect individual differences in what is experienced as aversive or

challenging (Moore et al., 2009). For these reasons, it may be too simplistic a view to consider RSA withdrawal as uniformly adaptive.

Well-validated measures of maternal physiological regulation using RSA have been described in the empirical literature. Evidence from animal research has demonstrated the importance of maternal physiological regulation for active attention, engagement with the needs of offspring, and parenting behaviors (Hansen, Bergvall, & Nyiredi, 1993; Lonstein & Gammie, 2002). In humans, a limited number of studies have examined maternal physiological regulation and how this regulation may enhance or hinder her interactions with one's children. Research has been moving in the direction of examining parents' physiological regulation while interacting with children to understand the role that parents' self-regulation plays in support of positive interactions (Moore et al., 2009). Research with parents and children has demonstrated links between RSA augmentation, positive social engagement, and self-regulation (Hill-Soderlund et al., 2008; Skowron et al., 2013). In addition, vagal regulation has been examined during challenging and negatively charged discipline interactions with toddlers in studies that demonstrated links between more over-reactive discipline and larger decreases in maternal RSA (Lorber & O'Leary, 2005; Lorber, 2007).

Maternal vagal regulation during separation and reunion. Two notable studies have examined maternal RSA during the Strange Situation Procedure, and the findings indicate that maternal separations from one's child are associated with maternal RSA withdrawal (Hill-Soderlund et al., 2008; Mills-Koonce et al., 2009). Mills-Koonce and colleagues (2009) found that RSA declined during separations in the SSP for all mothers regardless of the child's attachment security, suggesting that separation is challenging for caregivers. Hill-Soderlund and colleagues (2008) found that mothers of secure infants showed lower RSA during the final

reunion of the SSP than did mothers of insecure–avoidant infants, interpreted as evidence of greater efforts to engage in interactive repair with a distressed child among mothers of secure infants. Although these studies did not include the level of distress of the child in the analysis, the SSP elicits distress from many children during the repeated separations.

Maternal vagal regulation and caregiving behavior. Research has indicated that interacting with distressed infants is typically associated with decreases in RSA (Mills-Koonce et al., 2007; Moore et al., 2009). One study found that RSA reduction in response to infant negativity was associated with less maternal harshness, especially among mothers of children with avoidant attachment (Mills-Koonce et al., 2007). The second study looked specifically at the relation between maternal sensitivity and vagal regulation during the Still Face procedure and provides evidence for ways in which maternal vagal regulation operates in multiple interactions with one's infant including free play, infant distress, and subsequent reunion (Moore et al., 2009). The first episode of the Still Face procedure is similar to a free play task, and involves mother and infant facing each other at eye-level with the instruction to interact as they normally would if they had a few minutes of free time to spend together. During this episode, maternal RSA decreased from baseline. The next episode of the Still Face procedure involves the mother looking away from the infant, with a neutral expression on her face. This episode is a form of separation, where mothers are restricted from engaging in social interactions with the infants. The study found increase in RSA from baseline during this period. The final episode of the Still Face is a reunion, where the mother can return to interacting with her infant as she normally would. During this period, mothers showed a decrease in RSA from baseline. Infants' negative affect during the reunion episode was negatively related to maternal RSA, such that mothers showed lower RSA during reunion when infants displayed more negative affect (Moore et al.,

2009). In addition, maternal sensitivity was negatively correlated with maternal RSA in the reunion episode such that higher levels of sensitivity were related to lower levels of RSA (Moore et al., 2009).

In sum, there is growing evidence that maternal physiological regulation is an important component in positive caregiving behaviors (Hill-Soderlund et al., 2008; Mills-Koonce et al., 2007; Moore et al., 2009; Sethre-Hofstad et al., 2002). However, some of the mixed findings in the research literature suggest that the implications of RSA withdrawal and augmentation may be context specific (Conradt et al., 2013; Butler et al., 2006; Healy et al., 2011; Lorber & O'Leary, 2005; Moore et al., 2009). More work is needed to identify specific patterns of vagal regulation during parenting interactions related to various elements in the environment such as the nature of the task at hand, the affective tone of the interaction, and the behavior of the social partner (Moore et al., 2009). In theory, parents who regulate one's own reactions effectively are more likely to be able to respond sensitively and attend to the needs of one's infant (Dix, 1991, 1992; Leerkes, 2010). Existing theory and research have suggested that RSA withdrawal indicates effective regulation during challenging situations, yet more evidence is needed to better understand how vagal regulation operates in relation to maternal sensitivity, particularly in the context of infant distress.

The current study measured vagal regulation during infant distress and reunion with the distressed infant. In addition, maternal perception of the parenting task at hand, was assessed using both self-report interview questions and a non-verbally mediated measure of emotional experience during infant distress. This multi-measure approach allows for a more specific understanding of what RSA withdrawal and augmentation may indicate for a mother responding to her distressed infant. By including vagal regulation as one of multiple predictors of sensitive

caregiving, the study allows for the examination of how RSA may interact with other cognitive and affective components of parenting in the context of infant distress.

Conclusion

Of the factors described above in the literature review, maternal goals and mind-mindedness are the two that have consistently predicted maternal sensitivity across a variety of empirical studies (Meins et al., 2001, 2012, 2013; Leerkes, 2010; Leerkes et. al, 2015). The constructs of parenting goals and mind-mindedness are considered to tap into cognitive processes that influence parenting behavior more generally (Dix, 1991; Leerkes, 2010; Leerkes et al, 2015). Both of these constructs are also related to an important and under-studied precursor of sensitivity as defined by Ainsworth: holding the infant's perspective in mind (Ainsworth, 1967; Ainsworth et al., 1974; Mesman & Emmen, 2013).

Recent studies have examined sensitivity to distress with statistical models that include multiple predictors simultaneously, including cognitive, emotional, and physiological responses to infant distress (Leerkes 2010; Leerkes et al., 2011, 2015). However, most of these studies have measured maternal response to infant distress with *expectant* mothers and standardized video-recorded clips of crying infants who were not the mother's own (Leerkes et al., 2011, 2015). Leerkes (2010) also demonstrated that the relation between prenatal and postnatal measures of maternal response to distress are in fact weak and non-significant. While the prenatal findings with standardized infant crying are interesting from a prevention perspective, the lack of correlation with mother's responses towards her own infant points to the need to conduct more research studying mother's responses to her own infant's distress. The current study examined how maternal responses to her own infant's distress (emotional reactions, physiological regulation, cognitive processing, and cue detection) are related to maternal

sensitivity to that same episode of infant distress.

The Present Study

The current study extends a line of research on sensitivity that focuses on infant distress and processes involved in responding sensitively to infant distress. Sensitivity to distress is particularly important because it has been found to be a stronger predictor of infant attachment than sensitivity in non-distress contexts (del Carmen et al., 1993; Leerkes et al., 2009, 2011). The present study examined two cognitive constructs (parenting goals and mind-mindedness) that capture what Ainsworth and colleagues (1978) described as the ability to "maintain infant's point of view" during infant distress. It is important to note that infant crying is an emotionally and physiologically arousing context for mothers, which may challenge or interfere with a mother's ability to respond sensitively to infant distress (Leerkes, 2010; Leerkes & Crockenberg, 2003; Mills-Koonce et al., 2007). Research to date has not consistently supported maternal emotion as a direct predictor of maternal sensitivity. Maternal negative emotion, however, may interact with other important variables to predict sensitivity. In the present study maternal negative emotion and vagal regulation were examined as a potential moderator of the expected links between maternal cognitions (i.e., maternal goals and maternal mind-mindedness) and sensitivity.

Infant-oriented goals and maternal mind-mindedness have consistently predicted maternal sensitivity across a variety of empirical studies (Meins et al., 2001, 2012, 2013; Leerkes, 2010; Leerkes et. al, 2015). Infant oriented-goals (Leerkes, 2010) have been examined in relation to sensitivity to distress in particular as well as sensitivity more generally, which is referred to as global sensitivity or total sensitivity. Global sensitivity scores include both sensitivity to distress and non-distress cues from the infant. One challenge in working with the

construct of mind-mindedness is that it has not yet been examined specifically in the context of infant distress. Rather, mind-mindedness typically has been examined in relation to global sensitivity, in the context of free-play interactions, which may or may not include times of infant distress (Meins et al., 2001, 2012, 2013). It is unclear if the relation between mind-mindedness and sensitivity would hold up in the context of distress when mothers need to regulate emotions for herself and simultaneously hold the infant's perspective in mind. The present study furthers research in this area by examining both parenting goals and mind-mindedness, during an episode of infant distress to explore how each predicts maternal sensitivity to distress.

Studies examining maternal emotional and physiological reactions to infant distress have focused primarily on the prenatal period, with mothers responding to standardized cries rather than one's own infant's distress (Leerkes, 2010; Leerkes et al., 2011, 2015). Leerkes (2010) is the only study to date that has examined maternal emotional responses to her own infant's crying, measuring both prenatal and postnatal maternal reactions to infant distress. The very low correlation between prenatal and postnatal scores reported by Leerkes (2010) suggests that emotional responses to standardized video-recorded cries may involve different processes and elements than emotional responses when experiencing the distress of one's own infant in vivo. It is important to acknowledge the relationship between a mother and her own child, and the complex and intense reactions that may develop in response to one's own infant's distress. The current study addressed this issue by exploring maternal emotional response and vagal regulation in relation to the mother's own infant's distress. Maternal negative emotion and vagal regulation were examined as a potential moderator of the expected links between maternal cognitions (i.e., maternal goals and maternal mind-mindedness) and sensitivity. It is important to understand whether mothers' emotional responses to infant distress interact with maternal goals and

maternal mind-mindedness to predict sensitivity. Likewise, maternal physiological regulation in the context of infant distress could interact with maternal cognition (i.e., maternal goals and maternal mind-mindedness) to predict sensitivity.

The present study seeks to address the issues described above by examining maternal emotional response and vagal regulation when the mother's own infant is distressed (rather than during the prenatal period using standardized video-recordings of other infants crying), while controlling for the intensity of the infants' distress. In addition, the present study examined cognitive predictors of sensitivity (parenting goals and mind-mindedness) in the context of distress. Maternal goals and mind-mindedness were assessed in relation to a time when the infant is fussing or crying, and then maternal sensitivity was measured during that same period of infant distress. Finally, the present study examined potential interactions between maternal responses to infant distress (emotional reactions and vagal regulation) and known cognitive predictors of sensitivity (parenting goals and mind-mindedness). The present study extends current research literature by examining predictors of maternal sensitivity to distress in a low-income sample of racially and ethnically diverse mothers. The aim of the current study was to build understanding of potential factors that may contribute to mother's behavior towards her distressed infant in the context of demographic risk.

The current study examined two different families of hypotheses. The first family of hypotheses, considered primary for this study, centers on the relation between maternal goals and maternal sensitivity to distress. The second family of hypotheses was exploratory in nature and examined the relation between mind-mindedness and sensitivity to distress. There are two main benefits in separating the hypotheses into families. First, it allows the exploratory hypotheses about mind-mindedness to be analyzed separately from the hypotheses about maternal goals.

Since maternal goals and mind-mindedness are both constructs that tap into mother's capacity to hold the infant's perspective in mind, there is likely to be overlap in the variance explained by these cognitive constructs. If maternal goals and mind-mindedness were considered together, this overlap in variance explained may make it difficult to understand how these constructs and interaction terms relate to maternal sensitivity. In addition, exploring two separate families of hypotheses maximizes the opportunity to pick up on interaction effects, which are an important element of this study in the prediction of sensitivity to distress. A total of eight hypotheses were proposed:

Research Hypotheses:

Family A related to maternal goals

1. Infant-oriented parenting goals will be positively associated with observed maternal sensitivity to infant distress, after controlling for demographic factors.
2. Intensity of maternal negative emotion during infant distress in the arm restraint task will moderate the relation between maternal goals and maternal sensitivity to distress such that the benefit of infant-oriented goals in sensitive responding to distress will be stronger for mothers who have less intense negative emotional reactions to the infant's distress, and relatively weaker for those with intense negative reactions to the infant's distress.
3. Maternal self-focused negative emotions in response to her infant's distress during the arm restraint task will moderate the relation between maternal goals and maternal sensitivity to distress, such that the benefit of having infant-oriented goals for sensitive responding to distress will be stronger for mothers who have infant-focused negative emotions towards the infant's distress, and relatively weaker for those with self-focused negative reactions to the infant's distress.

4. Maternal vagal regulation during the reunion with the infant, after the arm restraint, will moderate the relation between maternal goals and maternal sensitivity to distress, such that the benefit of having infant-oriented goals for responding sensitively to distress will be stronger for mothers who have greater vagal withdrawal, and relatively weaker for those with vagal augmentation during the reunion with the distressed infant.

Family B related to maternal mind-mindedness

5. Mind-mindedness will be positively associated with observed maternal sensitivity to infant distress, after controlling for demographic factors.
6. Intensity of maternal negative emotion during infant distress in the arm restraint task will moderate the relation between maternal mind-mindedness and maternal sensitivity to distress such that the benefit of appropriate mind-mindedness in sensitive responding to distress will be stronger for mothers who have less intense negative emotional reactions to the infant's distress, and relatively weaker for those with intense negative reactions to the infant's distress.
7. Maternal self-focused negative emotions in response to her infant's distress during the arm restraint task will moderate the relation between maternal mind-mindedness and maternal sensitivity to distress, such that the benefit of appropriate mind-mindedness for sensitive responding to distress will be stronger for mothers who have infant-focused negative emotions towards the infant's distress, and relatively weaker for those with self-focused negative reactions to the infant's distress.
8. Maternal vagal regulation during the reunion with the infant, after the arm restraint, will moderate the relation between maternal mind-mindedness and maternal sensitivity to distress, such that the benefit of having appropriate mind-mindedness for responding

sensitively to distress will be stronger for mothers who have greater vagal withdrawal, and relatively weaker for those with vagal augmentation during the reunion with the distressed infant.

Chapter 3

Method

Participants

A total of 100 mothers were selected for this study from a larger, longitudinal study focused on parenting in low-SES families. Participants were recruited from a mid-sized city in the Northeastern section of the United States through a large community health care provider, childcare centers, and a variety of community agencies serving low-income mothers and children. The goal in recruiting from these local agencies was to select a low-income sample that reflects the racial and ethnic diversity of the community so that the constructs of interest can be studied in low-SES families across racial and ethnic backgrounds. The metropolitan area is racially and ethnically diverse (52% Black, 20% Latinx), where 44% of children live in households with income below the poverty level (US Census Bureau, 2017). Mothers were included in the present study if they indicated on the consent form that data could be used for future research and met the following criteria: (a) mothers completed the 6-month lab visit and interview in English, (b) the dyad participated in the stressor task during the 6-month lab visit, (c) the infant fussed or cried during the stressor task and subsequent reunion period, and (d) observational codes of mother's behavior after the stressor task were available. The first 100 participants who completed the 6-month lab visit and met the inclusion criteria listed above were included in this study sample.

The final sample was attained by screening 140 participant dyads that met the first two criteria described above: completing the stressor task and interview at the 6-month lab visit. Of the 140 dyads screened, 18 infants (13%) were excluded because they did not fuss or cry during the stressor task. Among the remaining 122 dyads in which the infant was distressed to some degree during the arm restraint task, 22 did not have an observational code for sensitivity to

distress. There were three primary reasons that a score for sensitivity to distress was unavailable: missing codes (n = 5), the infant self-soothed or fell asleep before the end of the arm restraint task (n = 8), or the infant did not show distress during the reunion period (n = 9). It is important to note that dyads were included in the study (n = 100) only if infants displayed distress during the arm restraint and during the reunion period.

Mother-reported race and ethnicity was as follows: 39% as Black/African American, 10% as biracial/multi-racial, 35% as White/European American, 8% as Latina, 1% as Asian/Asian American. Information about race and ethnicity was missing for 7% of the participants due to data collection error or mothers declining to answer. Regarding family income, 45% of mothers in this sample reported a household income of $10,000 or less per year, 26% reported between $10,001 and $30,000, 12% reported between $30,001 and $50,000, and 13% reported a household income of $50,001 or more per year. Data on household income was not known for 4% of mothers. Mothers also reported on the highest level of formal education received with 11% not finishing high school, 32% completing high school or GED, 24% completing some college but not finishing a degree, 7% completing an associate degree, 13% completing a bachelor's degree, and 10% completing a graduate degree. No information regarding educational attainment was available for 4% of mothers.

Table 3.1
Maternal Race, Income and Education

Variable Name	Values	Percent
Race/Ethnicity (n = 100)	Black/African American	39%
	White	35%
	Bi-racial/Multiracial	10%
	Latina	8%
	Asian	1%
	Missing	7%
Household Income (n = 100)	$10,000 or less	45%
	$10,000 – 30,000	26%

	$30,001 – 50,000	12%
	$50,001 or more	13%
	Missing	4%
Educational Achievement (n = 100)	Grade School	1%
	Some High School	10%
	High School Diploma/GED	32%
	Some College	24%
	Associate Degree	7%
	Bachelor's Degree	13%
	Graduate Degree	9%
	Missing	4%

Coding Teams

Most of the measures included in the present study (five of the eight) involved coding of behaviors, transcripts, or both. This section serves to describe the three independent coding teams and clearly identify the measures coded by each team. Two of the coding teams (Team A & Team C) were created, trained, and monitored for reliability as part of a larger longitudinal study. Team A coded infant level of distress, and descriptive data about the coders were unavailable. Maternal sensitivity to distress was coded by two White women, both of whom were trained by an expert rater (Team C).

Coding Team B was created for the purpose of the present study to code the constructs of maternal goals, maternal mind-mindedness, and maternal negative emotion. Team B included two coders, one of whom is the author. Given the diversity of the sample in terms of maternal age, race, and ethnicity, identity-related factors were considered in selection of the second coder for Team B (i.e., Black woman from the East Coast in her twenties) to balance the identity-related characteristics of the first coder (i.e., White woman from the Mid-West in her forties). The second coder was blind to the hypotheses of the study. The two coders trained together using practice cases pulled from the larger study. Practice cases were identified as cases that did not meet the eligibility criteria (i.e., missing outcome data) yet the essential coding components

(i.e., infant distress during stressor task and maternal interview completed in English) were intact and available. In the section below, measures that involve coding are identified as coded by Teams A, B, and C.

Measures

Demographics. Demographic characteristics were collected via maternal self-report when infants were six months old. The demographics questionnaire requested information about a variety of topics related to family structure in addition to the following information about socio-economic status: maternal race and ethnicity, whether the participating infant was the mother's first child (primipara), household income, and mother's highest level of education. All questionnaire data were collected via data collection software, Questionnaire Development System™ (V. 3.0, NOVA Research Company, Silver Spring, MD). This software automatically reads the questionnaire questions and multiple-choice answers aloud to allow participants who may have reading difficulties to complete the questionnaire portion of the study. Participants were given the option to switch to a silent mode if they preferred to read the questions themselves.

Race was self-reported, and participants were able to select more than one race/ethnicity category, if applicable. Thus, if a participant selected more than one race/ethnicity, the variable was recoded into a new category: bi-racial/multi-racial/multi-ethnic. Participants indicated whether or not the participating infant was the mother's first child by answering *yes* or *no*, with additional response options for *don't know* or *decline to answer*. Participants reported household income by selecting from a predetermined range of values (as reported in Table 3.1). Finally, maternal educational status was self-reported via open text response to the prompt "please tell us about your highest level of education completed." Individual responses were then grouped by

educational achievement (as reported in Table 3.1). Demographic information was missing or not provided for seven participants, which brought the sample size down to 93.

Infant distress. Infant distress was measured using video-recordings of the arm restraint task by coding length and intensity of infant behavioral reactivity (vocal and facial behaviors; Braunger-Rieker & Stifter, 1996; Sherman, Stupica, Dykas, Ramos-Marcuse & Cassidy, 2013). The arm restraint task is considered a preferred assessment strategy when studying infant distress in the first year of life (Braungart-Rieker & Stifter, 1996; Moscardino & Axia, 2006), and has been used successfully to elicit frustration with infants aged 2 – 12 months (e.g., Bennett, Bendersky, & Lewis, 2005; Camras, Oster, Campos, Miyake, & Bradshaw, 1992; Moscardino & Axia, 2006; Sherman et al., 2013). Data from Leerkes and colleagues (2004, 2010) provide evidence of reliability and validity for the arm restraint procedure as a way to elicit distress from infants at six months of age. Expression of infant distress was an inclusion criterion in the present study, so all 100 cases included infant distress data.

All infant vocalizations and facial expressions were coded for quality of distress every five-seconds on a four-point scale (0 = *no vocalizations, no negative facial affect*; 1 = *mild vocal and/or facial negative reactivity*; 2 = *moderate vocal and/or facial negative reactivity*; and 3 = *high vocal and/or facial negative reactivity*). Mild negative reactivity is negative reactivity of low intensity, such that the infant shows a fussy facial expression, a fussy vocalization, or both. A fussy vocalization with a flat facial expression may also be counted here. Moderate negative reactivity is characterized as moderate in intensity, including crying, an open squared mouth, and open or partially opened eyes. Finally, high negative reactivity refers to high-intensity cues, such as screams, closed or partially closed eyes, and wide or open mouth. Breath holding, tears, silent screams, and color changes in the face would also indicate high intensity reactivity.

Behavioral coding of infant videotaped behaviors began immediately following the start of the task (i.e., when the research assistant placed her hands on the infant's arms to restrain them). Coding ended one minute after the research assistant had released the infant's arms, as soon as the research assistant turned the car seat away from the camera to face the mother. Infant distress was calculated by adding negative reactivity ratings across all five-second epochs to obtain a score for overall infant distress.

Each infant's negative behavioral reactivity was coded from videos of the arm restraint task by trained coders as part of a larger study (Coding Team A). Five percent of cases (i.e., 10 cases) were used as training cases. In this process, randomly matched raters independently coded assigned cases. These independent codes were used to calculate coder reliability during training. Coding partners met to review ratings for shared cases and discuss discrepancies. A final rating was assigned via consensus. Once raters achieved intra-class correlation (ICC) scores above .90, they were allowed to code as independent coders. Reliability was checked throughout the coding process to monitor for coder drift. In the full dataset, 15% (i.e., 31 cases) were double coded to calculate overall rater reliability. ICC estimates and 95% confidence intervals were calculated based on a single-rater, absolute agreement, two-way random effects model. ICC values less than 0.5 indicate poor reliability, between 0.5 and 0.75 moderate reliability, between 0.75 and 0.9 good reliability and, values above 0.9 indicate excellent reliability (Koo & Li, 2016). For the present study, ICC estimates were .98 (CI = .96 - .99), indicating excellent inter-rater reliability.

Maternal goals. Mother's goals in relation to infant distress were coded using transcripts from an open-ended question, modeled after Leerkes (2010): "*When you were with (name of child) after the task was over, describe the goals of your behavior at that time*."

Responses were evaluated according to 18 categories developed by Leerkes and colleagues (2004). Each category was scored as being present or absent for each mother. Responses were rated by two coders (Coding Team B), and reliability was established before coding began. A set of 15 initial reliability cases were pulled from the larger study. The criterion for selection of the initial reliability cases was that outcome data were unavailable, thus the initial reliability cases were not eligible to be included in the present study. Inter-rater reliability was calculated using Cohen's kappa statistic (Cohen, 1960). Kappa was 0.87 ($p < 0.001$) indicating almost perfect inter-rater reliability. After establishing initial reliability, on-going reliability was assessed throughout the coding process to monitor for coder drift. Disagreements were resolved by discussion. In the final dataset, 25% of cases were double coded and inter-rater agreement was found to be $\kappa = 0.83$ ($p < 0.001$).

The score for *infant-oriented* goals was the sum of eight categories: wants to soothe infant, wants secure relationship/attachment with infant, wants infant to be happy, wants infant to understand and value emotions, views crying as a means of communication, wants her response to contribute to infant social competence, coping skills, or other indices of positive adjustment (e.g., self-esteem). Scores for *infant-oriented* goals could range from 0 to 8. The score for *mother-oriented* goals was the sum of 10 categories: wants to minimize crying, stop crying because it bothers her or interferes with her productivity; wants infant to control emotions without her assistance, wants infant to conform/behave, wants to respond in a way that makes herself and others think she is a good parent, does not want to spoil infant, places emphasis on physical needs over emotions, and places emphasis on cognitive development over emotions. Scores for *mother-oriented* goals could range from 0 to 10. Based on previous research (Leerkes et al., 2004; Leerkes, 2010), a difference score was created by subtracting the sum of mother-

oriented categories from the sum of the infant-oriented categories such that high scores reflect more infant-oriented goals. Difference scores could range from -10 (*extremely mother-oriented*) to 8 (*extremely infant-oriented*). In previous studies, this difference score has been associated with sensitivity to distress (Leerkes et al., 2004; Leerkes, 2010), demonstrating the usefulness of a score based on the relative extent to which mothers endorsed each type of goal. A goal score was coded and calculated for all 100 cases.

Maternal mind-mindedness. Mind-mindedness was coded from maternal responses to five questions in the video-recall interview. The interview provided a structured opportunity for the mother to verbalize her impressions of what it was like for her infant during the arm restraint and subsequent reunion. Interview-based statements have been used previously to code mind-mindedness with mothers of toddlers (Meins et al., 1998) where it has been found to be associated with parenting behavior, as expected. The approach used in the present study, using interview-based statements in a distress context with mothers of infants, is novel. For this reason, hypotheses related to this measure of mind-mindedness were exploratory.

The mind-mindedness coding procedures outlined by Meins and Fernyhough (2010) were adapted for the present study in order to use interview-based statements made by the participants after the infant distress task and subsequent reunion. First, all the *mind-related* statements were identified in the transcript. Mind-related comments include an internal-state term referring to the infant's mind or emotion such as references to wishes and desires, mental states (e.g., thoughts, knowledge, interests), mental processes (e.g., recognition, remembering, decision making), emotions, and attempts to manipulate people's beliefs (Meins & Fernyhough, 2010). Two trained coders (Coding Team B) completed this first coding step for each case and disagreements were resolved through discussion. After all of the mind-related statements were identified and

agreed-upon by the two coders, the mind-related comments were then coded by Team B as *appropriate* or *non-attuned* based on a digital recording of the infant's behavioral cues during the distress task.

A comment was coded as an *appropriate* mind-related comment if the coder agreed with the mother's reading of her infant's internal state, based on the infant's observable cues. Although it is not possible for the coder to know for certain the internal state of the infants, it is important to remember that mothers' statements were in reference to a time when infants were in distress, so *appropriate* responses typically included some reference to the distressed emotional state. Examples of *appropriate* comments include: "he wanted to get out of the car seat," "she didn't like that," "he was trying to break free," "she was angry that she couldn't move," "he hates the car seat," "she probably wanted her pacifier," "he didn't understand," and "she needed a distraction."

A code of *non-attuned* was given if the coder believed that the mother was misinterpreting her infant's internal state, the internal state comment referred to an event that had no obvious relation to the infant's current activity, or the referent of the mother's internal state comment is not clear. Examples of *non-attuned* comments in the present study, when the infant was fussing or crying, included: "he's fine," and "she was just mad out of nowhere."

The mind-mindedness coding system was strictly dichotomous, so a mind-related comment was classified either as *appropriate* or as *non-attuned*. Coding Team B established inter-rater reliability before coding began, using a set of 10 reliability cases pulled from the larger study. Initial reliability, calculated using Cohen's kappa statistic (Cohen, 1960), was found to be perfect ($\kappa = 1.0$, $p < 0.001$). After establishing initial reliability, on-going reliability was assessed throughout the coding process to monitor for coder drift. Disagreements were

resolved by discussion. In the final dataset, 25% of cases were double coded and inter-rater agreement was found to be excellent ($\kappa = 0.98$, $p < 0.001$). Based on previous studies (Meins et al., 2001, 2002, 2003), the final scores for *appropriate* mind-related comments and *non-attuned* mind-related comments were expressed as a proportion of the total number of comments produced by the caregiver in order to control for differences in verbosity. Mind-mindedness was coded, and a score was calculated for all 100 cases.

Maternal emotion ratings. Maternal emotion in response to infant distress was measured in two ways: intensity of negative emotions and whether the negative emotions were infant-focused or self-focused. Intensity was measured moment-by-moment during a video-recall procedure. Self-focused versus infant-focused negative emotion was coded from an interview following the video-recall.

Intensity of negative emotion. Participant's ratings of her emotions experienced during the arm restraint procedure and subsequent reunion with her infant was collected using a video-reviewing procedure adapted from Gottman and Levenson (1985) and described in Dix et al. (2004). A number of studies have provided evidence for the validity of the video-recall procedure for measuring emotion during interpersonal interactions (Dix et al., 2004; Gottman & Levenson, 1985; Lorber, 2007; Lorber & O'Leary, 2005; Lorber & Slep, 2005). Both Lorber (2007) and Gottman and Levenson (1985) reported that participants' physiological reactions during the later video-recall patterned the physiological reactions evident during the actual interaction, suggesting that viewing the video was sufficient to re-create the emotion experienced during the original episode. This concurrent validity was demonstrated whether the video-recall procedure happened within an hour after the actual interaction (Lorber, 2007) or several days after the interaction (Gottman & Levenson, 1985). Patterns of maternal vagal regulation were

compared during the video-recall task and the in vivo interaction to examine the validity of the measure in this sample. In the present study, the vagal regulation scores from the in vivo task and the video-recall task were strongly related ($r = .65$, $p < .001$).

In the present study, mothers were shown a video recording from the arm restraint task that she just completed with her infant. This laboratory task was designed to be an emotion-eliciting task for mom and infant. During the video review procedure, the mother watched herself and her infant on the screen and made continuous ratings of her own emotion using a rating dial apparatus (see Appendix F for an image of the rating dial). The dial operated on a circular meter, such that when the dial was in the 12 o'clock position the rating was completely neutral. The dial could be turned 120° to the left or the right. The region to the left of center represented positive emotion and was shaded green (from 8 to 11 o'clock). The region to the right of center represented negative emotion and was shaded red (from 1 to 4 o'clock). The region on the dial from 11 to 1 o'clock was shaded yellow to represent subtle emotions on either side of neutral. The dial was described as *extremely negative* at one end of the dial (farthest you can turn the dial red), *extremely positive* at the opposite end of the dial (farthest you can turn the dial green), and *neutral, neither positive nor negative* at the center position. The mother was instructed to use her own definitions of negative, positive, and neutral in rating how she was feeling during the arm restraint task.

A computer with custom dial-recording software was configured to acquire dial output continuously. Dial position was expressed on a scale from 0 to 5, with 2.5 corresponding to *neutral*. The dial output was analyzed in 5-second intervals, and the average rating for each interval was recorded and output to a Microsoft Excel workbook. The method of calculation for emotional intensity, based on previous studies (Dix et al., 2004; Gottman & Levenson, 1985;

Lorber, 2007), involved addition of values across all 5-second intervals. In the present study, the average scores were first transformed so that *neutral* was equal to 0, and the scale ranged from -2.5 to +2.5. Then, scores for each interval were added together for a total sum indicating the level of emotional intensity rated during the task.

Considerable technical difficulties interfered with data collection and interpretation of data output. Thirty-five of the 100 cases included in this study had valid dial rating data, with problems stemming from three sources: missing video (3), incorrect settings on data collection device (26), invalid protocol or calibration (36). For this reason, the emotional intensity variable was not used in the analyses as proposed. The two hypotheses involving this variable were not included in the final analysis. Rather, exploratory analyses were used to examine the relations between emotional intensity and other variables of interest at a preliminary level.

Self-focused v. infant-focused negative emotion. The video-recall interview occurred immediately after the video-recall dial rating task, so that the mother could verbally express her emotional experience during the arm restraint task. Responses to three questions were used to code mother's emotional reaction, (a) *"What was it like for you during the time [child] was in the car seat?"* (b) *"What was it like for you during the reunion?"* and (c) *"How did it feel when [child] needed comfort from you?"* These responses were used to code mothers' emotions as *infant-focused* or *self-focused*. Coding was based on the procedures outlined in Dix et al. (2004) and Leerkes (2010). The concerns underlying each emotion were coded as infant-focused when they were the result of concern for the child's welfare, a desire to help the infant, sympathy or empathy for the infant, or feeling pleasure or pride in the infant's behavior. Examples of *infant-focused* concerns include "*I felt sad for the baby because he was upset*," and "*I was irritated because the study was frustrating him*." In contrast, emotions were coded as *self-focused* when

mothers expressed concern about her own interests rather than the infant's. This included responses that expressed negative attributions of the infant, negative reactions to the infant's behavior, or concerns that the infant's behavior will reflect poorly on the mother. For example, "*I was irritated by the sound of the cry*," or "*All that crying made me feel nervous*."

Two previous studies, both of which have used this coding system for maternal emotional responses to one's own children, have done so in conjunction with a video-reviewing procedure using different methods and prompts. Leerkes (2010) asked mothers to rate how strongly they felt 17 different emotions (e.g., sad, irritated, concerned) on a 4-point scale ranging from 1 (*not at all*) to 4 (*very strongly*) after watching a video of one's child. Mothers were then asked why they felt each emotion they endorsed, and these responses were coded as *infant-* or *self-focused*. Leerkes (2010) provided convergent validity for the coding system, finding that *infant-oriented* emotions were linked with sensitivity to distress, as expected. Dix and colleagues (2004) asked mothers to endorse six emotion categories during the video-recall task, pausing the video each time the mother moved the dial. Mothers were then asked why they felt each emotion they endorsed, and these responses were coded as *infant-* or *self-focused*. Dix and colleagues (2004) also provided convergent validity for the coding system, as *child-oriented* emotions were linked with supportive parenting, as expected.

In the present study, the same coding system used by Leerkes (2010) and Dix et al. (2004) was applied to maternal responses to interview questions at the end of the rating dial task. In order to avoid interruption of ongoing moment-by-moment emotion ratings, the present study did not pause the dial-rating task each time the dial was moved to ask the mother about her experienced emotion. Rather, after using the rating dial to indicate one's emotional experience during the video-review, mothers were asked open-ended questions about how they felt at

different points during the arm restraint task. The main difference between the present study and the two reviewed above is that the open-ended prompts allowed mothers to generate emotion terms rather than choosing from a set list.

Mothers' responses were transcribed, and emotions were coded as *infant-focused* or self-*focused*. Responses were rated by Coding Team B. Reliability was established before coding began ($\kappa = 0.91$, $p < 0.001$), based on a set of 10 reliability cases pulled from the larger study. After establishing initial reliability, on-going reliability was assessed throughout the coding process to monitor for coder drift. Disagreements were resolved by discussion. In the final dataset, 25% of cases were double coded and inter-rater agreement was found to be substantial ($\kappa = 0.80$, $p < 0.001$). The number of *self-focused* negative emotions and *infant-focused* negative emotion codes were tallied. The final score was calculated by subtracting the number of *infant-focused* negative emotions from the number of *self-focused* negative emotions. Negative emotion was coded, and a score was calculated for all 100 cases.

Respiratory sinus arrhythmia. Heart rate data collected via the ambulatory electrocardiograph (ECG) equipment were edited using Mindware software and respiratory sinus arrhythmia (RSA) values were derived according to the following procedure. The ECG signal was sampled at 1000Hz and passed through an A/D converter. RSA values were derived from the inter-beat interval series and re-sampled at 25 milliseconds to create a stationary wave form. The integral of the power in the RSA band (.12 to .40 for mothers) was extracted to obtain the RSA statistic. Trained research assistants visually inspected the data for movement artifacts and removed R spikes identified by the software in error. A mid-beat feature was used to estimate missing beats due to movement artifacts. RSA was extracted in 30-second epochs. Due to

technological issues in collecting ambulatory signals which were then transmitted via wi-fi, RSA data were missing for 10 cases.

Maternal RSA values used in the present study were taken from the arm restraint task (stressor) and post-arm restraint reunion period (reunion), as well as from two "baseline" tasks. Exploring two lab tasks as a potential baseline was based upon recommendations in the literature (Jennings, Kamarck, Steward & Eddy, 1992; Quintana & Heathers, 2014; Thayer et al., 2009). The standard Baseline task (which occurred at the start of the lab) was designed as a passive, resting baseline to measure heart rate and respiration before the stressor tasks were introduced. However, comparing a passive, resting baseline to an interactive reunion period introduces a number of potential confounds in terms of sustained attention, psychomotor activity, and social interaction with infant (Laborde, Mosley & Thayer, 2017). For this reason, an alternative "vanilla" baseline was identified as an additional point of comparison from which to create a change score (Jennings et al., 1992). The Free Play task was determined to be the best alternative baseline task given that it is designed to be a restful period and occurs in the lab just prior to the arm restraint stressor task. The psychomotor and attentional components of Free Play are similar to the arm restraint reunion given that mom is more likely to be physically active and attending to her infant, in comparison to the resting Baseline. Theoretically, using Free Play as a vanilla baseline would limit some of the potential confounds due to cardiac differences in passive and active contexts (Jennings et al., 1992; Quintana & Heathers, 2014; Thayer et al., 2009).

The RSA values for the six (30-second) epochs of arm restraint were averaged for a single value: maternal RSA during the 3-minute arm restraint stressor. The RSA values for the four (30-second) epochs of 2-minute post-arm restraint reunion were averaged for a single value:

maternal RSA during arm restraint reunion. For the standard baseline, an average value was created from the RSA values for the 10 (30-second) epochs of the 5-minute Baseline task. The alternative baseline value was created by averaging values for the final 10 (30-second) epochs of the Free Play task. To create vagal regulation scores, the RSA value during baseline was subtracted from the mother's arm restraint RSA values (Llabre, Spitzer, Saab, Ironson, & Schneiderman, 1991). Four vagal regulation scores were created: Arm Restraint Stressor—Baseline, Arm Restraint Stressor—Free Play, Arm Restraint Reunion—Baseline, and Arm Restraint Reunion—Free Play. One measure of vagal regulation was chosen for the final analysis; a decision which was based upon exploratory analysis described in the next chapter.

Maternal sensitivity. Video recordings were coded for maternal sensitivity according to the well-established NICHD guidelines (1999). This measure of sensitivity was selected because a recent review examining over 50 measures of sensitivity used in empirical studies concluded that the NICHD measure was most similar to Ainsworth's sensitivity scale in terms of conceptualizing and operationalizing the construct (Mesman & Emmen, 2013). In this coding system, sensitivity to distress and sensitivity to non-distress are separate subscales. Sensitivity to distress, which is rated on a scale of 1 (*low sensitivity*) to 5 (*high sensitivity*), was selected as the subscale of interest for the present study because sensitivity was scored at the end of the arm restraint procedure, when the mother was told that the task was over and was free to interact with her infant. This post-arm restraint reunion period lasted for four minutes. Given that infants in this study were selected for demonstrating distress during the arm-restraint, the post-arm restraint reunion period offers an opportunity to observe the maternal caregiving in response to infant distress. Researchers have used this reunion period as a means to assess the manner in which the mother regulates or fails to regulate her infant's negative affect or distress (Leerkes, 2010;

Grienenberger, Kelly, & Slade, 2005).

Sensitivity to distress codes were scored as part of a larger study (Coding Team C). Coders were trained to use the NICHD sensitivity scale (NICHD, 1999) by Dr. Margaret Owen, who was one of the Principal Investigators in the NICHD Study of Early Child Care and Youth Development (1990-2007) and is thus an expert in the coding system. All coders were blind to additional information. Inter-rater reliability was established before coding began. Reliability was assessed on a randomly selected 17% of cases and was assessed on an on-going basis to prevent coder drift. The ICC estimates for sensitivity to distress were calculated based on an absolute-agreement, 2-way random-effects model. The average measure ICC estimates were 0.94 (with a 95% confidence interval from .77 to .94, $F_{(30,30)} = 16.01$, $p < .001$) indicating excellent reliability. Availability of outcome data was an inclusion criterion in the present study, so all 100 cases included a sensitivity to distress score.

Procedures

The study procedures consisted of a two-hour laboratory visit that occurred when the infant was six months old. Mothers who were interested in participating in the study after receiving information from flyers, posters, and/or speaking with a research staff member were screened for eligibility over the phone. If mothers were eligible to participate, they were invited to come into the laboratory to take part in the study. Mothers and infants were video recorded continuously during the lab procedures. Although mothers and infants completed various tasks and activities during the visit to the laboratory, only those tasks relevant to the present study are described here.

After completion of the consent process, mother and infant were connected to electrocardiograph (ECG) equipment to monitor heart rate via three electrodes linked to an

ambulatory device. Heart rate output was transmitted via a wireless signal to a computer equipped for data acquisition. After connection to the ambulatory heart rate monitors, the lab started with a 5-minute baseline, during which time mothers' resting heart rate was measured. Heart rate data were time locked with video data and were collected continuously while mothers and infants participated in a variety of tasks and activities.

Approximately 30 to 60 minutes into the lab visit, mother and infant had a free play activity, designed to give the participants a break from the structured lab tasks and facilitate recovery from the associated stress of competing the first part of the lab visit. Following the free play activity, infants were administered a stressor task designed to elicit distress (i.e., arm restraint procedure). The arm restraint procedure was drawn from the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith & Rothbart, 1994). In this procedure, mothers were asked to place the infant in a car seat, secure the straps for safety, and position themselves behind the infant's field of view. A research assistant proceeded to gently restrain the infant by holding the infant's arms against the infant's body. After two minutes of arm restraint, or 30 seconds of hard crying (i.e., when the infant's cry is at peak distress and the infant cannot increase the distress level any further), the research assistant released the infant's arms. The infant was then left in the car seat for 60 seconds to allow for the use of self-regulatory behaviors such as self-soothing (e.g., sucking thumb). Lastly, the mother was allowed to go to her infant and parent in whatever way she thought appropriate (this is referred to as the reunion period in the present study).

Following the arm restraint and reunion period, each mother was shown a video recording of the arm restraint task in which her infant participated. As mothers watched the video, they used a video-recall dial rating system to continuously rate the intensity of emotions

they had experienced during the infant arm restraint (Dix et al., 2004; Gottman & Levenson, 1985). After the mother watched the video and rated the intensity of emotion she remembered feeling, a set of open-ended interview questions were asked about the mother's thoughts, feelings, and goals during the arm restraint task and the subsequent reunion. The interview questions and responses were recorded with a digital audio device and later transcribed for coding. Childcare was provided during the video-recall dial rating and interview portions of the laboratory visit. Each part of the study was accompanied by a monetary incentive. Specifically, mothers received $50 for participating in the two-hour laboratory visit when infants were 6 months old.

Design

Data were analyzed using SPSS for Windows, version 25 (IBM Corporation, 2017). Two series of hierarchical (or blocked) regressions were conducted to examine the primary and exploratory families of hypotheses. The first regression analysis examined maternal goals and potential moderators in the prediction of maternal sensitivity to distress. The second regression analysis explored mind-related comments and potential moderators in the prediction of maternal sensitivity to distress. Both hierarchical regression analyses had the same criterion variable: maternal sensitivity to distress after the arm restraint task. The benefits of separating the analyses into two families were two-fold. First, it allowed the exploratory hypotheses about mind-mindedness to be analyzed separately from the hypotheses about maternal goals. Since maternal goals and mind-mindedness are both constructs that tap into mother's capacity to hold the infant's perspective in mind, there was likely to be overlap in the variance explained by these cognitive constructs. If maternal goals and mind-mindedness were included in the same regression analysis, this overlap in variance explained may have made it difficult to understand

how these constructs and interaction terms related to the criterion variable. In addition, running two separate sets of hierarchical regressions for maternal goals and mind-mindedness maximized the opportunity to identify interaction effects, rather than pitting the two cognitive constructs against each other to compete for variance in the dependent variable.

Hierarchical regression involves entering separate blocks of variables to determine how much of the variance in the outcome is explained by each block. Initial variables entered are typically demographic characteristics. Preliminary analyses were conducted to identify any potential effects of demographic (e.g., race) or contextual (e.g., infant distress) variables on maternal sensitivity. Multicollinearity was assessed by examining the relations between all variables. Violations of assumptions such as normality and homoscedasticity of residuals were examined as part of each regression analysis.

Two moderation models were removed from the hypotheses. Both moderators related to maternal emotion were unable to be included. Due to significant missing data from the dial rating task and intensity of emotion variable, the hypotheses related to this moderator were unable to be examined. Therefore, the planned analysis included six hypotheses, rather than eight as originally proposed. The primary analyses (*Hypotheses 1-3*) examined the relation between maternal goals and maternal sensitivity to distress and tested two moderators (negative emotion and vagal regulation) of the relation between goals and sensitivity to distress. The exploratory analyses (*Hypotheses 4-6*) mirrored the primary analyses using maternal mind-mindedness as the predictor of maternal sensitivity to distress and tested the same moderators (negative emotion and vagal regulation) of the relation between maternal mind-mindedness and maternal sensitivity.

Chapter 4

Results

Data Preparation

Initial procedures were conducted to prepare the data for analysis, assess the validity of measurement, and finalize the sample. These steps included data cleaning, clarifying criteria for inclusion of cases, assessing missing data and adjusting the hypotheses accordingly, and creating final variables based on exploratory analysis. The sections below describe the steps involved in data preparation.

Data cleaning. To reduce the likelihood of typographical errors, data were entered into a database in duplicate by different research assistants. Duplicate databases were compared using SPSS to identify incongruent data fields. Discrepancies were resolved by checking the original or raw data and entering the correct value.

Limiting sample due to income. One of the primary aims of this study was to better understand predictors of maternal sensitivity to distress in a low-income context. For this reason, the final sample was intentionally limited to include low-income households only, and 13 cases with household income above $50, 000 were eliminated. After intentionally limiting the sample to low-income households, the sample size was 87 participants.

Missing data. The quantity and nature of missing data per variable were examined (Table 4.1). Due to the complexity of the study design, some data were missing due to technological issues (ten cases were missing RSA data). Additionally, seven cases were missing demographic data due to participant non-response. Cases with missing data were excluded from analysis. Thus, the sample size varied for different analyses conducted.

Table 4.1
Missing Data per Variable

Variable	Missing	Variable Total
Sensitivity to Distress	0	100
Maternal Goals	0	100
Mind-mindedness	0	100
Negative Emotion	0	100
Vagal Regulation	10	90
Emotional Intensity	65	35
Potential Covariates		
Infant Distress Level	0	100
Primipara Status	12	78
Educational Level	4	96
Household Income	4	96
Race/Ethnicity	7	93

Note: Highest variable $N = 100$.

Eliminated hypotheses. Given that 65% of the data collected with the emotion rating dial were missing or not useable, the two hypotheses involving the emotional intensity variable were dropped from the primary analysis and were explored in a post-hoc analysis.

Selecting final variable for vagal regulation. To aid in the selection of variables used in the regression analysis, descriptive statistics and correlations were examined for the four vagal regulation variables. The sample size for these exploratory analyses was 77. Descriptive statistics for the four vagal regulation scores can be found in Appendix G. It is common in the existing literature to find non-normal distributions of vagal regulation values (Chambers & Allen, 2007; Lewis, Furman, McCool & Porges, 2012; Laborde et al., 2017). In this sample, skewness fell within an acceptable range for two vagal regulation variables: those calculated with Free Play as baseline. Kurtosis values fell outside of the acceptable range for all four variables, suggesting that these variables were not normally distributed. Correlations among the four vagal regulation variables can be seen in Table 4.2. As expected, the two variables based on the stressor task of arm restraint were positively correlated ($r = .48$, $p < .01$), as were the two

variables based on the reunion task of the arm restraint (r = .53, p < .01). Similarly, the two variables using the traditional resting Baseline were positively correlated (r = .34, p < .01), as were the two variables using Free Play as a vanilla baseline (r = .42, p < .01). Only one of the vagal regulation variables, *Reunion – Free Play*, was correlated with the outcome variable, sensitivity to distress (r = -0.33, p < .01). Bivariate correlations were examined between the four potential vagal regulation variables and other predictors with only one significant relationship found: a positive correlation between Stressor – Resting calculation of vagal regulation and the mind-mindedness variable (r = -0.29, p < .01).

Table 4.2
Bivariate Correlations for Potential Vagal Regulation Variables and Outcome Variable

		Stressor Resting	Stressor Free Play	Reunion Resting	Reunion Free Play	Sensitivity to Distress
Stressor - Resting Baseline	*r*	1	.48**	.34**	-0.03	0.10
Stressor - Free Play Baseline	*r*		1	-0.60	.42**	-0.17
Reunion - Resting Baseline	*r*			1	.53**	-0.18
Reunion - Free Play Baseline	*r*				1	-0.33**

Note. **p < .01.

The vagal regulation variable measured as the difference score between Reunion and Free Play was chosen to be included in the regression analysis for three reasons. First, vagal regulation during the reunion task is of primary interest in the present study due to the focus on maternal behavior during this same time period. In addition, calculating vagal regulation using a vanilla baseline has strong theoretical support (Jennings et al., 1992; Quintana & Heathers, 2014; Thayer et al., 2009). The Free Play task offers a point of comparison with fewer potential

confounds than a resting Baseline, given the demands of the reunion task (attending to and interacting with one's own infant). Lastly, based on the exploratory analysis, the variable calculated using *Reunion - Free Play* is appropriately suited to regression analyses as it is correlated with the outcome variable but none of the other predictors (Tabachnick & Fidell, 2007).

Descriptive Statistics and Correlations

Normality of continuous data was examined via descriptive statistics and visual inspection. Based on previous literature, acceptable ranges of skewness and kurtosis were calculated using the standard error of each measure multiplied by two (Tabachnick & Fidell, 2007). To evaluate skewness, a range was created between the negative and positive values of .55 (2 x Standard Error of Skewness). If the value of skewness fell within this range, then the distribution was considered to not be inappropriately skewed. Kurtosis was evaluated using the same formula described above (2 x Standard Error of Kurtosis) to construct a range of normality from -1.08 to 1.08. Descriptive statistics for dependent and independent variables are presented in Table 4.3.

Table 4.3
Descriptive Statistics for Dependent and Independent Variables

	n	Min	Max	*M*	*SD*	Skewness	Kurtosis
Sensitivity to Distress	75	2	5	3.52	.78	.20	-.36
Infant Distress	75	6	70	38.68	14.59	-.08	-.44
Goals	75	-2	5	1.16	1.19	.08	.87
Mind-Mindedness	75	.00	.35	0.14	.07	.57	-.02
Negative Emotion	75	0	6	1.87	1.54	.80	.27
Vagal Regulation during Reunion	75	-3.10	3.75	0.27	1.05	-.12	2.53

The mind-mindedness and negative emotion variables were positively skewed, with values that fell outside acceptable ranges. Normality of these variables has not been reported in

previous studies. One reason the distribution of these variables in the present study might be non-normal is because this study is examining maternal responses to infant distress, which are expected to be negatively valanced situations. Transformation was not used to address non-normality in the mind-mindedness nor negative emotion variables because the type of transformation necessary to adjust for skew would change the original units to a log scale, making it more difficult to interpret results. In addition, regression analyses are considered robust enough to tolerate some departures from normality (Tabachnick & Fidell, 2007). Acceptable ranges of skewness and kurtosis were observed for the outcome variable (maternal sensitivity to distress) as well as the following predictors: infant distress and maternal goals. The histograms and Q-Q plots for these variables also demonstrated characteristics of a normal distribution.

As a preliminary step, relations between the outcome variable and continuous predictor variables were examined using a bivariate correlation matrix. A strong regression model includes predictors that are correlated with the outcome variable but uncorrelated with the other predictors (Tabachnick & Fidell, 2007). Examining the relations in this way allows one to see whether the predictors are related to the outcome in the present sample, as would be expected based on the theoretical model. As can be seen in Table 4.3, the outcome variable, sensitivity to distress, was significantly and positively correlated with maternal goals ($r = .34$, $p < .01$) and maternal vagal regulation ($r = .33$, $p < .01$). None of the other predictors were significantly related with sensitivity to distress. In addition, none of the continuous predictor variables were significantly correlated with each other in this sample. The sample sizes for these preliminary correlations (noted in Table 4.3) vary depending on the amount of missing data for a particular variable.

Table 4.4
Bivariate Correlations for Predictor and Outcome Variables

		Sensitivity Distress	Infant Distress	Goals	Mind-Minded	Negative Emotion	Vagal Regulation Reunion – FP
Sensitivity to Distress	*r*	1	.08	.34**	.10	.04	-.33**
	n		85	85	85	85	75
Infant Level of Distress	*r*		1	.14	-.13	-.03	-.06
	n			85	85	85	75
Maternal Goals	*r*			1	-.04	-.07	-.18
	n				85	85	75
Mind-Minded	*r*				1	.13	.03
	n					85	75
Maternal Negative Emotion	*r*					1	-.08
	n						75
Vagal Regulation Reunion	*r*						1
	n						

Note. $^{**}p < .01$.

Preliminary Analysis for Sensitivity to Distress

Consistent with standard procedure (Tabachnick & Fidell, 2007), to maximize power, preliminary analyses were conducted to identify potential links between demographic or contextual variables and the dependent variable. Based on published recommendations and previous studies (e.g., Meins et al., 2011; Meins, 2013; Leerkes et al., 2015, 2017), the following variables were considered as potential covariates: household income, race, maternal education, whether the infant was the mother's first child, and level of infant distress.

Household income. The categories for this variable were based on three pre-determined ranges from which participants could choose to describe one's household income: *below $10k,*

*$10k—$30k, $30k—$*50k. The relation between sensitivity to distress and household income was analyzed using ANOVA (n = 81). Ratings of maternal sensitivity to distress varied among the three income groups ($F_{(2, 78)} = 4.66$, $p < .05$). In particular, Tukey's post-hoc test indicated that moms with a household income of $10,000 or less had significantly lower scores than moms with a household income of $30,000—$50,000. Eleven percent of the variance in sensitivity to distress was attributable to household income ($\eta^2 = 0.11$), and thus household income was included as a control variable.

Race. ANOVA (n = 78) was used to examine the relation between sensitivity to distress and race measured with four groups (*Black/African American*, *Latina*, *Bi- or Multi-racial*, and *White/European American*). Ratings of maternal sensitivity to distress varied among racial groups ($F_{(3, 74)} = 3.50$, $p < .05$). Tukey's post-hoc test indicated that for moms who identified as *Black/African American*, scores for sensitivity to distress were lower than for moms who identified as *White/European American*. Differences in sensitivity ratings were not statistically significant for the remaining group pairings. Twelve percent of the variance in sensitivity to distress was attributable to self-identified race ($\eta^2 = 0.12$). Thus, race was included as a control variable.

Educational level. Based on open-ended responses to a question asking moms about highest level of education they had completed, four categories were created to capture the range of values: *some high school, high school diploma or GED, some college or associate degree, bachelor's degree or higher*. One case did not fit within these four categories and was removed as an outlier. Maternal level of education was examined in relation to sensitivity to distress using ANOVA (n = 81). Ratings of sensitivity to distress varied among the four educational levels ($F_{(3, 77)} = 2.87$, $p < .05$). Tukey's post-hoc test indicated that the mean score for moms

with a *high school diploma or GED* was significantly different than the mean score for moms with a *bachelor's degree or higher*. Differences in sensitivity ratings were not statistically significant for the remaining educational levels. Ten percent of the variance in sensitivity to distress was attributable to educational level ($\eta^2 = 0.10$). Thus, educational level was also included as a control variable.

In summary, preliminary analyses identified three covariates related to maternal sensitivity to distress which were included in the regression models as control variables: household income ($n = 81$), race ($n = 87$), and education ($n = 81$). The relations among these three covariates were explored using Chi-Square tests of independence. None of the Chi-Square tests were valid when including the variables as categorized (three income groups, four racial categories, and four educational groups) due to low expected counts in more than 20% of the cells. Even after collapsing categories for race (*White* and *People of Color*) and income (*below $30k and $30k—50k)* the relations with education could not be tested using Chi-square.

The Chi-Square test with income and collapsed racial categories (*White* and *People of Color*) was valid. Based on a sample size of 78, results indicated a statically significant relation between participants' race and household income ($X^2_{(2, N = 78)} = 11.14$, $p < .05$). A higher proportion of *White* moms were in the income group *$30k—$50k* compared to the other two income groups (*below $10k* and *$10k—$30k*). A lower proportion of moms of color were in the income group *$30k—$*50k compared to the other two income groups (*below $10k* and *$10k—$30k*). In this sample, household income and race are confounded. All three control variables were included in the regression analyses, despite evidence of possible collinearity, given that a unique contribution of this study is to examine constructs of interest in a low-income, diverse sample.

Primipara status. Response to the demographic question of whether the mother had children prior to the infant with whom she was participating was used to create a binary variable for primipara (given birth to one child) and multipara (given birth to more than one child) status. An independent-samples *t*-test was conducted to compare sensitivity to distress between primiparas and multiparas. There was not a significant difference in the sensitivity to distress scores for the primipara (M = 3.58, SD = .64) and multipara (M = 3.56, SD = .76) groups ($t_{(67)}$ = .15, p = .43). These results suggest that the experience of having more than one child was not linked with sensitivity to distress in this sample.

Infant distress. This continuous variable had values ranging from 6 (brief, fussy behavior) to 70 (intense, prolonged crying). The relation between sensitivity to distress and level of infant distress was examined with a bivariate correlation (n = 85). Level of infant distress was not correlated with the dependent variable (r = .11, p = .32) and therefore was not added to the regression model in Block 1, as proposed.

Regression Analyses

In this section, the results of two hierarchical regression models are presented, examining predictors of maternal sensitivity to infant distress. The first regression model tests *Hypotheses 1* to *3* related to the construct of maternal goals, and the second model tests *Hypotheses 4* to *6* related to the construct of mind-mindedness.

Preliminary analysis for maternal goals. The maternal goals model was generated to test the relation between maternal goals and maternal sensitivity to distress. Before running the regression model, preliminary analyses were conducted to explore the relations between maternal goals and unique aspects of this sample to rule out potential confounds. First, household income was examined in relation to maternal goals, given that this sample was limited to participants

with a household income below $50,000. Goals did not differ among the three household income groups in this low-income sample (*below $10k, $10k—$30k, $30k—$50k*), based on the results of an ANOVA (n = 81).

Next, ANOVA (n = 78) indicated that there were no differences in maternal goals among the four racial groups in this racially diverse sample.

Lastly, maternal education was examined as a potential confound with maternal goals, given that goals is measured via verbal expression, and elaborated or varied verbal expression could influence goals ratings (Leerkes, 2010). Based on ANOVA (n = 81) with four categories of education, there were no significant differences in maternal goals among the education groups.

Models for maternal goals. To investigate the potential relations between maternal goals and maternal sensitivity to distress, a hierarchical (or blocked) regression model was run. In a hierarchical regression model, groups of variables are entered as blocks into the model to understand the effect of each group of variables on the outcome or dependent variable, after controlling for other blocks previously entered into the equation.

The first block of variables included demographic characteristics, or control variables. All of the control variables included in this model were categorical. Before entering categorical variables into a regression model, they need to be recoded as a series of dichotomous variables. Each of the categorical control variables (household income, race, education) was dummy coded in the following way. For all but one category of the variable, a new variable was created with a value of one for each case that was a member of that category and zero indicating not being a member of that category. The category not recoded into a dichotomous variable was the reference group, or the category to which all the other categories were compared. Two

household income categories were included in the regression: *below $10k* and *$10k—$30k*. The category of *$30k—$50k* was used as the reference group given that most of the existing research on sensitivity has been conducted with middle-class samples. Racial categories included were *Black/African American*, *Latina*, and *Bi- or Multi-racial*. The *White/European American* category was the reference group because most of the existing research on sensitivity has been conducted with *White/European American* mothers. Education was included as a control variable by adding three categories to the regression: *some high school, high school diploma or GED,* and *some college or associate degree*. The category of *bachelor's degree or higher* was left out as a reference group because many existing studies of sensitivity are based on middle-class samples which are most likely to have this level of education.

The second block included the maternal goals variable. The third block contained the potential moderating variables of negative emotion and vagal regulation, followed by both interaction terms in the fourth block. Due to listwise deletion, the sample size for the full model (up through block #3) was 73.

Assumptions tested. Hierarchical multiple regression is based on the following assumptions: linearity; the absence of multicollinearity; the homoscedasticity, independence, and normality of residuals; and an absence of leverage points or outliers which may influence the model (Garson, 2010; Tabachnick & Fidell, 2007).

Testing for linearity involved examining the relation between predictors and the outcome to determine whether the relation is linear. Scatterplots were examined, and a fit line was added to the scatterplots to determine linearity. Linearity was established in each case. Predictors that are highly collinear (i.e. linearly related) can cause problems in estimating the regression coefficients. Multicollinearity of predictors was not detected in VIF and tolerance statistics. VIF

and tolerance are reciprocal statistics (Garson, 2010), therefore reporting only one set of values is necessary. A commonly accepted limit for VIF values is < 4.0 (Garson, 2010) and the levels for this model were within this acceptable range.

Homoscedasticity means that the error variance should be constant (homogenous across levels of the predicted values). In order for this assumption to be satisfied, residual errors should be dispersed in a relatively equal manner on a scatterplot graph where standardized residuals are on one axis and predicted values on the other. If the model is well-fitted, there should be no pattern to the residuals plotted against the fitted values. For the maternal goals model, the scatterplot showed some patterning, suggesting that the variance of the residuals is non-constant. This may be an indication of heteroscedasticity.

To satisfy the assumption of independence of residuals, the Durbin-Watson coefficient was calculated as a test of whether errors associated with one observation are not correlated with the errors of any other observation. The range of possible values for the Durbin-Watson statistic is 0 to 4, and a statistic near 2 is considered acceptable (Garson, 2010). For this model, the coefficient was 1.97, indicating an absence of autocorrelation.

Normality is a term used to describe the assumption that the error terms of the variables (residuals) are normally distributed. A visual analysis of the P-P plot and histogram of the standardized residual error indicated some deviation from a normal distribution. However, the tests of normality were not statistically significant, indicating that the standardized residuals from this regression conform to the assumption of being normally distributed (Tabachnick & Fidell, 2007).

To determine whether outliers or leverage points were present that could affect the model Cook's distance was examined. In linear regression, an outlier is an observation with a large

residual (Tabachnick & Fidell, 2007). This means that it is an observation with an unusual value on the outcome variable, given the values on the predictor variables. A leverage point is an observation with an extreme value on a predictor variable (Tabachnick & Fidell, 2007). Leverage is a measure of how far an observation deviates from the mean of that variable. Cook's distance can be thought of as a general measure of influence, as it combines information on residuals and leverage (Field, 2005). The conventional cut-off point for Cook's D is 4/n, which in this regression model is 4/73 or .055. The initial results of the maternal goals model indicated that 3 cases exceeded this cutoff, with all others falling below this threshold. The regression model was run a second time, with these three outliers removed, and although the findings were similar, the model with outliers removed explained more variance and the fit statistics were slightly improved. The results of the regression model with outliers removed (sample size of 70) are reported below. Note that the coefficient of determination (the percentage of the variance in the dependent variable that is attributed to the independent variables) is reported in terms of adjusted R^2 which takes into account the potential for greater sampling error variance and is considered to be a more accurate estimate for small samples (Hill & Thompson, 2004).

Model summary. The full model is presented in Table 4.5. The first model, which included control variables (race, household income, and education) in the prediction of sensitivity to distress was significant ($F_{(8, 61)} = 3.24$, $p < .01$). Race, household income, and education together explained 21% of the variance in maternal sensitivity to distress (adjusted $R^2 = .21$, $p < .01$). Analysis of unstandardized and standardized coefficients indicated that self-identification as *Black* compared to *White* had a negative statistically significant relation with the outcome variable ($b = -0.64$ and $\beta = -0.44$, $p < .01$).

The second model which added maternal goals to the equation, was statistically significant ($F_{(9, 60)} = 3.91$, $p < .01$) and explained approximately 28% of the variance in maternal sensitivity to distress (adjusted $R^2 = .28$). Adding maternal goals to the model in the second block explained an additional 7% of the variance in maternal sensitivity to distress after controlling for the relations of the demographic variables ($\Delta R^2 = .07$, $p < .05$). Analysis of unstandardized and standardized coefficients indicated that higher ratings on maternal goals (more infant-oriented) were positively related to higher scores on observed maternal sensitivity to distress ($b = .19$ and $\beta = .30$, $p < .05$).

The third model (full model) which included the demographic variables, maternal goals, and the potential moderators (negative emotion and vagal regulation) was significant ($F_{(11, 58)} = 3.69$, $p < .01$). The full model explained approximately 30% of the variance in maternal sensitivity to distress (adjusted $R^2 = .30$). Adding vagal regulation and negative emotion to the model in the third block did not significantly increase the amount of variance explained compared to the previous model. Analysis of unstandardized and standardized coefficients indicated that *Black* identity ($b = -0.50$ and $\beta = -0.34$, $p < .05$) and maternal goals ($b = 0.16$ and $\beta = 0.26$, $p < .05$) both contributed unique variance to the outcome in the full model. The fourth model examined the interaction terms and was not significant.

Table 4.5
Hierarchical Regression Model Exploring Relations among Maternal Goals and Maternal Sensitivity to Distress, Taking into Account Household Income, Race, Education, Negative Emotion, and Vagal Regulation (n = 70)

	Block 1: Control Variables	Block 2: Primary Predictor	Block 3: Potential Moderators
	b	*b*	*b*
Income below $10k	-0.17	-0.14	-0.13
Income between $10k & $30k	-0.16	-0.14	-0.20
Black/African American	-0.64**	-0.62**	-0.50*
Latina/Hispanic	-0.59	-0.58	-0.31
Multiracial	-0.45	-0.31	-0.16
Some High School	-0.46	-0.10	-0.19
HS diploma or GED	-0.49	-0.28	-0.29
Some College	-0.15	0.05	0.03
Goals		0.19*	0.16*
Negative emotion			0.02
Vagal regulation			-0.16
Adjusted R^2	0.21**	0.28**	0.30**
R^2	0.30**	0.37**	0.41**
Change in R^2		0.07*	0.04

Note: b = the unstandardized regression coefficient
*$p < .05$, **$p < .01$

Hypotheses tested. Results of this model support *Hypothesis 1* by indicating that goals are significantly related to sensitivity when controlling for demographic variables. Neither *Hypothesis 2* nor *Hypothesis 3* were supported by the results because the addition of the moderators to the regression model did not explain any additional variance in the outcome.

Preliminary analysis for maternal mind-mindedness. The maternal mind-mindedness model was generated to test the relation between maternal mind-mindedness and maternal sensitivity to infant distress. Before running the regression model, preliminary analyses were conducted using ANOVA to explore the relations among maternal mind-mindedness and other

predictors to rule out potential confounds. Mind-mindedness did not differ among three household income groups in this low-income sample (n = 81). Based on a sample size of 78, no differences were found in maternal mind-mindedness among the four racial groups.

Maternal education was examined as a potential confound with mind-mindedness, given that the measurement is based on verbal expression and elaborated or varied verbal expression could influence mind-mindedness ratings. ANOVA (n = 81) was used to examine the relations among mind-mindedness ratings and level of education. Ratings of mind-mindedness varied among the four groups ($F_{(3, 77)} = 4.08$, $p < .01$). Tukey's post-hoc test indicated differences between moms who attained a *high school diploma or GED* and moms who had a *bachelor's degree or higher*, such that moms with a lower educational level had lower mind-mindedness scores. Differences in mind-mindedness ratings were not statistically significant for the remaining group pairings. Measure of effect size estimated that almost 14% of the variance in mind-mindedness was attributable to maternal educational level ($\eta^2 = 0.14$).

Models for maternal mind-mindedness. To investigate the potential relation between maternal mind-mindedness and maternal sensitivity to distress, a hierarchical regression model was run in the same fashion described above for maternal goals. The first block of variables entered into the analysis contained categorical demographic characteristics. Household income, race, and educational level were dummy-coded to be included in the regression as dichotomous variables in Block 1. Household income categories included in the regression were *below $10k* and *$10k—$30k*. The category of *$30k—$50k* was left out as a reference group given that most of the existing research on sensitivity has been conducted with middle-class samples. Racial categories included were *Black/African American*, *Latina*, and *Bi- or Multi-racial*. The *White/European American* category was left out as a reference group as most of the existing

research on sensitivity has been conducted with *White/European American* mothers. Educational categories included in the regression were: *some high school, high school diploma or GED,* and *some college or associate degree.* The category of *bachelor's degree or higher* was left out as a reference group for the same reason given for the analysis of maternal goals. The second block included the maternal mind-mindedness variable. The third block contained the potential moderating variables of negative emotion and vagal regulation, followed by both interaction terms in the fourth block. Due to listwise deletion, the sample size for the full model (up through block #3) was 73.

Assumptions tested. The same procedures described above in testing assumptions for the maternal goals model were also used to test assumptions for the maternal mind-mindedness model. Testing for linearity involved examining scatterplots using a fit line, and linearity was established in each case. Multicollinearity of predictors was not detected in VIF and tolerance statistics. The VIF levels for this model ranged from 1.10 to 3.31, all falling below the commonly accepted limit of 4.0 (Garson, 2010). Homoscedasticity for the maternal mind-mindedness model was visually examined using a scatterplot with standardized residuals on one axis and predicted values on the other. The scatterplot showed some patterning, suggesting that the variance of the residuals is non-constant. This may be an indication of heteroscedasticity. The Durbin-Watson statistic for this model was 1.85, indicating an absence of autocorrelation, and satisfying the assumption of independence of residuals. A visual analysis of the P-P plot and histogram of the standardized residual error indicated some deviation from a normal distribution, but the tests of normality were not significant, indicating that the standardized residuals from this regression conform to the assumption of being normally distributed.

To determine whether outliers or leverage points were present that could affect the model, Cook's distance was examined. The initial results of the maternal mind-mindedness model indicated that three cases exceeded the conventional cutoff for Cook's distance. The regression model was run a second time, with these three outliers removed. The model with outliers removed explained more variance and the fit statistics were slightly improved. The results of the regression model with outliers removed (sample size of 70) are reported below. As before, adjusted R^2 is reported in the text below because it is considered a more accurate estimate of the amount of variance in the outcome variable explained by a model with a small sample (Hill & Thompson, 2004).

Model summary. The results of the maternal mind-mindedness model are presented in Table 4.6. The first model, which only included control variables (race, household income, and education) in the prediction of sensitivity to distress, was significant ($F_{(8, 61)} = 3.24$, $p < .01$). Race, household income, and education together explained 21% of the variance in maternal sensitivity to distress. The second model which added mind-mindedness to the equation, was statistically significant ($F_{(9, 60)} = 2.84$, $p < .01$). However, adding mind-mindedness did not explain any additional variance compared to the previous model.

The third model (full model) which added potential moderators (vagal regulation and negative emotion) to the equation, was statistically significant ($F_{(11, 58)} = 2.97$, $p < .01$). The full model including demographic variables, mind-mindedness, vagal regulation, and negative emotion explained approximately 24% of the variance in maternal sensitivity to distress (adjusted $R^2 = .24$). Adding vagal regulation and negative emotion to the model in the third block did not significantly increase the amount of variance explained compared to the previous model. Analysis of unstandardized and standardized coefficients indicated *Black* self-identified

race (b = -0.50 and β = -0.34, $p < .05$) and vagal regulation (b = -0.20 and β = -0.29, $p < .05$) both contributed unique variance to the outcome in the full model. The fourth model examined the interaction terms and was not significant.

Table 4.6
Hierarchical Regression Model Exploring Relations among Maternal Mind-Mindedness and Maternal Sensitivity to Distress, Taking into Account Household Income, Race, Education, Negative Emotion, and Vagal Regulation (n = 70)

	Block 1: Control Variables	Block 2: Primary Predictor	Block 3: Potential Moderators
	b	*b*	*b*
Income below $10k	-0.17	-0.15	-0.15
Income between $10k & $30k	-0.16	-0.15	-0.25
Black/African American	-0.64**	-0.65**	-0.50*
Latina/Hispanic	-0.59	-0.60	-0.23
Multiracial	-0.45	-0.45	-0.22
Some High School	-0.46	-0.47	-0.54
HS diploma or GED	-0.49	-0.53	-0.50
Some College	-0.15	-0.17	-0.18
Mind-mindedness		-0.31	-0.11
Negative emotion			-0.01
Vagal regulation			0.20*
Adjusted R^2	0.21**	0.19**	0.24**
R^2	0.30**	0.30**	0.36**
Change in R^2		0.00	0.06**

Note: b = the unstandardized regression coefficient
*$p < .05$, **$p < .01$, ***$p < .001$

Hypotheses tested. *Hypothesis 4* was not supported by the results of this regression model as mind-mindedness was not significantly related to maternal sensitivity when controlling for household income, race, and education. Neither *Hypothesis 5* nor *Hypothesis 6* were supported based on the results of this regression model.

Post-Hoc Analyses

Given that the emotional intensity variable could not be used in the main analysis due to missing data, post hoc analyses explored the relations between intensity of maternal negative emotion during infant distress and other variables in this study. None of the bivariate correlations produced significant findings, perhaps due to the small number of cases included (n = 35). Intensity of negative emotion as measured by the dial task was not correlated with the outcome variable, nor any of the other continuous variables. One significant preliminary finding, related to this aspect of the study was the correlation between maternal vagal regulation when experiencing the arm restraint task in vivo and when watching the arm restraint on video during the dial rating (r = .69, p < .05). Potential implications are discussed in the next chapter.

Chapter 5

Discussion

Findings

Research to date shows the importance of maternal sensitivity to infant distress as a predictor of infant attachment security (del Carmen et al., 1993; McElwain & Booth-LaForce, 2006), as well as social competence and affect regulation (Davidov & Grusec, 2006; Leerkes et al., 2009). Research examining sensitivity to distress has identified various predictors of this behavior such as emotional reactions (Leerkes et al., 2004, 2016; Leerkes, 2010), physiological reactivity to crying (Leerkes et al., 2016, 2017), attachment state of mind (Leerkes et al., 2016), and reflective functioning (Krink et al., 2018). Initial studies on this topic used research designs that assessed maternal qualities at an earlier time period (often prenatally), and later assessed sensitivity to distress with one's own infant (Leerkes et al., 2004; Leerkes et al., 2015). Now that links have been established among common predictors and sensitivity to distress, research is moving towards understanding the conditional factors that allow some caregivers to respond sensitively in certain contexts, while others do not. This type of research question involves a shift in design to capture what is going on for caregivers (at emotional, cognitive and physiological levels) *during* a specific distress episode, *while* interacting with the distressed infant (Krink et al., 2018; Leerkes, 2010; Leerkes et al., 2016). The current study assessed predictors of sensitivity to distress at multiple levels (cognitive, emotional, and physiological) during a time when the mother was responding to her own infant's distress. This study makes a number of contributions to understanding pathways by which caregivers are able to respond sensitively to an infant's distress.

One major contribution that the current study makes to the field of maternal sensitivity is due to the nature of the sample. Much of our understanding about maternal sensitivity comes from studies examining samples from White, middle-class communities (Mesman et al., 2012b; Malda & Mesman, 2017). Thus, the present study extends current research literature by examining predictors of maternal sensitivity to distress in a low-income sample of racially and ethnically diverse mothers. The aim of the current study was to build understanding of potential factors that may contribute to mother's behavior towards her distressed infant in the context of demographic risk. As expected, findings indicate that demographic factors contribute to differences in sensitivity to distress. Infant-oriented maternal goals in responding to distress are linked with behavioral sensitivity to distress, as predicted. Results also indicate that maternal vagal regulation while interacting with the distressed infant contributes to maternal behavioral sensitivity in that same time period. Results of the current study will be discussed with regards to themes and findings in the existing literature, methodological implications, limitations of the current study, and directions for future research.

Demographic variables and behavioral sensitivity to distress. When considered all together, the demographic control variables of income, education and race accounted for 21% of the variance in maternal sensitivity to distress. These demographic variables are often confounded (Mesman et al., 2012b) and more than one recent study examining both income and ethnicity in relation to parenting and has found that income explains variance in parenting above and beyond ethnicity (Chaudhuri et al., 2009; Bakermans-Kranenburg et al., 2004). Socioeconomic status is considered to be a universal factor affecting parenting and developmental outcomes across cultures (Malda & Mesman, 2017), and one widely referenced mechanism used to describe the effects of SES is the cumulative stress model (Conger &

Donnellan, 2007; Booth et al., 2018; Neuhauser, 2018). It is important to remember that in this sample, the demographic control variables of race and household income were confounded. Although this sample was selected to included low-income households, three distinct levels of income were included in the present study. Preliminary analysis indicated that a higher proportion of White moms were in the income group *$30k—$50k* compared to the other two income groups (*below $10k* and *$10k—$30k*). A lower proportion of moms of color were in the income group *$30k—$*50k compared to the other two income groups (*below $10k* and *$10k—$30k*). Although other potential confounds could not be tested in the preliminary analysis due to small sample size, it is possible that additional demographic characteristics are confounded with race, as reported in other studies (Chaudhuri et al., 2009; Bakermans-Kranenburg et al., 2004). Although important to consider, income and other confounding demographic factors do not suffice to fully explain racial and ethnic differences in parenting studies (Yaman, Mesman, van IJzendoorn, Bakermans-Kranenburg & Linting, 2010). Racial and ethnic minority groups experience stressors specific to their history and experiences in the majority culture (such as racism, discrimination, and acculturation stress), which in turn influence parenting practices and socialization goals (Emmen et al., 2013; Dunbar, Leerkes, Coard, Supplle & Calkins, 2017; Dunbar, Perry, Cavanaugh & Leerkes, 2015; Nelson, Leerkes, O'Brien, Calkins & Marcovitch, 2012).

A significant finding in the current study was related to the variance explained by the demographic control variable of race. It is important to note that race was included as a variable for descriptive purposes, and the primary goal of the study was to broaden understanding of sensitivity by including participants that are often under-represented in developmental research. Without critically examining the construct of sensitivity in diverse samples, the field risks

perpetuating the idea that the parenting qualities found in well-studied samples (White, middle-class) are "universal" and "good" for babies. This is an idea that the current study aims to challenge by examining potential predictors of sensitivity to distress in a racially and ethnically diverse sample of low-income families. Although it may be tempting for some to do so, the study was not designed to make racial comparisons, and conclusions of this sort would be not only ill-advised from a methodological standpoint, but also counter-productive in terms of contributing to an integrative perspective of human development (Garcia Coll et al., 1996).

Consistent with other studies of maternal sensitivity that indicate links with race (Malda & Mesman, 2017; Mesman et al., 2012a, 2012b) the current findings suggest that identifying as African American/Black was linked with lower scores on sensitivity to distress. A number of potential reasons for these findings have been put forth including ethnocentricity of the sensitivity measure itself (Keller, 2007; Mesman & Emmen, 2013) and potential bias in observational coding (Malda & Mesman, 2017). Due to these potential problems with the construct of sensitivity, some researchers have begun to examine new conceptualizations of parenting behavior that may be less culture-bound and more predictive of later attachment outcomes (Woodhouse et al., 2019).

The current research literature on emotion socialization goals may also offer insight for understanding the link between race and sensitivity. Studies have found differences in mother's beliefs about children's expression of negative emotions and emotion socialization practices based on race (Dunbar et al., 2015, 2017; Nelson et al, 2012). In the United States there are different beliefs about the acceptability and negative social consequences for children's display of negative emotions among African American and European American mothers (Nelson, 2012). African American mothers, especially those of boys, have been found to minimize (suppress)

displays of negative emotions more than European American mothers (Nelson et al., 2012; Dunbar et al., 2017). Suppression strategies have the potential to be coded as "less sensitive" than other forms of emotion socialization. However, given the context of oppression and discrimination that African American families must navigate, teaching children to suppress negative emotions in situations when expressing negative emotions might be harmful is a protective and adaptive emotion socialization strategy (Dunbar et al., 2017).

Maternal goals and behavioral sensitivity to distress. As expected, infant-oriented goals were positively and significantly associated with maternal sensitivity to distress after taking into account household income, race, education, negative emotion, and vagal regulation. Previous research shows links between infant-oriented goals and sensitivity to distress as a main effect (Leerkes et al., 2004; Leerkes, 2010) and an interaction effect when combined with other parenting constructs (Leerkes et al, 2004). Infant-oriented goals included elements of soothing distress, mutual regulation, or addressing emotional needs in a relational way, and these types of goals have been linked, both theoretically and empirically, with sensitivity to distress (Solomon & George, 1996; Leerkes et al., 2004; Leerkes, 2010). One of the unique contributions of the current study is that the context of infant distress allowed for an examination of the subtle differences in stated parenting goals. For example, findings indicated that there was a meaningful difference between the two goals: *I wanted to help him calm down* (coded as infant-oriented) and *I wanted him to stop crying* (coded as mother-oriented), with the goal stated in terms soothing and co-regulation found to be linked with behavioral sensitivity to distress.

One adjustment that could be made in future research examining parenting goals would be to broaden the concepts beyond the use of dichotomous codes (i.e., mother-oriented and infant-oriented). The maternal goals coding used in the current study was based on the work of

Leerkes and colleagues (2004, 2010), and use of the terms infant-oriented and mother-oriented was maintained for the sake of consistency and replicability. However, the labeling of these dichotomous codes may create an over-simplified view of maternal goals in responding to infant distress, in light of the emotion socialization literature presented above (Nelson et al., 2012; Dunbar et al., 2015, 2017). Theory suggests that one reason mother-oriented goals are likely to undermine sensitivity is because they prioritize the mother's needs over the infant's (Leerkes, 2010; Leerkes et al., 2016). I would suggest an elaboration of this theory to include other potential mechanisms linking mother-oriented goals and less sensitive responses to infant distress. For example, mother-oriented goals could be conceptualized as focused on infant self-regulation or emphasizing socialization over emotional expression. One benefit of considering goals more broadly is that it captures the idea that a mother's goal in responding to her infant's distress may be nuanced, dynamic, and complex. For example, a goal may be driven by the mother's sense of what is important (mother-oriented) and at the same time in the best interest of the child (infant-oriented). Refinement of the terminology, beyond prioritizing self or other, may expand our understanding of differences in emotion goals among various racial, ethnic, and cultural groups.

Cross-cultural research on socialization goals provides a framework for that could be useful in considering parenting goals in responding to infant distress (Keller, 2007, 2012; Tamis-LaMonda et al., 2008). The underlying assumption for these anthropological studies is that goals are a way for parents to transmit specific psychological and behavioral qualities that parents believe are important for the infant's development (Keller, 2007, 2012; Tamis-LaMonda et al., 2008). Socialization goals are viewed as a way to balance the important developmental tasks of autonomy and relatedness (Keller & Otto, 2014; Tamis-LaMonda et al., 2008). Although

autonomy (independence) and relatedness (interdependence) have historically been viewed as dichotomous constructs, as this model has become more refined, it has been noted that all cultures value both autonomy and relatedness (Keller & Otto, 2014; Tamis-LaMonda et al., 2008). The differences in socialization goals relate to the many ways in which autonomy and relatedness are combined and where emphasis is placed across various situations and developmental periods (Tamis-LaMonda et al., 2008). Future research may benefit from shifting the terminology away from mother- versus infant-oriented goals towards a categorization that emphasizes the function that the goals are serving, such as autonomy and relationship goals or socialization and co-regulation goals.

The study hypotheses were constructed based on a conceptualization of goals as a cognitive construct that theoretically overlaps with the cognitive construct of mentalization. This potential overlap between the two constructs was one of the main reasons that the hypotheses were structured as two separate sets of analyses. However, the distinctions between the constructs became more apparent while coding and considering how these two predictors of sensitivity may be operating in the current sample within the context of the lab. Maternal goals in responding to infant distress seem to be more similar to a motivational construct than a cognitive one per se, and it is possible that these two constructs are quite distinct. As noted in the example above, a mother may be able to take the perspective of her infant and perceive that the infant wants or desires one thing (i.e., to nurse, take a nap, be held by mom), but the mother's goals for soothing the infant might not necessarily align with the infant's desire given the situational demands (to finish the lab task) and other internal processes (self-regulation) competing for the mother's resources (Booth et al., 2018).

Maternal mentalization and behavioral sensitivity to distress. Mind-mindedness was not significantly related to sensitivity to distress, neither before nor after taking into account household income, race, and education. Previous studies have indicated links between mentalizing constructs and sensitivity (Koren-Karie et al., 2002; Meins et al., 2001, 2012; Grigenberger et al., 2005; Stacks et al., 2014), as well as sensitivity to distress (Krink et al., 2018). Interpretations of the current finding must take into consideration that mind-mindedness is typically measured in the context of free-play. Measuring mind-mindedness in a distress context was a novel approach and an exploratory step in the current study. Most mentalizing constructs have been measured by coding transcripts of interviews (Zeegers, Colonnesi, Stams & Meins, 2017). Mind-mindedness is a unique construct in that it can be coded from an interview or from statements generated during interaction with the child, providing a 'real-time' sense of how the caregiver is viewing the child in terms of mental states (i.e. desires, feelings, beliefs, goals). In order to better understand maternal sensitivity in the context of distress, coding of mind-mindedness was applied to an interview regarding an infant distress context.

One limitation that became apparent during the mind-mindedness coding was the reliance on explicit verbal expression, and the potential for the stressful lab task to interfere with the mother's verbal expression of her mentalizing capacity. A second measurement issue revealed during the coding phase was that the phrasing of one of the interview questions may have influenced responses in an unanticipated way. The standardized setup of the lab involved strapping the infant in a car seat and moving the seat so that the mother was out of infant's view, before beginning the arm restraint task. In an attempt to use neutral language, the question asked, "what do you think your baby needed during the time s/he was in the *car seat.*" The purpose of this phrasing was to avoid drawing attention to the separation (what do you think your

baby needed when s/he was apart from you or could not see you) or the distress (what do you think your baby needed when s/he was fussing or crying). However, the phrasing referencing the car seat did lead many moms to consider the context of the car seat itself, and some commented on what the infant typically needs when riding in the car, rather than on what the infant needed in the context of the lab. It is also important to note that in this low-income sample, not all infants regularly travelled in cars, so the experience of being placed in a car seat was not necessarily as "universal" of an experience as originally designed. Elements of the lab task and the interview question may have pulled some attention away from the reflection of what the mother believed the infant needed during the recent distress episode. Given the distress context in which mind-mindedness was measured, it is understandable that the findings linking mentalization and sensitivity were not replicated in the current study.

In addition to the challenges mentioned above, which are specific to this study, findings from the current study highlight limitations of the mind-mindedness coding in general. It is important to note that within the mind-mindedness coding system, statements about the infant's physical needs (i.e., hungry, tired, needing a diaper change) are not counted as mind-related comments. While the rationale behind this coding decision is understandable given that perception of physical needs does not involve viewing the child as having a mind, it seemed problematic for the context and sample of the current study. When mothers were asked what they thought their fussing or crying infant needed, common responses included feeding and napping. This may in part be due to the regularity of feeding and napping at 6 months of age, and perhaps mother's awareness of her infant's typical schedule. Nevertheless, viewing the infant as tired or hungry is a reasonable (and potentially accurate) form of perspective-taking response given the situation. The mind-mindedness construct seems to give more credit to

comments about "complexity" of mind, such that simple approaches to caregiving focused on basic needs are not scored highly. Given this limitation of the coding system it is understandable that mind-mindedness was not linked with sensitivity to distress in this sample.

Maternal vagal regulation and behavioral sensitivity to distress. Vagal regulation during the time when mother was attending to her distressed infant was significantly correlated with sensitivity to distress in the preliminary analysis. This variable was initially conceptualized as a potential moderator given the emotional demands of parenting during infant distress. Although moderation was not supported by the findings, vagal regulation was linked with sensitivity to distress in the mind-mindedness model, after taking into account household income, race, and educational level. These findings are parallel to previous findings indicating links between maternal vagal regulation and sensitivity to distress (Leerkes et al., 2016). These findings also fit with research linking vagal withdrawal with sensitivity in general (Moore et al., 2009) and theory that suggests regulating one's own reactions effectively may improve the likelihood of sensitively attending to the needs of one's infant (Dix, 1991, 1992; Leerkes, 2010). It is important to note that when goals are taken into account, the relation between vagal regulation and sensitivity to distress does not hold. This would suggest that perhaps we need more research with larger samples to better understand the relations between these constructs.

This study explored the use of two potential baseline tasks when calculating the vagal regulation score: the original "resting baseline" and an alternative "vanilla baseline" (Jennings et al., 1992). In general terms, the baseline period sets the standard against which the physiological data of interest is compared. The resting baseline typically captures a "basal level" of activity such that the participant is awake but otherwise resting. The idea of a vanilla baseline is to use a task that requires slightly more engagement than a resting baseline, one that is "not complex or

exciting, but induces sufficient activity to maintain alertness and to potentially reduce heart rate variability" (Jennings et al., 1992, p. 743). The original vanilla baseline, "functioned similarly to the flavor 'vanilla' among many choices of ice cream" (Jennings et al., 1992, p. 743). Over time this working label became a term in physiological research to describe a baseline that serves as a comparison for the level of alertness, attention, or cognitive load required for the task of interest. The term vanilla baseline is conceptualized as "a comparison condition, rather than a basal state" (Jennings et al., 1992, p. 743).

The vagal regulation variable ultimately used in the current study was the change score from maternal RSA during the free play to RSA in the time period when mom was attending to her distressed infant. In both lab contexts mom was attending to her infant, yet the infant cues to which she was orienting and responding were likely quite different. Although some infants may have expressed distress during the free-play task, for most it was a more relaxed interaction. In contrast, all infants included in the study were actively fussing or crying during the reunion period with their mothers after the arm restraint. Calculated this way, vagal regulation has the potential to capture change in maternal RSA when attending to different types of infant cues. The field would benefit from research examining the use of this calculation in future studies.

Maternal negative emotion and behavioral sensitivity to distress. The current study did not replicate findings in previous research linking maternal negative emotion and sensitivity to distress (Leerkes et al., 2004, 2015; Leerkes, 2010). Findings examining the relation between these two constructs have been mixed, with some studies finding bi-variate correlations but no significant links in regression analysis (Leerkes, 2010) and others finding significant interactions but no main effects (Leerkes et al., 2004). One possible reason that the current study did not find links between negative emotion and sensitivity to distress may be related to differences in

measurement. A variety of methods have been used to measure and operationalize maternal negative emotion during parenting tasks including questionnaires, self-generation of emotion terms, and coding responses to interview prompts. The current study coded responses from the open-ended prompts in the interview, which allowed mothers to generate their own emotion terms rather than choosing from a set list. One drawback to this approach is that the full meaning of mother's responses may have been missed. For example, if a mother did not explicitly state that a negative emotion was empathic and did not elaborate her response when given the opportunity through the follow-up question, then it was not known whether she was experiencing a negative emotion because the baby was upset, she found the crying aversive, or whether it was due to something else. Given that other constructs in the study were based on interview responses, the current study may have benefitted from assessing negative emotional reactions with a questionnaire format.

The current study aimed to examine one potential source of mixed findings by measuring both intensity and valance of negative emotion, however this analysis was not possible due to missing data. Intensity of negative emotion was measured using a dial rating and video-recall procedure. This procedure was technologically complex and could not be implemented consistently in the lab setting. It is important to note that findings indicated that the video-recall aspect of the procedure appeared to work effectively, even though the dial ratings of emotion intensity could not be used. The validity check for the video-recall procedure was to correlate vagal regulation during the actual task with vagal regulation while watching the task on video. The two vagal regulation scores were correlated, indicating that the mother was "re-experiencing" the events at a physiological level while watching them on video. The dial rating was likely a good primer for the participants to engage in before the video-recall interview and

may have served a valid function although the dial rating data could not be used as intended. Future research would benefit from continuing to explore possible reasons for the mixed findings between negative emotion and sensitivity to distress, perhaps developing alternative ways to measure intensity of negative emotion. Another possible avenue for future research would be to assess the impact of discrete negative emotions (frustration, anger, sadness) on sensitivity to distress rather than aggregating negative emotions together for an overall score.

Limitations

In addition to the limitations discussed in the context of the findings above, there were a few additional limitations that are important to mention. First, due to the non-experimental nature of the study design, conclusions about causality cannot be drawn from the results of this study. Generalizability of the findings should be limited to mothers similar to those who participated in this study, as the sample consists primarily of low-income mothers and their infants, and as such, results cannot be generalized to mothers in other socio-economic groups. Results must also be considered in the specific context of infant distress, noting that the findings of this study were based on a sample of infants who were not only distressed during the arm-restraint task, but were also distressed during the subsequent reunion period. Sensitivity to distress scores were not coded when infants self-soothed over the course of the arm restraint task or were not crying during the reunion period for other reasons (i.e., one infant fell asleep during the task, and a few calmed immediately upon seeing the mother). It is possible that the results apply to infants with common temperamental characteristics (reactivity, low frustration tolerance, difficult to soothe) or physical needs (hungry, tired) which may have contributed to the duration of the distress. It is important to emphasize that this study only examined maternal

sensitivity in dyads where the infant displayed distress during the reunion period, excluding infants who were in a calm state after the stressor task was completed.

Although this was a lab-based study, it was a grounded in a larger community-based research effort which aimed to engage a hard to reach population facing several barriers (low resources, transportation limitations). Given the long histories of abuse of this population by research institutions and researchers, the community-based effort that recruited and retained participants for the current study cannot be understated. Nonetheless, the final sample size for the regression analysis was small for the number of control variables included and the number of interactions proposed. A structural equation model was considered at the time of the proposal, as it would have been a good fit for the given measurement and research hypotheses, but was unable to be pursued due to the small sample size.

Future Research

In addition to the specific methodological recommendations included in the sections above, two general points are important to note. Although mothers were the focus of the current study, it is important to note that sensitivity is a quality applicable to all caregivers. A second focus for future research is related to widening the perspective on caregiving from a dyadic point of view to include multiple attachment relationships. This would include extending research to sensitivity with fathers and including family structures where other adults or groups of adults are the primary caregiver. Some research has begun in these areas and shows that fathers are as sensitive as mothers (Lucassen et al., 2011) and that infants form attachments with sensitive primary caregivers in a variety of family structures (Rottger-Rossler, 2014). Continuing to include diverse family structures and widen the breadth of sensitivity research beyond the mother-infant relationship is an important next step.

While the construct of sensitive parenting appears to be applicable to different cultural contexts both within and between countries, research is still needed to examine the specific ways in which maternal responses to infant distress may vary among ethnic minority groups in the United States. Recently, a special issue about the universality of attachment constructs (Attachment and Human Development, 2018) highlighted studies across the globe, which is an exciting advancement. However, this is not a replacement for the work that needs to be done in the United States to understand the ways in which current and historical oppression and discrimination impact the ways that parents respond to negative emotion and promote a sense of safety and security for their infants. Stressors specific to minority status need to be considered in addition to more general demographic stressors in understanding sensitivity to distress in ethnic minority families.

One difficulty that researchers face in the United States is the degree to which racial and ethnic identity are confounded with socioeconomic status. Because low-income families have received limited attention in the empirical literature on sensitivity, we know less about what helps parents provide more positive caregiving in the context of socioeconomic stressors. A key meta-analytic finding that has prompted critical thinking about the construct of sensitivity in different parenting contexts, is the finding that in the prediction of later attachment outcomes sensitivity has less predictive power in low-income samples than in middle class samples (DeWolff & van IJzendoorn, 1997). A number of hypotheses have been put forth to explain this differential predictive power, including the concept of cumulative stress (Conger & Donnellan, 2007), and the possibility that the construct of sensitivity does not fully capture the essential elements of caregiving which allow an infant to develop a secure attachment (Woodhouse et al., 2019). Future research would benefit from examining contextual influences on sensitivity to

distress, and parenting in general, to identify potential mechanisms that explain how distal contextual factors may impact parenting and subsequent child development outcomes.

Conclusion

Sensitivity to distress remains understudied, especially in populations with sociodemographic risk. The present study offers insights into predictors of sensitivity to distress in a low-income sample. The findings of this study indicate that infant-oriented maternal goals are linked with sensitivity to distress, even after accounting for the influence of demographic factors.

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Appendix A

Rating Dial used in Video Recall Procedure

Appendix B

Descriptive Statistics for Potential Vagal Regulation Variables

	n	Min	Max	*M*	*SD*	Skewness	Kurtosis
Stressor Task—BL	80	-4.22	6.74	0.22	1.29	1.14	8.90
Stressor Task—FP	80	-2.82	3.77	0.40	1.16	0.17	1.05
Reunion Task—BL	77	-3.5	2.07	-0.08	1.05	-0.91	1.49
Reunion Task—FP	77	-4.59	3.75	0.20	1.17	-0.87	4.34

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SELECTED PRESENTATIONS

Woodhouse, S.S., Effrig, J.C., **Beeney, J.R.**,* Cooper, G., Hoffman, K.T. & Powell, B. (2012, June). A Comparative Case Study of a Successful vs. an Unsuccessful Parent Psychotherapy. Symposium conducted at international meeting of the Society for Psychotherapy Research, Virginia Beach, VA.

Woodhouse, S.S. & **Scott, J.R.*** (2011, March). Attachment, secure base scripts, and perceived infant intentionality: Links with maternal secure base provision. Poster presentation at Biennial meeting of Society for Research in Child Development. Montreal, Quebec, Canada.

SELECTED PUBLICATIONS

Woodhouse, S.S., **Scott, J.R.**, Hepworth, A.E. & Cassidy, J. (2019). Secure base provision: A new approach to examining links between maternal caregiving and infant attachment. *Child Development.* doi: 10.1111/cdev.13224

PROFESSIONAL AFFLIATIONS

American Psychological Association 2010—present
Society for Research in Child Development 2007—present
Phi Beta Kappa Honor Society 2000—present