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Parenting has been identified as a key influence on children's temperament in the first years of life. This study examined the extent to which maternal sensitivity predicted infants' subsequent temperamental reactivity and adaptive emotion regulation and moderated the relationship between infants' early mother-oriented emotion regulation behavior and later adaptive emotion regulation. Mothers brought their infants to the laboratory when their infants were 6 and 16 months old to participate in 2 videotaped procedures at each time point which were designed to elicit negative emotions from infants (i.e., anger and fear). Mothers reported infant temperament at both time points. Researchers coded maternal behavior during periods of infant distress, infant negative reactivity and two types of adaptive emotion regulation behavior (i.e., mother-oriented and independent). There was modest stability in infant negative reactivity from 6 to 16 months but no evidence that maternal sensitivity to distress moderates this stability. Maternal sensitivity to distress moderated the relationship between reactivity at 6 months and the use of mother-oriented emotion regulation behavior at 16 months; however, there was no direct influence of maternal sensitivity on either type of adaptive emotion regulation behavior. Mother-initiated look-at-mother predicted the use of independent emotion regulation, but this association was not moderated by maternal sensitivity. In conclusion, different types of adaptive emotion regulation behavior appear to be influenced by different constellations of maternal and infant behavior.

LONGITUDINAL INFLUENCES OF MATERNAL SENSITIVITY
ON INFANT TEMPERAMENTAL REACTIVITY
AND EMOTION REGULATION

by

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To my sensitive parents, Mitchell S. Siepak and Julia R. Siepak, for responding
promptly, consistently and effectively to me--then, and now.

APPROVAL PAGE

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CHAPTER I

INTRODUCTION

There is mounting evidence that emotion regulation is a key influence on children's development, affecting the intrapersonal, social and cognitive domains. Emotion regulation is associated with anxiety, behavioral and oppositional disorders (Calkins & Dedmon, 2000; Calkins & Fox, 2002; Crockenberg & Leerkes, 2006; Keenan, 2000; Stifter, Spinrad & Braungart-Rieker, 1999), influences peer relationships (Calkins & Fox, 2002; Calkins, Gill, Johnson & Smith, 1999; Fantuzzo, Bulotsky-Shearer, Fusco & McWayne, 2005), and affects cognitive development (Graziano, Reavis, Keane & Calkins, 2007; Karrass and Braungart-Rieker, 2004; National Institute of Child Health and Human Development Early Child Care Research Network [NICHD ECCRN], 2004; Robinson and Acevedo; 2001). Furthermore, evidence clearly indicates that emotion regulation develops through an interactive process between caregivers and infants (Berlin & Cassidy, 2003; Braungart-Rieker, Garwood, Powers & Wang, 2001; Crockenberg & Leerkes, 2004 & 2006; Diener, Mangelsdorf, McHale & Frosch, 2002). This process is reciprocal in that infants elicit responses from others through their expressions of emotion and the nature of their temperaments (Bronfenbrenner & Morris, 1998; Seifer, 2000), and caregivers respond to infants in a manner that influences infants' current emotional state (Calkins & Johnson, 1998; Calkins et al., 1998; Crockenberg & Leerkes, 2004; Little & Carter, 2005; Smith, Calkins & Keane, 2006) and shapes their emotional development

(Crockenberg & Leerkes, 2006; Crockenberg & Smith, 2002; Gable & Isabella, 1992; Goldberg, MaKay-Soroka & Rochester, 1994; Jahromi, Putnam & Stifter, 2004; Jahromi & Stifter, 2007; Tonyan, 2005; Spinrad, Stifter, Donelan-McCall & Turner, 2004; van den Boom, 1994). However, the extent of maternal influence on temperamental reactivity and emotion regulation is not well understood. The goals of this study are: to examine the influence of maternal sensitivity on infants' temperamental reactivity and adaptive emotion regulation; and to determine whether maternal sensitivity influences the relationship between early mother-oriented emotion regulation behavior and later adaptive emotion regulation.

Maternal Sensitivity

The influence of parental behavior on child development has been an important area of research for decades. In studying attachment, Ainsworth, Blehar, Waters and Wall (1978) noticed that patterns of maternal behaviors were associated with patterns of infant behaviors. When mothers were aware of their infants' cues, responded to their infants promptly and tenderly, and respected their infants' own needs and desires, their infants explored their environment in competent, developmentally generative ways, sharing their experience with their mothers. The term maternal sensitivity refers to this pattern of maternal behavior in which mothers respond promptly, appropriately and contingently to their infants' cues. Because infants communicate their needs and desires through emotional expression, it seems likely that parents' sensitive responses to children interact with children's emotional state to influence children's emotion regulation development.

Leerkes (2008) suggests that mothers' sensitivity to their infants' distress is

distinct from sensitivity to infants when they are neutral or positive, and may differentially influence child outcomes. Children are most in need of help with emotion regulation when they are distressed. In fact, many studies have found that children most actively seek parents' assistance during emotionally challenging situations (e.g., Diener et al., 2002; Smith et al., 2006). So maternal behavior at those times seems the most influential on outcomes such as reactivity and regulation; thus this dimension of sensitivity was the focus of the current investigation.

Emotion

Fox and Calkins (2003) defined emotions as internal states which involve communication, appraisal, physiology and experience. Cole, Martin and Dennis described emotions as, "appraisal-action readiness stances" (p. 320), emphasizing the motivating quality of emotions. Both definitions included the aspect of appraisal, the individual's evaluation of the relationship between the self and the event or element of environment that evokes the emotion. Campos, Mumme, Kermoian and Campos (1994) asserted that emotions serve a function; that emotion is the individual's effort to influence the relationship between the self and a significant aspect of the environment. For example, anger arises when one perceives that one's goals have been blocked, sadness emerges with the perception that one's goals are impossible to obtain, and happiness arises as one's goals are attained. Attachment theory proposes that emotions also serve to signal caregivers about infants' needs, goals or internal states. Thus, we can define emotion as a motivating physiological and psychological reaction based on an appraisal of one's relationship with significant aspects of the environment and which may

communicate this appraisal to others. A definition of emotion regulation builds on this conceptualization of emotion.

Emotion Regulation

Kopp (1989) defined emotion regulation as the ability to manage emotional arousal, an adaptive, flexible and developmental process, heavily influenced in infancy and early childhood by caregivers. Thompson (1991) referred to emotion regulation as the modification of the timing, duration and intensity of emotion, involving both intrinsic and extrinsic processes. And recently, Calkins and Hill (2007) defined emotion regulation as “those behaviors, skills, and strategies, whether conscious or unconscious, automatic or effortful, that serve to modulate, inhibit [or] enhance emotional experiences and expressions” (p. 229). Fundamental to these three definitions is the notion that emotion is malleable and that regulation involves some degree of internal processing. Eisenberg and Spinrad (2004) add to the definition the concept that emotions are adaptive and goal-oriented. A working definition of emotion regulation that is in alignment with a functionalist conception of emotion is: those behaviors, skills, and strategies, whether conscious or unconscious, automatic or effortful, that modulate emotional experiences and expressions, enabling individuals to meet goals or to adapt to situations that are socially or biologically significant.

Temperament

Rothbart and colleagues have recognized the holistic quality of human experience and defined emotion regulation in relation to a broader, more complex system of psychological functioning. Rothbart and Derryberry (1981) offered a conceptualization of

emotion regulation as a subcomponent of a broader construct, temperament. They distinguished between “reactivity”, or a susceptibility to emotional and motor arousal, and “self-regulation”, which modifies this arousal. More precisely, Rothbart (2004) defined temperament as “individual differences in reactivity and self regulation assumed to have a constitutional base” (p. 40; Rothbart & Derryberry, 1981). Thus, situated as a source of individual differences in how we interact with the internal and external environment, temperament has an automatic or reactive aspect and a more active regulatory component. Calkins and Hill (2007) emphasize that the “control” or regulatory dimension of temperament is separate from, but dynamically linked to, the reactivity dimension. Empirical evidence supports this two-part definition of temperament (Braungart-Rieker & Stifter, 1996; Crockenberg & Leerkes, 2006). When we build on the previous definitions, we derive a concept of temperament as a characteristic way of reacting to an appraisal of one’s relationship with the environment (i.e., reactivity) and the subsequent manipulation of physiology, cognitions, attention, motivation and behavior in order to adapt to the situation or to accomplish individual goals (i.e., regulation). Although temperament is constitutionally based and is present at a very early age, researchers agree that aspects of temperament can change over time (Braungart-Rieker & Stifter, 1996; Lemery, Goldsmith, Klinnert & Mrazek, 1999; Posner & Rothbart, 2000; Rothbart, 2004; Thompson, 1991). To inform parenting research and practice, it is important to identify the nature and mechanisms of change in temperamental reactivity and emotion regulation and in the relationship between these two aspects of temperament over time. For example, identifying maternal sensitivity as a

factor in learning emotion regulation skills or coping with high negative reactivity could guide the selection of parenting practices to be taught in intervention programs for families.

CHAPTER II

THEORETICAL PERSPECTIVE

Three theoretical perspectives can be drawn together to outline the interrelatedness of maternal sensitivity, infant reactivity and emotion regulation. Bowlby's attachment theory proposes that a unique and significant relationship between infants and caregivers forms when a specific interaction sequence is repeated over time and across many contexts (Waters & Cummings, 2000). Field (1994) and Tronick (1989) present a theoretical perspective similar to attachment theory, the Mutual Regulation Model (MRM), which emphasizes the social goals of infants and the contingencies within parent-child interactions. Behaviorism and social learning theory (Bandura, 1969; Vygotsky, 1978; Rovee-Collier, 1996) suggest the mechanisms through which extrinsic emotion regulation provided by interaction with parents becomes internalized by infants as they develop emotion regulation skills.

Attachment Theory

Attachment theory proposes the importance of a pattern of maternal and infant behaviors which includes: infant signal of need and maintenance of signal until parent responds, parent detection and interpretation of signal and prompt, appropriate response, infant openness to parent response and comfort (Waters & Cummings, 2000). The three parts of this pattern (i.e., infant signal, parent response, infant response) provide a framework for understanding how parent behavior can influence child emotional

development. Children signal their emotional state to their parents through vocalizations and facial expression (Buss & Kiel, 2004). Temperamental reactivity is often indexed by the intensity, valence, latency and duration of emotional expression (Rothbart & Derryberry, 1981; Thompson, 1991), and thus influences the quality of infants' signals. How caregivers respond to infants' cries of distress, expressions of delight and bids for attention (i.e., maternal sensitivity) may reinforce infants' characteristic manner of signaling their emotions, shaping infant reactivity. Furthermore, caregivers' response may interact with infants' propensity to be comforted, affecting emotion regulation behavior. Four distinct interaction patterns have been identified by attachment researchers, providing a heuristic for understanding infant emotional development.

Based on the characteristic way in which infants use their caregivers for protection in threatening situations and for reassurance to explore the environment when there is no threat, researchers classify infants' relationships with their caregivers as secure, avoidant, resistant or disorganized (Ainsworth et al., 1978; Weinfield, Sroufe, Egeland & Carlson, 1999). According to attachment theorists, secure infants explore the environment freely, but often approach their caregiver to share their experience or gain reassurance. When distressed, secure infants will seek the caregiver and will be comforted by the caregiver's efforts. In contrast, avoidant infants will engage with the environment when the caregiver is present but may ignore the caregiver, and are not especially comforted by the caregiver when distressed. Resistant infants have a characteristic reluctance to leave the caregiver to explore the environment, and display a conflicted response to threats in that they may seek contact with the caregiver but are not

comforted. Infants with a disorganized attachment do not display a consistent, coherent pattern of behavior. These characteristic interaction patterns that form the attachment relationship are proposed to influence children's reactivity and emerging emotion regulation behaviors and skills.

In a seminal essay on attachment theory, Cassidy (1994) outlined how infants' emotional signals (i.e., reactivity) varied as a function of attachment classifications. Several researchers have found support for her propositions. Braungart-Rieker et al. (2001) noted muted affect in children with avoidant attachments to their caregivers, and Berlin and Cassidy (2003) found that mothers of avoidant children reported higher restriction on their children's emotional expressiveness. Cassidy (1994) proposed that children whose emotional signals have been ignored or rejected by their caregivers, as in the case of avoidant attachment, learn to minimize their expression of affect in order to avoid the pain of rejection. In contrast, Diener et al., (2002) found that children with insecure-resistant attachments were *more* affectively expressive than children in other classifications. These children have likely experienced inconsistent responses to their emotional signals, so tend to exaggerate them in order to attract attention from a caregiver who is often distracted, but who sometimes responds (Cassidy, 1994). Thus, mothers' response to infants (i.e., maternal sensitivity), appears to influence children's emotional signals (i.e., reactivity) in systematic ways.

Researchers have also found differences in regulatory behaviors according to attachment classifications (Braungart et al., 2001; Braungart & Stifter, 1991; Diener et al., 2002; Smith et al., 2006). For example, avoidant infants seem to be more likely than

secure infants to engage in self-regulation (thumb-sucking, self distraction and attention shifting), suggesting that these infants have learned to handle their emotions on their own instead of attempting to elicit the help of parents who might reject their emotions (Braungart-Rieker et al., 2001; Diener et al., 2002). Diener et al. found that resistant infants were more likely to use self-soothing or multiple emotion regulation behaviors than expected by chance, but this finding was with regard to father-infant attachment classification and not mother-infant. Furthermore, infants with secure attachments tend to turn to their parents for comfort in emotionally challenging situations (Diener et al., 2002; Smith et al., 2006), which suggests that infants have learned to depend on their parents for help in regulating their emotions, based on a history of parents' sensitive response to infants' emotional signals. Thus, emotion regulation behavior may vary according to differences in attachment classification.

Importantly, research supports Cassidy's (1994) argument that mothers' responses to negative emotions play a key role in these patterns. Goldberg et al. (1994) coded videos of the Strange Situation for maternal comments on infants' positive, negative and neutral emotion states, and found that mothers of resistant infants responded most often to infants' negative affect, mothers of avoidant infants responded least to infants' negative affect, and mothers of secure infants responded to all three emotion states. Thus, it is evident that mothers of infants in different attachment classifications were differentially attuned to their infants' emotion states, providing reinforcement for different valences of reactivity.

In summary, attachment theory proposes that when parents respond effectively to

infants' cues, infants learn to trust their caregivers to provide safety, physical help and emotional support. Secure in the expectation of maternal sensitivity, infants are able to explore their environment competently in developmentally generative ways (Waters & Cummings, 2000). Thus, attachment research on the protection-seeking and exploration behavior of infants presents evidence that maternal and infant behavior interact, forming distinct patterns of infant reactivity and emotion regulation. The examination of contingencies between mother and infant behavior in face-to-face encounters, as in research based on the Mutual Regulation Model, lends support to this premise of attachment theory.

Mutual Regulation Model

Although Tronick, Cohn and Shea (1986) regard mothers as responsible for the course of social exchanges with their infants, these researchers emphasize that the contingencies between mothers' and infants' emotional signals are crucial in shaping infants' emotional development. Their Mutual Regulation Model (MRM) proposes that infants' goal in face-to-face encounters is to engage their partners. When mothers cooperate with their infants' desire for social interaction, infants respond with positive emotions in order to sustain the pleasurable interaction. According to the MRM, over time and with repeated successful engagement with a responsive partner, infants develop an "affective core" of positive emotion and a sense of effectance that carries over into other relationships and later experiences. It is likely that, with the help of their caregivers, infants gain a sense of mastery over their emotional experience, shaping their characteristic way of reacting to the world and the way in which they regulate their

emotions. However, infants of depressed or otherwise impaired parents repeatedly fail to elicit an appropriate response from their parents in everyday face-to-face encounters, because their parents are either unresponsive or overly intrusive (e.g., prioritize their own goals over the infants'). For example, Field, Healy, Goldstein and Guthertz (1990) noted that in a 3-minute face-to-face interaction, 3 month old infants of depressed mothers spent more time in a negative state and less time in play than infants of non-depressed mothers. When matching the mothers' state to the infants' state, they found that depressed dyads spent more time disengaged from each other, less time attending to each other and less time in play together than non-depressed dyads, and overall, depressed dyads spent significantly less time in matching states. According to the MRM, infants without a supportive social environment may develop a tendency to react negatively to emotional challenges or a sense of helplessness rather than skill in emotion regulation. Thus, parental responsiveness (i.e., maternal sensitivity) is the key to the success or failure of infants in developing a sense of effectance and mastery over their emotions.

Learning Theory Perspectives

Reactivity is an internal experience, in addition to being a signal to others. Negative emotions are generally regarded as unpleasant, and reducing distress is a goal of emotion regulation. The process of operant conditioning may be one mechanism by which infants learn emotion regulation behaviors, skills and strategies in the context of the attachment relationship and face-to-face interactions. Behaviorism proposes that individuals learn through reinforcement and punishment, repeating behaviors that have positive consequences and avoiding behaviors that have negative consequences. When

infants are successful in reducing negative arousal or inducing and maintaining positive arousal, their behaviors are reinforced by a pleasant internal state, the attraction of and engagement with a social partner, the maintenance of a relationship with a caregiver, and/or the attainment of goals. For example, shifting attention away from an aversive stimulus appears to reduce negative arousal (Crockenberg & Leerkes, 2004; Diener et al., 2002; Grodnick, Bridges & Connell, 1996), and maternal behaviors that distract infants and engage their attention elsewhere have been associated with reductions in infant negative affect (Crockenberg & Leerkes, 2004). Furthermore, caregivers may provide physical reinforcement with voice, touch and embrace that helps infants gain control over their emotions (Crockenberg & Leerkes, 2004; Jahromi et al., 2004; Stack & Arnold, 1998).

According to the tenets of social learning theory, caregivers may also help infants learn how to regulate their emotions by scaffolding effective strategies. Crockenberg and Leerkes (2004) noted that when mothers used gentle touch and/or vocalizations to soothe their infants who were focused on the aversive stimulus, the infants were able to reduce their negative arousal. These authors suggest that this support may scaffold emotion regulation until their infants have the attention control necessary to disengage from aversive stimuli on their own. In a study by Grodnick, Kurowski, McMenamy, Rivkin and Bridges (1998), as children aged, their mothers decreased active engagement of their children's attention as children increased initiation of engagement strategies. These studies support the proposition that with parents' help, infants experience success in reducing arousal so they can effectively meet their goals, learning that emotions can be

controlled. With repeated success, infants develop a sense of efficacy and are able to regulate emotions more independently as they mature.

Social learning theory also proposes that individuals learn from observing others and imitating them. Indeed, infants often look to their parents to get emotional information when they are uncertain about a situation and respond to this information contingently (Buss & Kiel, 2004; Stenberg, 2003). According to social learning theory, when children observe how their parents regulate emotions, children learn how to regulate their own emotions (Eisenberg, Cumberland & Spinrad, 1998; Morris, Silk, Steinberg, Myers, & Robinson, 2007). It is also possible that caregivers who model changes in affect lead infants to regulate their emotions as they synchronize their emotional and behavioral states with each other (Field et al., 1990). For example, Feldman, Greenbaum and Yirmiya (1999) found that maternal-infant synchrony in affect when infants were 3 months old correlated positively with self-control in toddlerhood. This association between affect synchrony in infancy and later self-control suggests that infants learned to regulate themselves, perhaps by observing competent models of regulation (i.e., parents who sustained synchronous interactions with them).

Together, the MRM and attachment theory suggest that infants engage their caregivers in extrinsic support of emotion regulation development, and that the prompt, contingent response of caregivers is essential to this development. Caregivers' response to infants' cues must take into account children's needs, often at the expense of adult-focused goals (Dix, 2000). Caregivers must be able to share their infants' focus, understand infants' goals and help them meet those goals. Gradually, developing children

internalize emotion regulation behaviors, skills and strategies with the help of their caregivers. This internalization occurs through several learning processes, including operant conditioning, scaffolding and social learning, in the context of attachment relationships.

CHAPTER III

LITERATURE REVIEW

Developmental Course of Emotion Regulation

Emotion regulation develops continually over the lifespan, from infancy to senescence, because individuals face new emotional challenges at every stage of development. However, many researchers consider the toddler years to be the most salient period of emotion regulation development (Calkins et al., 1999; Kopp, 1989). An early study of infant emotions (Goodenough, 1931) suggested that emotions begin as innate behavioral response patterns in newborns which become more regulated throughout childhood in response to socialization. In a review on emotion regulation, Kopp (1989) described the stages of this process. At about three months, infants' systems are organized enough for intentional behaviors, such as turning the head, controlling the gaze and grasping objects, behaviors which can serve to regulate emotional experience. Subsequently, young infants begin to associate changes in the experience of emotional discomfort (e.g., boredom, fear, anger) and physiological discomfort (e.g., hunger, pain, temperature) with their behaviors and/or elements in the environment (e.g., crying, attracting caregivers for help). By 5 months, infants communicate information about their emotional state intentionally, with the expectation that caregivers will assist them. Around this time, infants' affective expression, cognitive and motor systems are organized and coordinated well enough to differentiate basic emotions (Weinberg &

Tronick, 1994). By the end of the first year, infants actively elicit the assistance of caregivers in their attempts to regulate emotion, can read the emotion cues of their caregivers, and are receptive to their caregivers' intentional socialization of emotion (Calkins & Hill, 2007; Kopp, 1989). By the end of the second year, toddlers can be deliberate in their emotion regulation strategies because they are able to manipulate their environments to some degree, evaluate the effectiveness of different strategies, and use language to understand and communicate their emotional experiences. Mangelsdorf, Shapiro and Marzolf (1995) found developmental differences in emotion regulation strategies used by the children in their study. At 6 months of age, the most prevalent emotion-related behaviors were gaze aversion and fussing; however, self-soothe and self-distract were more prevalent at 12 and 18 months of age. Directing others to help with the task was the dominant behavior at 18 months. They noted that these behavioral changes coincided with the development of motor and attention skills. Kopp noted that preschoolers actively explore emotions through pretend play and discussion of emotions with peers. They are also expected to regulate their emotions with increasing independence. Consistent with this view, Spinrad et al. (2004) found that mothers offered less assistance (e.g., soothing, distraction) in emotion regulation as children in their study aged from 18 to 36 months, but mothers increased their use of verbal explanations during that time, perhaps as a response to the expanding intellectual capabilities of their children. Thus, there is a gradual shift from the mostly external emotion regulation of newborns to the more internal and masterful emotion regulation of preschoolers (Smith et al., 2006). An interesting developmental window to examine is the period from 6 months,

when infants' emotions are organized but they are limited in their ability to act on the environment, to 16 months, when most infants have started walking and some have begun to talk. Because emotion and emotion regulation appear to underlie functioning in many domains (e.g., cognition, social interaction), important tasks for researchers are identifying those behaviors at both time points that are adaptive in regulating emotional experience, and understanding the influences that shape those behaviors.

Adaptive Emotion Regulation Behaviors

Adaptive emotion regulation can be defined as the modulation of emotional experience and expression in such a manner that immediate goals can be met (Bridges, Denham & Ganiban, 2004) and long term developmental needs can be fulfilled (Cole, Michel & Teti, 1994). Thus, certain behaviors can be classified as adaptive emotion regulation in the immediate context when they assist the individual in the achievement of goals or allow the functioning of other processes (Bridges et al., 2004; Cole et al., 1994; Campos et al., 1994; Keenan, 2000). Adaptive emotion regulation may be extrinsic assistance from caregivers or intrinsic, self-initiated behaviors.

Eliciting the involvement of caregivers can be considered adaptive because more capable partners can help infants meet their goals (Thompson, 1991). There is some empirical support that mother-oriented emotion regulation behavior effectively reduces toddlers' distress. Using contingency analysis, Diener and Mangelsdorf (1999) found that when toddlers engaged in "fussing to mother," their negative affect decreased. Furthermore, toddlers who have a secure attachment with a parent, which by definition means they use their parents as a secure base and protection in the face of uncertainty

(Waters & Cummings, 2000), display less negative emotion during emotional challenges than those with insecure attachments (Diener et al., 2002; Smith et al., 2006).

Because distress can disrupt processes such as problem solving or engagement with the social and physical environments, and because distress is unpleasant, behaviors that reduce distress can be considered adaptive. A contingency analysis by Crockenberg and Leerkes (2004) indicated that for infants, looking away and self-soothing (sucking fingers, gumming, or gentle rubbing) were most likely to be followed by a reduction of distress. Buss and Goldsmith (1998) noted a decrease in negative affect following distraction in frustration-eliciting tasks. In correlational analyses of data from older infants and toddlers, distraction, active engagement alone and with parents, and passive use of objects were negatively associated with distress (Bridges, Grolnick & Connell, 1997; Diener et al., 2002; Grolnick et al., 1996).

Findings about self-soothing conflict somewhat. Crockenberg and Leerkes (2004) found that 6 month old infants' negative affect decreased after self-soothing, and Braungart-Rieker et al. (2001) found a negative association between self-soothing and negative affect among 4 month old infants. However, several researchers have found positive associations between self-soothing and distress in toddlers (e.g., Diener et al., 2002; Grolnick et al., 1996). It is possible that self-soothing serves as an adaptive behavior for infants, but as children develop a larger repertoire of skills, it becomes less adaptive. Considering that self-soothing is prevalent among infants and toddlers who are insecurely attached (Braungart & Stifter, 1991; Diener et al., 2002), and that insecure attachment is associated with negative outcomes (Weinfield et al., 1999), it is likely that

self-soothing in toddlers is not an adaptive emotion regulation behavior.

Emotion regulation can be considered adaptive not only when it reduces distress in the moment, but also when it fosters long term outcomes that enable individuals to function well in response to environmental demands. Stifter et al. (1999) found that infants who engaged in lower levels of regulatory behaviors (i.e., orientation to mother or object, avoidance, non-negative communication and self-soothing) engaged in more avoidance and defiance when asked to comply with parents' requests in toddlerhood, suggesting that emotion regulation deficits in infancy may have a negative influence on later relationships with parents. In a laboratory setting, Crockenberg and Leerkes (2006) found that a focus on the aversive stimulus and withdrawal moderated the relationship between distress at 6 months and anxious behavior at 2 ½ years, such that infants who were more distressed were more anxious as toddlers when they frequently engaged in either of these two behaviors. In another study relating emotion regulation to long term outcomes, Robinson and Acevedo (2001) found that infants high in reactivity who looked to their mother frequently during emotional challenge had better developmental outcomes (i.e., higher cognitive and language skills) at 2 years of age than infants who were low on reactivity and did not look to their mother frequently. Thus, it appears that several behaviors are related to later functioning and so may be considered adaptive emotion regulation strategies.

In sum, adaptive emotion regulation behaviors include those in the service of attention control (e.g., looking away, engagement with mother or a different stimulus), behaviors that reduce the experience of distress (e.g., self-soothing for infants, soothing

from mother), goal-oriented behaviors (e.g., approach and problem solving), and behaviors that elicit the help of caregivers (e.g., look-at-mother, asking her or others to eliminate the source of distress). The current study aims to examine the direct and indirect effects of maternal sensitivity on adaptive emotion regulation behaviors.

Changes in Temperament Over Time

Although temperament has genetically influenced physiological underpinnings and has previously been assumed to be stable across the lifespan, there is ample evidence that environment influences the phenotypical manifestations of temperament, especially early in life (Rothbart & Bates, 2006). Both the reactivity and emotion regulation dimensions appear to change over time. In a cross-sectional study of infant reactions to strangers, Manglesdorf, Shapiro and Marzolf (1995) noted differences in emotion regulation strategies among 6 month old, 12 month old and 18 month old infants and attributed change in strategy use to the developing motor, social and attention systems of infants across these ages. Focusing on both aspects of temperament and using a longitudinal design, Braungart-Rieker and Stifter (1996) detected a distinction between reactivity and regulation at both 5 months and 10 months of age, but over time the association between the two constructs changed. Early in life, reactivity was related to regulation, but by 10 months, infants had developed regulatory skills which were independent of their reactive tendencies. The authors concluded that endogenous factors (e.g., maturation of cognitive and neurological systems) and/or exogenous factors (e.g., caregiver assistance in regulation) may have contributed to these temperamental changes over time.

To examine developmental change in specific dimensions of temperament, Lemery et al. (1999) collected parent reports of child temperament at 7 time points from 3 months to 4 months child age. They found progressive change in positive emotionality, distress/anger, fear and activity level during infancy (i.e., 3 months to 18 months), but stability in these dimensions after 24 months. Similarly, NICHD ECCRN (2004) found that dysregulation was relatively stable from 24 to 36 months. These findings are slightly out of alignment with Roberts and DelVecchio (2000) who noted, in a meta-analysis of temperament and personality across the lifespan, that temperamental traits were the least consistent during the period from birth to 3 years of age. Perhaps the difference in age of consistent temperamental characteristics rises from the broader age span analyzed by Roberts and DelVecchio. In addition to finding considerable change in several temperamental dimensions for very young infants (i.e., birth to 6 months), van den Boom (1994) also noted changes in maternal behavior during that time period. This suggests that environmental influences, specifically maternal behavior, may contribute to discontinuity in early temperament.

Posner and Rothbart (2000) proposed that reactivity is present early in life, whereas the ability to self-regulate develops later. Nonetheless, changes in reactivity during the early years of life have been noted. Maternal behavior seems to be an important influence on infant reactivity, both concurrently and longitudinally. When Crockenberg and Leerkes (2004) used contingency analysis to determine which maternal behaviors were associated with decreases in negative infant affect, they found that distraction and maternal support (soothing vocalizations or touch while sharing infants'

focus on the aversive stimulus) were effective in helping 6 month old infants calm down in the moment after being confronted with a noisy, novel toy. These authors noted that shared attention and contingent responsiveness were essential qualities of mother-infant interactions that led to decreases in negative infant affect. Contingency analysis in a study on reactions to pain by Jahromi et al. (2004) indicated that the effectiveness of some maternal behaviors in regulating infant emotions depended on the intensity of infants' distress. Specifically, feeding/pacifying reduced infant negative affect only at low or moderate levels of distress. Reduced crying was least likely to follow touching, caretaking or distraction when infants were highly distressed. However, at all levels of infant distress, the combination of holding/rocking and vocalizing was the most effective maternal regulation behavior, although neither behavior alone was effective. Thus, concurrent maternal behaviors seem to elicit changes in reactivity in the moment. Perhaps with repetition over time, reactivity is shaped by maternal behavior.

When examining the longitudinal relationship between maternal behavior and infant reactivity, Crockenberg and Smith (1982/2002) found that mothers' longer response times predicted longer cry duration of distressed infants at 3 months of age. Conversely, in a study examining mother-infant dyads during routine inoculations, Jahromi and Stifter (2007) found that effective maternal soothing at 2 months infant age was associated with a shorter duration of infant crying at 6 months infant age. However, there was no association between early maternal soothing and later cry intensity, which suggests that perhaps maternal behavior affected infant regulatory ability, but not reactivity. Nonetheless, evidence of instability in reactivity suggests that maternal

behavior early in the first year shapes infant reactivity. Because reduction of distress may reinforce infants' attempts at regulating emotion, it is possible that maternal behavior affects emotion regulation development as well.

Direct Effects of Maternal Sensitivity on Emotion Regulation

Evidence of the influence of maternal behavior on infant emotion regulation is accumulating. Using a global coding system on a face-to-face interaction setting, Gable and Isabella (1992) found that positive maternal state (mood/affect) and higher maternal physical activity (providing an appropriate level of stimulation) with their 1 month old infants was associated with better infant regulation (affect and gaze) at 4 months of age. Schieche and Spangler (2005) found that when mothers were attentive and helped their toddlers in appropriate ways during increasingly challenging tasks, their toddlers engaged in more exploration and help seeking, two adaptive behaviors that support positive development. Similar findings by Calkins and Johnson (1998) concur that when mothers used positive guidance and feedback, their toddlers were more likely to use constructive strategies to cope with emotionally challenging situations. Thus, maternal behavior can foster adaptive emotion regulation.

Maternal behavior can also have a negative effect on emotion regulation skills. Calkins, Smith, Gill and Johnson (1998) found that when mothers used negative interaction patterns (i.e., scolding, physical control and verbal directives), their 2 year olds were more focused on the aversive stimulus and engaged in less distraction (an adaptive emotion regulation behavior) than 2 year olds with more positive mothers. Some evidence has been found that suggests that there are negative effects on emotion

regulation when mothers are overly intrusive. Calkins and Johnson (1998) noted that mothers who had a tendency to take control of the tasks and do things for their toddler had toddlers who were more distressed and more likely to act out aggressively. Similarly, Grolnick et al. (1998) found that toddlers' distress was positively related to mothers' use of redirection, active engagement and reassurance, and negatively related to mothers' use of behaviors that were unrelated to the task. The authors concluded that overly intrusive mothers did not allow their toddlers to learn independent emotion regulation strategies. More sensitive mothers would attune to toddlers' nascent emotion regulation skills and scaffold appropriate strategies, rather than taking control of toddler's emotional state.

Maternal Sensitivity as a Moderator

Longitudinal Relationship Between Early Reactivity and Later Adaptive Emotion Regulation

Substantial evidence exists that infants and toddlers who are highly reactive (i.e., display high levels of negative affect in response to novelty or frustration) are less adept at emotion regulation and tend to use fewer adaptive strategies than children who are less reactive (Braungart-Rieker & Stifter, 1996; Calkins & Dedmon, 2000; Calkins & Johnson, 1998; Crockenberg & Leerkes, 2004; Diener et al., 2002; Feldman et al., 1999; Grolnick et al., 1996; Little & Carter, 2005). However, results of these studies reflect variation in outcomes for highly reactive infants. Maternal sensitivity may be a key factor accounting for this variation. In a review of the literature, Propper and Moore (2006) found consistent evidence that even if infants are highly reactive in early infancy, they may become well-adjusted and socially adept if they have sensitive parents. Propper and

Moore also noted that social environments interact with genotypic physiology such that negative social environments (e.g., abusive or insensitive parenting) foster the expression of maladaptive behaviors in individuals who are genetically inclined toward low impulse control, internalizing and externalizing behavior disorders and antisocial behavior. Two lines of research further elucidate the moderating effects of maternal sensitivity on emotional development, investigations on the characteristics of irritable infants and investigations which focus on attachment.

Some neonates are more irritable than others, and understanding their development is the focus of much of the temperament research (e. g., Crockenberg & Smith, 1982/2002; Stifter & Spinrad, 2002; van den Boom, 1994; van den Boom & Hoeksma, 1994). Crockenberg and Smith (1982/2002) found that infants who were classified by the Neonatal Behavioral Assessment Scale (NBAS) as irritable remained difficult to soothe at 1 month and at 3 months. Their mothers responded more slowly than mothers of non-irritable infants, especially to irritable male infants. Perhaps these infants were more distressed by the time their mothers intervened and so were more difficult to soothe. To explore the effects of maternal behavior on infant emotional development, van den Boom (1994) taught mothers of 6 month old irritable infants (classified as such by assessment with the NBAS shortly after birth) how to respond sensitively to their infants' cues. At 9 months, their infants engaged in more sophisticated exploration of the environment, soothed themselves more effectively and were more sociable than irritable infants whose mothers did not receive the intervention, and therefore were less sensitive. Furthermore, intervention dyads were more likely to be securely attached at 12 months,

whereas the majority of control dyads were classified as insecurely attached, demonstrating positive effects of an improved caregiving environment on mother-infant relationship quality. That maternal sensitivity can be taught and can have lasting effects is an important finding, because compared with mothers of non-irritable infants, mothers of irritable infants typically engage in low levels of effective stimulation and lower response to positive affect (van den Boom & Hoeksma, 1994). Studying older children, NICHD ECCRN (2004) found that children who were dysregulated (i.e., displayed high negative affect, especially with mother, and/or defiance) received less sensitive and less stimulating caregiving at both 24 and 36 months of age. Dysregulation was stable across the two time periods, which suggests that these children did not receive guidance in emotion regulation. Furthermore, mothers of dysregulated children were more likely to be depressed, poorly educated, and have low incomes than mothers of better regulated children, which indicate a lack of resources to support sensitive parenting. Together, these studies suggest that irritable (i.e., highly reactive) infants with less sensitive mothers may become harder to soothe over time, perhaps because they do not receive the guidance and support they need in order to develop emotion regulation skills. Conversely, highly reactive infants with more sensitive mothers may become better regulated over time.

Investigations into the consequences of attachment relationships also demonstrate the moderating effect of maternal sensitivity on infant emotion regulation. Attachment can be considered a proxy for maternal sensitivity, because the attachment relationship forms as a result of caregiver responsiveness (Ainsworth et al., 1978; Waters &

Cummings, 2000; Weinfield et al., 1999). Secure attachment reflects caregivers' consistent, sensitive, but not intrusive response to both positive and negative emotions of their infants. Mothers of insecurely attached infants are less sensitive, more intrusive, and less responsive than mothers of securely attached infants, with differences between mothers of resistant and avoidant infants. Specifically, mothers of avoidant infants seem to dislike close physical contact and are less expressive than other mothers, whereas mothers of resistant infants are preoccupied and inconsistently responsive (Ainsworth et al., 1978; Cassidy, 1994; Mills-Koonce et al., 2007; Weinfield et al., 1999). Empirical evidence supports the contention that maternal sensitivity differs by attachment group; specifically, mothers of insecure infants are less sensitive than mothers of secure infants (Braungart-Rieker et al., 2001; Mills-Koonce et al., 2007) Thus, different attachment classifications can be considered to reflect variations in maternal sensitivity.

For example, examining the behavioral and physiological organization of toddlers during challenging situations and the influences of inhibition and maternal behavior, Schieche and Spangler (2005) found moderating effects of attachment quality. Presenting toddlers with three tool-using tasks of increasing difficulty, the researchers found that children identified by maternal report as highly inhibited differed in the level of salivary cortisol activation (an index of emotional stress) and behavior patterns depending on their attachment classification. Highly inhibited toddlers in the resistant and disorganized groups, who likely had a history of insensitive parenting, had higher levels of cortisol activation and were less engaged in the tasks than inhibited toddlers in the secure attachment group. Inhibited toddlers with secure attachment, who likely had a history of

sensitive maternal responsiveness, had lower cortisol levels, more actively sought their mothers' help and were more engaged in the tasks. Although maternal behavior did not have a direct effect on cortisol activation, maternal sensitivity, as reflected by attachment classification, appears to moderate the relationship between inhibition and emotion-related physiology and regulation behavior.

Braungart and Stifter (1991) examined patterns of negative reactivity and emotion regulation behavior during the Strange Situation among infants in different attachment classifications. They found that infants classified as C (insecure-resistant) and infants classified as B3/B4 (a sub-group of secure) both displayed high distress when their mothers left the room. However, the B3/B4 infants, who presumably had more sensitive mothers than the C infants, soothed more easily and used more regulatory behaviors (i.e., orienting toward people and/or objects, exploring toys) during the reunion episode, when their mothers returned. Interestingly, B1/B2 and B3/B4 infants, who have mothers assumed to be equally sensitive, did not have the same pattern of behavior. The B1/B2 infants were less upset when their mothers left the room and used lower levels of regulatory behavior compared to the B3/B4 infants, suggesting that temperamental reactivity may be a more important influence on behavior than extrinsic emotion regulation when mothers are sensitive.

Longitudinal Relationship Between Early Mother-Oriented Emotion Regulation and Later Adaptive Emotion Regulation

The theories outlined above propose that children take an active role in engaging their caregivers. Empirical support for this proposition can be found in several studies of

toddler emotion regulation development in which behaviors directed towards caregivers are noted. Examples of this “mother-oriented” emotion regulation behavior cited in the following studies include social referencing/looking at mother, seeking proximity to or contact with mother, engaging mother in interaction, fussing or vocalizing to mother, and asking mother for help. Findings from research designs that constrain mothers’ involvement with their toddlers during part of an emotionally challenging task confirm that toddlers most actively seek her help during this constrained period, suggesting that toddlers seem to expect help from their mothers when they are distressed (Diener & Mangelsdorf, 1999; Grolnick et al., 1996). Similarly, Parritz (1996) found that toddlers exhibited more mother-oriented behaviors (proximity, pulling/pushing mother toward the aversive stimulus and social referencing) when they were faced with a novel toy, an unfamiliar animal or a stranger than during a free play session. Additionally, Smith et al., (2006) found that higher negative affect during episodes designed to elicit either positive emotion or fear from toddlers was associated with more mother-oriented behavior.

Interestingly, there is evidence that some toddlers do not seek their parents’ help for emotion regulation and tend to rely more on independent behaviors to reduce distress. Tonyan (2005) found that 14 month old toddlers with mothers who minimized the importance of their child’s distress (e. g., made comments such as, “Don’t be a crybaby!”) signaled their emotions to their mothers less clearly at 24 months of age than other toddlers. It may be that these toddlers learned that their parents would not help them manage distress because the parents rejected their negative emotions. Likewise, Braungart and Stifter (1991) found that toddlers who had been classified as having an

avoidant attachment style with their parents, a proxy for insensitive parenting, were less likely to turn to parents and more likely to engage in self-soothing and self-distraction during emotionally challenging situations; although Diener et al. (2002) found this to be the case only when toddlers were classified as avoidant with fathers but not with mothers. Thus, whether toddlers use mother-oriented emotion regulation strategies, which are considered adaptive, may depend on maternal response to toddlers' emotional needs. In fact, Diener et al. found that toddlers in their study with secure attachments, a proxy for sensitive mothering, used more parent-focused emotion regulation behavior than those with insecure attachments. Together, the evidence presented suggests that most toddlers seek the help of caregivers when they are emotionally challenged. However, some toddlers encounter a social environment unresponsive to their distress and may develop a more self-reliant emotion regulation style. Thus, maternal sensitivity may moderate the link between the use of mother-oriented emotion regulation and adaptive emotion regulation.

The literature reviewed thus far regarding children's use of mother-oriented emotion regulation behavior focused on infants and toddlers from the ages of 12-13 months to 24 months. Few studies examine the mother-oriented behavior of younger infants. An exception is Robinson and Acevedo (2001), who measured the frequency of look-at-mother and affect expression of 6 to 9 month old infants during six emotion-eliciting episodes (two positive, two anger and two fear). They called this combination of infant affect and visual engagement "emotional vitality", or the tendency to experience emotions intensely and to share those emotions with others. Robinson and Acevedo

hypothesized that infants high in emotional vitality (i.e., display high positive and negative affect and look frequently at caregivers) are able to engage the help of others in regulating reactivity and exploring the environment and so would have better developmental outcomes than infants low in emotional vitality (i.e., low affect and infrequent looking at caregivers). When the children were 2 years old, the researchers measured their cognitive and language skills, yielding data that confirmed this hypothesis. The longitudinal relationship between use of mother-oriented emotion regulation in infancy and later use of adaptive emotion regulation skills, and the influence of maternal sensitivity on this relationship, remains unclear.

Summary and Hypotheses

The MRM and attachment theory support the proposition that maternal sensitivity to infants' emotion cues is an important influence on reactivity and emotion regulation in early toddlerhood. Infants learn through operant conditioning, scaffolding and imitation of models which are provided in the context of attachment relationships. Empirical evidence substantiates the presence of individual variation in both the way in which infants elicit adult involvement and the way in which adults respond to their infants' signals, possibly resulting in differences in the use of adaptive emotion regulation behavior. Because infants can actively elicit support from their caregivers, those infants who encounter a social environment that is responsive to their efforts may receive more help in developing emotion regulation skills than infants who do not receive support from the social environment. Based on the literature reviewed and the theories outlined above, the following hypotheses will be tested:

1. Maternal sensitivity will moderate the relationship between infant negative reactivity at 6 months and 16 months. Specifically, infants who are more reactive at 6 months and who have more sensitive mothers will be lower in reactivity at 16 months than more reactive infants with less sensitive mothers. This association will not be apparent for infants who are lower in reactivity at 6 months.
2. Maternal sensitivity at 6 months will be positively associated with infants' adaptive emotion regulation behavior at 16 months.
3. Maternal sensitivity will moderate the relationship between negative reactivity at 6 months and the use of adaptive emotion regulation behavior at 16 months. Specifically, more reactive infants with more sensitive mothers will use more adaptive emotion regulation behavior whereas more reactive infants with less sensitive mothers will use less adaptive emotion regulation behavior at 16 months. This association will not be apparent for infants who are lower in reactivity at 6 months.
4. Maternal sensitivity will moderate the association between infants' use of mother-oriented emotion regulation behavior at 6 months and their use of adaptive regulation behavior at 16 months. Specifically, infants who looked more at their mothers at 6 months will use more adaptive emotion regulation behavior, both mother-oriented and independent, at 16 months if their mothers were more sensitive. This association will not be apparent among infants whose mothers were less sensitive at 6 months.

In this study, temperament, emotion regulation, and maternal sensitivity were observed during tasks designed to elicit infant fear and anger, two specific emotions that are central in conceptions of temperament (Rothbart & Bates, 2006). However, no predictions were made with regard to specific emotions, but rather with regard to negative reactivity, the regulation of negative emotion, and maternal sensitivity to distress. Thus, measures across the fear and anger contexts were collapsed for each construct. This approach is consistent with the conceptualization and is further supported by empirical evidence. For example, negative emotionality, a composite of reactivity within several negative emotions has good predictive utility, especially in interaction with parenting to predict child outcomes (e.g., Feldman et al., 1999; Rothbart & Bates, 2006)

CHAPTER IV

METHOD

Participants

The participants were drawn from the Infant Parent Project, which examined the predictors of maternal sensitivity to infant distress. Women in their eighth month of pregnancy were recruited from childbirth classes offered at a local hospital, the Public Health Department, and a teen parent program sponsored by the YWCA. When their infants were 6 months old, 101 mothers and infants completed an observational assessment of infant temperament, emotion regulation, and maternal behavior. Seventy mothers and toddlers who had observational data at 6 months returned for observational assessments when their toddlers were 16 months old. This group of mothers was 77 % Caucasian, 17% African American and 6% other races. Maternal age ranged from 17 to 37 years ($M = 28.2$). Thirteen percent of the mothers had a high school education or less; 21% had attended college; 66% had a 4 year degree or higher. All mothers were primiparous; 94% were married or living with their partner. Annual incomes ranged from \$15,000 to \$170,000 ($M = \$65,000$). All infants were healthy and full term, and 54% were male. There were no significant differences on demographic variables, 6 month infant reactivity, or maternal sensitivity between dyads who returned for the 16 month observation and those who did not.

Procedure

Study Design

Research assistants visited local childbirth classes and the public health department to recruit pregnant mothers for participation in the Infant Parent Project, from which this study is drawn. Mothers brought their 6 month old infants to the playroom on campus to participate in an observation of infant temperament, emotion regulation, and maternal behavior. Mothers and toddlers returned to the playroom when their toddlers were 16 months old to participate in a second observation. During each visit, mother-infant dyads participated in tasks designed to elicit negative emotions from infants (i.e., fear and anger), procedures adapted from Goldsmith and Rothbart's (1996) Lab Tab protocol. These procedures have been used widely in the study of emotion regulation and their predictive utility has been demonstrated (Calkins & Johnson, 1998; Crockenberg & Leerkes, 2004 & 2006; Diener & Mangelsdorf, 1999).

Prior to each visit to the playroom, mothers responded to a questionnaire rating their child's temperament. Participating families were given gift cards to a department store.

6 Month Observation

Near the infant's 6 month birthday, mothers brought their infants to the observation playroom. Mothers and infants were videotaped from the time they entered the room until the end of the second emotion eliciting task. When they arrived, mothers and infants had a ten minute period to adjust to the setting as mothers changed infants into gender neutral clothes. After this adjustment period, mothers were asked to place

their infant in a car seat and sit nearby where they could reach their infants and the infants could see them. Then the research assistant presented two emotion eliciting tasks (novelty and limitations, counterbalanced) separated by a 5-minute break. Mothers were asked to remain seated and refrain from interacting with their infants during the first minute of each task, then were allowed to interact however they would like. A basket of toys was available within mothers' reach throughout each task. If at any time an infant became extremely upset for 1 minute duration, or if a mother requested, the research assistant stopped the task.

Novelty task. On a table in front of the infant, the researcher placed a large remote control truck with a Spider Man doll riding on top, then moved out of the infant's sight. The table had a barrier fixed on the edge so that the toy truck would not touch the infant. The truck approached to within about 1 foot of the infant, stopped, made loud noises (horn, ignition sound, music and a voice saying, "Move it out.") and vibrated, then retreated to about 3 feet away. The research assistant signaled the mother after 1 minute indicating that she could interact with her infant however she would like, with the exceptions of touching the toy or taking the child out of the carseat unless the mother wanted to end the task. The truck's approach-stop-retreat sequence was repeated two more times while the mother was involved. At the end of the procedure, the truck stopped within the infant's reach and stayed still without making noise for 1 minute. The entire task lasted 4 minutes.

Limitation task. With mother seated nearby and the infant in the car seat, the research assistant gently held the infant's forearms, keeping them by the infant's side.

The research assistant positioned herself so the infant could not see her face. After 1 minute, the research assistant signaled the mother that she could interact with her infant however she would like, with the exception of taking the child out of the carseat unless the mother wanted to end the task. After a total of 4 minutes, the research assistant released the infant's arms.

16 Month Observation

Mothers and infants returned to the observation playroom when infants were 16 months old (toddlers). The research team conducted the Ainsworth Strange Situation. Afterwards, the research team carried out two 4-minute emotion eliciting tasks. Because there were no effects of order of task at the 6 month observation and the novelty task was anticipated to be the most challenging, the tasks were not counterbalanced, increasing the likelihood that both tasks would be completed. As before, mothers were asked to remain seated and refrain from interacting with their toddlers during the first minute of each task, then were allowed to interact however they would like with their toddlers. A basket of toys was available within mothers' reach throughout each task. If at any time a toddler became extremely upset for 1 minute duration, or if a mother requested, the research assistant stopped the task. Eight toddlers did not complete one of the tasks; 4 toddlers did not complete either task.

Limitation task. The researcher took out a toy phone and offered it to the toddler. Once the toddler was involved with the phone, the researcher took it from him/her and placed the phone in a clear plastic jar, closing the lid tightly so that it was impossible for the toddler to open and placed it on the floor near the toddler. Mothers were asked to

refrain from opening the jar for their toddler until the 4 minute task had ended. The research assistant encouraged the toddler to open the jar with verbal prompts (“I’m calling you! Get the phone out of the jar!”). After 4 minutes, the research assistant opened the jar and gave the phone to the toddler.

Novelty task. A research assistant dressed in a green robe, wearing a green character face mask (Shrek) and carrying large green plastic hands entered the room and stood still at the door for 10 seconds. Then the research assistant spoke a script (“Hello, [child’s name] what are you doing? I’m an ogre,” etc.) in a neutral voice. Another research assistant knocked on the observation room window when one minute had passed, to signal mothers that they could begin interacting with their toddlers however they normally would. The research assistant approached to within 2 feet of the toddler, crouched down and repeated the script. The masked researcher crossed the room and performed a short dance while humming a song with which the toddler would likely be familiar, and then slouched in a chair pretending to sleep while snoring loudly. The research assistant pretended to wake up and approached the toddler again, crouching down next to him/her and repeating the script until the other assistant knocked on the window to indicate the end of the 4 minute task.

Measures

Behavioral Coding

All infant and maternal behavior was continuously coded using event-based coding in the Observer Video Pro 5.0 (Noldus). Coders blind to the hypotheses and other data were trained to achieve adequate reliability (i.e., average Kappa > .70).

Reactivity at 6 and 16 months. Reactivity was rated by trained observers based on video-tapes of the playroom observations. Different coders, blind to the hypotheses, rated reactivity at 6 months and 16 months. By observing facial expression, body movement, and vocalizations coders rated child reactivity on a 7 point scale ranging from (1) high positive (open mouth, intense smile, laughing or squealing) to (7) high negative (screams, wails, sobs intensely, mouth wide), according to a rubric designed by Braungart-Rieker and Stifter (1996). (See Infant Reactivity in Appendix A.). Inter-rater reliability was calculated based on 33 tapes for the 6 month observation, which was 32% of the sample (Kappa = .73), and based on 20 tapes for the 16 months rating, which was 30% of the sample (Kappa = .89). Average level of reactivity across the novelty and limitations tasks was calculated, yielding a measure of observed infant reactivity at each age. Because higher scores indicate more negative reactivity, the term ‘reactivity’ will refer to negative reactivity in the remainder of this document.

Maternal sensitivity to distress. Considering that the sensitivity of any discrete maternal behavior can only be assessed when the infants’ emotional state is taken into account, maternal behavior was coded in reference to concurrent infant affect (Leerkes & Crockenberg, 2003). First, thirteen maternal behaviors were coded: *negative*—negative reactivity or vocalization in reaction to infant; *intrusive*—makes infant conform to mothers’ goals; *mismatched affect*—mother laughs or smiles while infant is distressed, mother denying infant’s emotions; *withdraw*—mother moves away or abruptly stops interacting; *distracted from infant*—mother is uninvolved with infant, perhaps engaged in other activities; *persistent ineffective*—mother continues an action that is not effective;

monitor—mother watches infant; *calming contact*: mother soothes infant with touch or vocalization; *supportive*—mother provides physical or verbal support when infant is focused on task or on verge of distress; *task focused*—mother directs infant’s attention toward emotion-eliciting task; *engagement non-task*—mother plays with or engages infant’s attention; *routine care*—mother grooms infant, wiping nose, straightening clothes; *uncodable*—mother cannot be seen. (See Maternal Behavior Codes in Appendix B for complete descriptions.)

Next, these files were merged with the code files containing the observed reactivity ratings noted above (i.e., each task at each age separately). The maternal behavior received a sensitivity rating of 1 (insensitive), 2 (ambiguous/moderately sensitive) or 3 (sensitive), depending on the observed reactivity rating which co-occurred with the behavior. Table 1 outlines the scoring rubric. For example, a maternal behavior code of “monitoring” received a sensitivity rating of 2 when infant affect was positive, 3 if infant affect was neutral and 1 if infant affect was negative. That is, if a mother was just watching her distressed infant, her behavior was rated insensitive because she was not attempting to meet her infant’s needs. However if she was just watching her neutral infant, she was rated as sensitive, because she was available to engage should the infant need her. When watching a happy baby, a mother was rated just moderately sensitive because she was not matching the infant’s affect or making an effort to interact positively. Thus, each moment of the activity was assigned a sensitivity rating. In this study, maternal sensitivity to distress calculated by averaging the sensitivity rating across all moments of infant distress. Maternal sensitivity to distress was averaged across tasks,

Table 1. *Maternal Behavior Codes and Sensitivity Ratings Based on Infant Affect*

Maternal Behavior	Description	<u>Rating Based on Infant Affect</u>		
		Positive	Neutral	Negative
negative	directs negative affect toward the infant	1	1	1
intrusive	forces own agenda on the infant	1	1	1
mismatched affect	affect is incongruent with infant's	1	1	1
withdraw	mother abruptly moves away or ends interaction with infant	1	2	1
distracted	uninvolved or minimally involved with infant	1	2	1
persistent ineffective	continues to respond to infant in same ineffective manner when alternative responses are available	2	2	2
monitor	watches infant/situation without intervening	2	3	1
task focused	engages with infant focusing on the arousing task	3	3	1
calming	soothes infant physically or vocally	3	3	3
supportive	maintains the infant's attention on the task while simultaneously calming the infant	3	3	3
non-task focused engagement	plays with or distracts the infant without using the arousing task	3	3	3
routine care	engages in practices like wiping nose, straightening clothing	3	3	1

Note: Infant positive affect is a rating of 1, 2, or 3, neutral is 4, and negative is a rating of 5, 6, or 7.

yielding 2 ratings on a continuous scale from 1.0 - 3.0. Kappa for the 6 month data was .79, based on 18 videos (17% of the sample). Kappa for the 16 month data was .89, based on 20 videos (28% of the sample). Maternal sensitivity using this dyadic coding system has predicted children's subsequent behavior problems (Crockenberg & Leerkes, 2006) and has correlated with global ratings of sensitivity (Leerkes & Crockenberg, 2002), demonstrating its validity.

Mother-Oriented Emotion Regulation (6 months). Developmentally and because of limited movement in the car seat, the only mother-oriented emotion regulation behavior available to infants at 6 months was to look at their mother. Because infants may look at their mothers on their own initiative or in response to mothers' actions, two types of mother-oriented emotion regulation behavior were identified. **Look-at-mother** was coded as **mother-initiated** if mothers spoke, presented a toy, touched, or actively sought to engage infants' attention in the moment immediately preceding infants' shift of gaze toward their mothers. **Infant-initiated look-at-mother** was coded if infants looked at their mothers when mothers made no salient bid for infants' attention. Reliability between coders was good (Kappa = .85). The percentage of time infants engaged in either of these looking behaviors during the emotion-eliciting tasks was calculated. Infant-initiated and mother-initiated look-at-mother were not correlated with each other.

Adaptive emotion regulation (16 months). Six behavior categories were coded for the 16 month old toddlers (gaze, body position, soothing, stimulation, venting, problem solving). Within each category, several behaviors were coded as follows: *gaze*—inspect aversive stimulus, look away, look at mother; *body position*—approach, withdraw, seek

proximity to mother, neutral; *soothing*—self-soothing, soothing from mother, no soothing; *stimulation*—play alone, play with mother, no play; *problem solving*—object-focused, bid to mother, bid to experimenter, no problem solving; *venting*—venting, no venting. (See Toddler Emotion Regulation in Appendix C.)

As described in the introduction, prior literature was consulted to identify the set of regulatory behaviors that appear to be adaptive both in the short- and long-term. Because both extrinsic and intrinsic regulation behaviors can be considered adaptive, but may have different predictors, scores reflecting these two different types of adaptive emotion regulation behavior were created. **Mother-oriented emotion regulation behavior** at 16 months was the percent of time toddlers engaged in active efforts to utilize their mothers as a source of support. This included looking at mother, seeking proximity to mother, playing with mother, and asking mother for help, verbally or nonverbally. **Independent emotion regulation behavior** included looking away from the stimulus (but not toward mother), approaching the stimulus, playing alone, asking the researcher for help, and object-focused problem solving. Note that self-soothing (e.g., thumb-sucking, hair twirling) was not included in independent emotion regulation, because of the association of this behavior with maladaptive emotion regulation in the literature (Braungart and Stifter, 1991; Diener et al., 2002).

Maternal Report of Temperament

Before each of the observation playroom visits, temperament rating scales were mailed to mothers to complete at home and bring with them to the visit. At 6 months postpartum, mothers completed the Infant Behavior Questionnaire-Revised (IBQ-R;

Gartstein & Rothbart, 2003); then at 16 months postpartum mothers completed the Toddler Behavior Assessment Questionnaire (TBAQ; Goldsmith, 1996). Both scales ask mothers to describe on a scale from 1 (*never*) to 7 (*always*) the frequency with which their child displayed various behaviors in response to everyday situations in the past week. For example on the IBQ-R, mothers were asked, “When something the baby was playing with had to be removed, how often did s/he cry or show distress for a time?” In previous research, both measures demonstrated adequate inter-rater reliability between parents or parents and caregivers, and resulting scores tend to correlate mildly with trained observers’ reports of temperament based on laboratory assessments (Goldsmith, Rieser-Danner, & Briggs, 1991; Rothbart, 1986; Rothbart & Goldsmith, 1985). In the present study, scores from 2 subscales of the IBQ-R, fear and distress to limitations (32 items total) were averaged to yield a measure of maternal report of infant reactivity at 6 months (Cronbach’s alpha = .84). Scores from 2 subscales of the TBAQ, social fear (19 items) and anger (28 items) were averaged to yield a measure of maternal report of infant reactivity at 16 months (47 items total; Cronbach’s alpha = .85).

Data Reduction

The observed and maternal report measures of reactivity were positively correlated at each age, $r(df = 69) = .27$, $p < .05$ at 6 months and $r(69) = .24$, $p < .05$ at 16 months. Thus, to capitalize on the advantages of each type of measurement and to create the most reliable measure of reactivity, these scores were standardized and averaged within age. Higher scores indicate more negative reactivity.

CHAPTER V

RESULTS

Preliminary Analyses

Data analysis was conducted in three steps. First, distributions were examined. Several variables had significant outliers which were brought into range (within +/-3.29 SD of the mean) following procedure outlined by Tabachnick and Fidell (2001). Next, the proportion of missing data was determined (1.16%). Missing values were imputed, with the exception of maternal sensitivity to distress. Four infants did not express distress. It is possible that their mothers were highly sensitive and prevented their infants' distress; it is also possible that these infants were not easily aroused, regardless of their mothers' degree of sensitivity. Because it is impossible to infer mothers' degree of sensitivity from infants' composure, missing values for maternal sensitivity to distress were not imputed. Final sample size was 66 mother-infant dyads. Descriptive statistics of maternal and infant behavior are presented in Table 2.

Next, potential covariates were examined. ANOVA, t-tests, and correlations were used to determine if infant reactivity, emotion regulation behavior and maternal sensitivity to distress varied based on infant gender, maternal race, education or income. None were significant. Zero-order correlations among predictors and 16 month emotion regulation behavior and reactivity were calculated and are reported in Table 3.

Table 2: *Descriptive Statistics*

	<u>M</u>	<u>SD</u>	<u>Range</u>
Maternal Sensitivity to Distress	2.25	.49	1.15-3.0
<u>Infant Reactivity</u>			
6 months			
Observed	4.12	.27	3.49-4.90
Mother Report	2.68	.59	1.41-4.20
Combined	0.0	.80	-1.31-2.61
16 months			
Observed	4.25	.36	3.77-5.42
Mother Report	3.65	.54	2.58-4.82
Combined	0.0	.79	-1.22-2.23
<u>Emotion Regulation Behavior</u>			
6 months look-at-mother			
Infant-Initiated	.03	.03	0.0-.12
Mother-Initiated	.10	.07	0.0-.30
16 months adaptive			
Mother-Oriented	.11	.06	0. -.24
Independent	.51	.10	.29-.85

Note: n = 66.

Table 3: *Zero-Order Correlations Among Primary Variables*

	1	2	3	4	5	6	7
1. Maternal Sensitivity to Distress (6 months)							
2. Infant Reactivity at 6 months	.08						
3. Mother-Initiated Look-at-mother (6 months)	.10	-.06					
4. Infant-Initiated Look-at-mother (6 months)	-.35**	.16	.04				
5. Toddler Reactivity at 16 months	.04	.36**	.13	.00			
6. Mother-Oriented Emotion Regulation (16 months)	-.02	.12	-.06	-.01	.37**		
months)							
7. Independent Emotion Regulation (16 months)	.09	.05	.31**	.01	.31**	.19	

Note: n = 66. ^tp < .10; **p < .01

Primary Analyses

Hierarchical multiple regression was used to test Hypothesis 1, stability of infant reactivity from 6 months to 16 months with moderation by maternal sensitivity. With 16 month reactivity as the dependent variable, 6 month reactivity and maternal sensitivity, both variables centered, were entered as main effects in the first block. Moderation by maternal sensitivity to distress was tested by entering the product of the two centered main effect variables (6 month reactivity x maternal sensitivity) into the second block as recommended by Aiken and West (1991). As reported in Table 4, infant reactivity at 6 months had a direct effect on reactivity at 16 months, indicating stability. Contrary to the hypothesis, there was no evidence of moderation by maternal sensitivity on the stability of infant reactivity.

Hierarchical multiple regression was also used to test Hypotheses 2 and 3, the direct effects of maternal sensitivity on adaptive emotion regulation at 16 months and the moderating effects of maternal sensitivity to distress on the relationship between infant reactivity at 6 months and use of adaptive emotion regulation at 16 months. First, the regression was calculated with mother-oriented emotion regulation behavior as the dependent variable. Main effects were examined by entering 6 month reactivity and maternal sensitivity to distress, both variables centered, into the first block. The proposed moderation effect of maternal sensitivity to distress was tested by entering the product of the centered main effect variables (6 month reactivity x maternal sensitivity) into the second block. Thus, the full model included 2 direct effects and one interaction. With a sample size of 66, sample size relative to predictors exceeded the rule of thumb that there

Table 4: *Hierarchical Regression Predicting Reactivity at 16 Months from Reactivity at 6 Months (Hypothesis 1).*

<u>Infant Reactivity at 16 months</u>					
	B	SE	Beta	ΔR^2	ΔF
Step 1				.13	4.58*
Infant Reactivity 6 mo.	.34	.11	.36**		
Mat. Sensitivity to Distress	.02	.19	.01		
Step 2				.00	.00
Reactivity X Sensitivity to Distress	.00	.27	.00		
Total					.13
F for Model			3.00*		

Note: n = 66; * $p < .05$; ** $p < .01$

be 10 participants per predictor (Howell, 2002). This model was repeated using independent emotion regulation behavior as the dependent variable. As shown in Table 5, infant reactivity and maternal sensitivity to distress at 6 months had no direct effect on mother-oriented or independent emotion regulation behavior at 16 months. The interaction between infant reactivity and maternal sensitivity at 6 months was significant at trend level in relation to mother-oriented emotion regulation. Given evidence that detecting interactions in non-experimental research is difficult, this interaction effect was interpreted as recommended by Whisman and McClelland (2005). This moderating effect was interpreted by graphing 3 regression lines relating infant reactivity to mother-oriented emotion regulation, one line for each of three levels of maternal sensitivity, low (-1 SD), mean, and high (+ 1 SD), as in the Figure. Consistent with the hypothesis, early infant reactivity was only positively associated with the subsequent use of mother-oriented emotion regulation behavior if mothers were high in sensitivity to distress ($B = .02, p < .01$). In contrast, infant reactivity at 6 months was unrelated to the use of mother-oriented emotion regulation behavior at 16 months if mothers were low on sensitivity to distress ($B = -.02, ns$).

Hypothesis 4, the moderating effect of maternal sensitivity on the association between infants' use of mother-oriented emotion regulation behavior at 6 months and their use of adaptive emotion regulation behavior at 16 months, was tested with hierarchical multiple regression. First, the regression was calculated with mother-oriented emotion regulation behavior as the dependent variable. Main effects were examined by entering mother-initiated look-at-mother and maternal sensitivity to distress, both

Table 5: *Hierarchical Regressions Predicting Adaptive Emotion Regulation Behavior at 16 Months from 6 Month Reactivity (Hypotheses 2 and 3).*

	Mother-Oriented					Independent				
	B	SE	β	$R^2\Delta$	F Δ	B	SE	β	$R^2\Delta$	F Δ
Step 1				.02	.56				.01	.27
6 mo. Reactivity	.01	.01	.13			.00	.02	.02		
Sensitivity to Distress	.00	.02	-.03			.02	.03	.09		
Step 2				.06	3.67^t				.01	.72
Reactivity X Sensitivity	.04	.02	.26 ^t			-.03	.04	-.12		
Total				.08					.02	
F for Model	1.61					.42				

Note: n = 66; ^tp < .10; *p < .05; **p < .01.

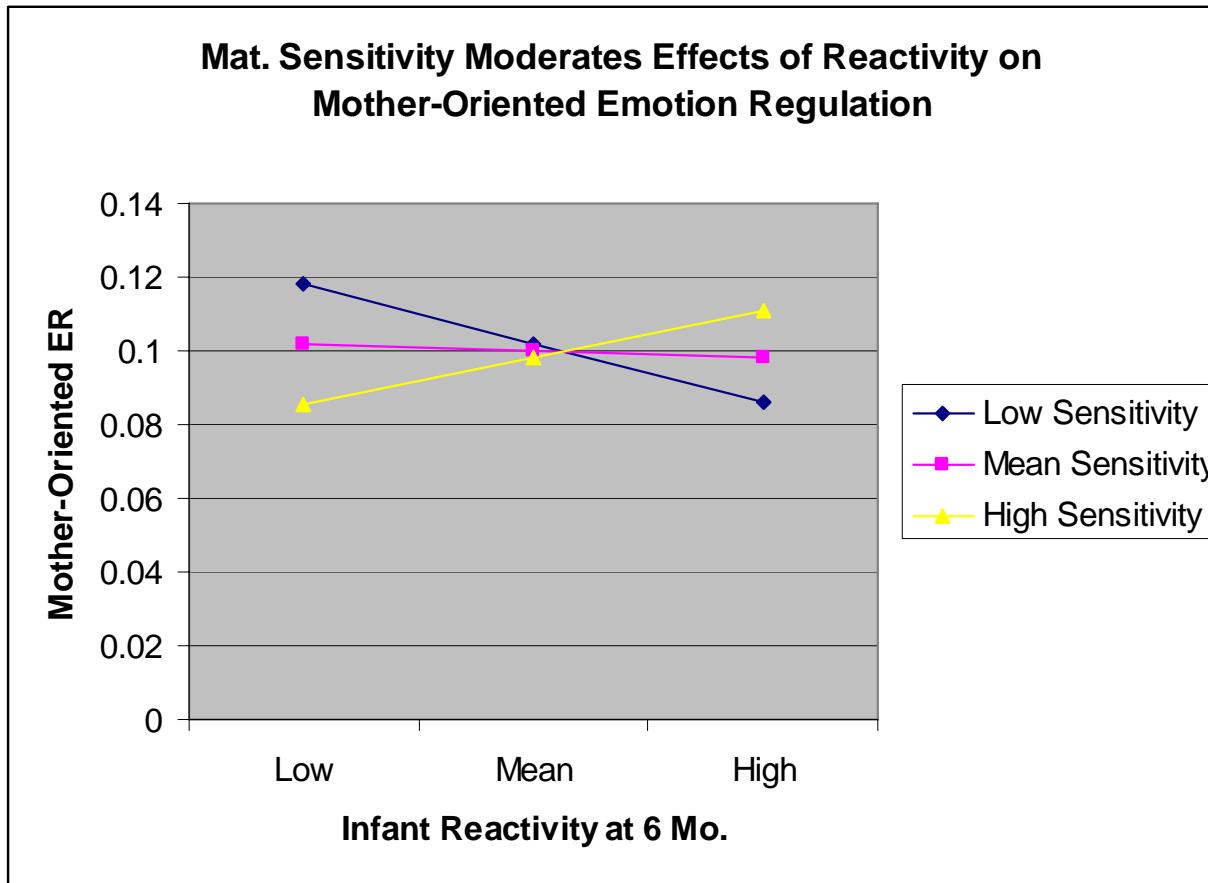


Figure *Maternal Sensitivity Moderates the Effects of Infant Reactivity at 6 Months on Mother-Oriented Emotion Regulation at 16 Months*

variables centered, into the first block. The proposed moderation effect of maternal sensitivity to distress was tested by entering the product of the centered main effect variables (mother-initiated looks to mom x maternal sensitivity) into the second block. This regression analysis was repeated with independent emotion regulation behavior as the dependent variable. Then a second set of similar regression analyses was calculated substituting infant-initiated look-at-mother for mother-initiated. Results are reported in Tables 6 and 7.

Mother-initiated look-at-mother predicted independent emotion regulation behavior, but not mother-oriented, in a positive direction. Infant-initiated look-at-mother had no direct effect on either type of adaptive emotion regulation behavior. Maternal sensitivity did not moderate the relationship between mother- or infant-initiated look-at-mother and either type of adaptive emotion regulation behavior.

Post Hoc Analysis

Given that mother-initiated and infant-initiated look-at-mother operated differently, and the difference between the two is that mothers did something prior to one but not the other, it is possible that these effects are actually a function of sensitive maternal behavior. To explore this possibility, the percent of time mothers used engagement (i.e., played with or distracted their infants), one type of sensitive behavior, was examined. This maternal behavior was selected because conceptually, it should be the maternal behavior most likely to promote looking at mother. Consistent with this view, maternal engagement was positively associated with mother-initiated look-at-mother (r [df = 68] = .27, $p < .05$), but negatively associated with infant-initiated look-at-

Table 6: Hierarchical Regressions Predicting Adaptive Emotion Regulation Behavior at 16 Months from Mother-Initiated Look-at-Mother at 6 Months (Hypothesis 4)

	<u>Mother-Oriented</u>					<u>Independent</u>				
	B	SE	β	$R^2\Delta$	$F\Delta$	B	SE	β	$R^2\Delta$	$F\Delta$
Step 1				.01	.18				.09	3.27*
Mom-Init. Looks to Mom	-.06	.11	.07			.45	.18	.30*		
Sensitivity to Distress	.00	.02	-.01			.01	.03	.06		
Step 2				.01	.58				.01	.98
Mom-Init. Looks X Sensitivity	.14	.19	-.10			.32	.32	.12		
Total				.02					.10	
F for Model	.311					2.51				

Note: n = 66; $^t p < .10$; $*p < .05$; $**p < .01$; init. = initiated

Table 7: Hierarchical Regressions Predicting Adaptive Emotion Regulation Behavior at 16 Months from Infant-Initiated Look-at-Mother at 6 Months (Hypothesis 4)

	<u>Mother-Oriented</u>					<u>Independent</u>				
	B	SE	β	$R^2\Delta$	$F\Delta$	B	SE	β	$R^2\Delta$	$F\Delta$
Step 1				.01	.03				.01	.33
Infant-Init. Looks to Mom	.06	.29	.03			.20	.51	.05		
Sensitivity to Distress	.00	.02	-.01			.02	.03	.11		
Step 2				.00	.25				.00	.02
Infant-Init. Looks X	.28	.55	.06			.14	.97	.02		
Sensitivity										
Total				.01					.01	
F for Model			.10					.22		

Note: n = 66; ${}^t p < .10$; $*p < .05$; $**p < .01$; init. = initiated

mother ($r [df = 68] = -.45, p < .01$). Thus, maternal sensitivity may underlie the direct effect of mother-initiated look-at-mother on independent emotion regulation behavior.

In summary, the hypotheses were only mildly supported. There was some evidence of stability in reactivity from 6 to 16 months, but no evidence of moderation by maternal sensitivity to distress. Maternal sensitivity moderated the relationship between infant reactivity at 6 months and use of mother-oriented emotion regulation at 16 months, but did not have a direct effect on infants' use of adaptive emotion regulation at 16 months. Mother-initiated look-at-mother at 6 months was associated with the use of independent emotion regulation at 16 months, but this association was not moderated by maternal sensitivity. The posthoc analyses suggest that maternal engagement had an indirect effect on subsequent independent emotion regulation by enticing infants to practice looking away from the distressing event.

CHAPTER VI

DISCUSSION

The longitudinal effects of maternal sensitivity on infants' temperamental reactivity and emotion regulation were investigated in this study of infant emotional development, an improvement over correlational and cross-sectional studies in the literature. The study included both extrinsic and intrinsic emotion regulation behavior (i.e., mother-oriented and independent) as outcomes.

Impact of Maternal Sensitivity on Infant Reactivity

The results show modest stability in temperamental reactivity from 6 months of age to 16 months. That there was not a strong correlation between early and later reactivity is consistent with the view that temperamental characteristics are malleable early in life (Lemery et al., 1999; Rothbart & Bates, 2006). However, there was no moderating effect of maternal sensitivity on the relationship between early and later reactivity.

Three possibilities may explain this null finding. First, as explained in the introduction, attachment researchers have noted that infants in avoidant attachment relationships tend to mute their emotional displays. Avoidant attachments seem to be based on maternal rejection of infant needs, an insensitive behavior. So perhaps there were reductions in reactivity for both the infants with sensitive mothers whom they learned to trust in challenging situations, and the infants with rejecting mothers.

Therefore, it was not possible to detect the hypothesized effect of maternal sensitivity on infant reactivity. An alternate reason for the null finding is that perhaps during this period of development (i.e., 6 months to 16 months), maturation exerts more of an influence on reactivity than parenting does. A third possible reason there was no detected moderation effect of maternal sensitivity was that the sample size may have been too small which limited statistical power.

Impact of Maternal Sensitivity on Adaptive Emotion Regulation

Maternal sensitivity interacted with reactivity at 6 months to predict the use of mother-oriented emotion regulation behavior at 16 months, as hypothesized. Specifically, infants who were higher in reactivity and who had less sensitive mothers used less mother-oriented emotion regulation behavior at 16 months than infants who were higher in reactivity and who had more sensitive mothers. More reactive infants whose mothers were not effective in responding to their distress at 6 months may have learned that their mothers were not reliable sources of extrinsic emotion regulation and therefore turned to them less often over time as a source of support in arousing situations. That more reactive infants with sensitive mothers actively enlisted their mothers' help during a challenging situation suggests that mothers were an exogenous source of emotion regulation for these children. The moderation of the relationship between reactivity and mother-oriented emotion regulation is consistent with the view that the quality of parenting has an impact on emotion regulation over time (Crockenberg & Leerkes, 2004 & 2006; Berlin & Cassidy, 2003).

That maternal sensitivity did not influence toddlers' use of independent emotion regulation behavior was notable. From a learning theory perspective, infants may associate relief from distress specifically with their mothers and consequently increase their use of mother-oriented regulation behavior when mothers are sensitive. But infants may not associate other regulation behavior with their mothers, which may explain why maternal sensitivity did not interact either directly or indirectly with independent emotion regulation. Another explanation of this null finding is that although some sensitive mothers may foster independent emotion regulation behavior in their infants, perhaps infants of less sensitive mothers adopted independent behaviors on their own, obscuring the hypothesized moderation effect.

Contrary to the view that mothers' behaviors, both positive and negative, are linked to variability in infants' emotion regulation behaviors, maternal sensitivity at 6 months was not directly related to the use of adaptive emotion regulation behavior at 16 months. Two explanations exist. First, a global measure such as maternal sensitivity may not be sensitive enough to capture the effects of parenting on children's emotion regulation behavior. Spinrad et al. (2004) found that a global measure of maternal behavior in regulation of their children's emotions at 18 and 30 months was not associated with their children's ability to self-regulate emotions at 5 years of age, whereas specific behaviors *were* associated. Second, attachment theory and the MRM propose that both infant and maternal behavior are important to the interactions between them.

Early Mother-Oriented Emotion Regulation and Later Adaptive Emotion Regulation

Early mother-oriented emotion regulation behavior, measured in this study as percent of time 6 month old infants looked at their mothers during the emotional challenge tasks, predicted the later use of independent emotion regulation behavior. However, only mother-initiated look-at-mother was predictive of this outcome; infant-initiated was not. Considering that mother-initiated look-at-mother was positively associated with maternal engagement in the post hoc analysis, it may be that mothers who were skilled in scaffolding disengagement of attention from the aversive stimulus at 6 months fostered independent emotion regulation in toddlerhood. The control of attention is an effective emotion regulation behavior, associated with positive concurrent and long-term outcomes (Calkins & Hill, 2007; Crockenberg & Leerkes, 2004 & 2006; Posner & Rothbart, 2000). In the current study, of the behaviors designated as independent emotion regulation, most involved directing attention away from the aversive stimulus (i.e., look away, play with another toy, bid to experimenter) rather than toward it (approach and object-focused problem solving).

Interestingly, it was mother-initiated look-at-mother that was directly related to later emotion regulation, whereas infant-initiated look-at-mother was not. This finding is puzzling until the negative correlation between this behavior and maternal sensitivity to distress and maternal engagement is taken into account. Attachment theory would propose that infants looked to their mothers to signal a need for help; social learning theory would propose that infants were looking for emotion information from their

mothers; the MRM would propose that it is the contingencies between mother and infant behavior that are important, not just the behavior of one partner in the interaction. Thus it appears that in this sample, infants who initiated looks to their mothers did not encounter a social environment that was responsive to their needs. Taken together, this set of findings is consistent with the hypothesis that the association between mother-oriented emotion regulation and adaptive regulation over time is somewhat dependent on the mother's behavior and/or the situation in which mother and child are observed. It also underscores the utility of coding mother-initiated and infant-initiated look-at-mother separately.

Why did maternal sensitivity have no moderating effect on the relation between look-at-mother at 6 months and adaptive emotion regulation at 16 months? It could be that there were two types of mothers who were effective in engaging their infants' attention at 6 months: those who scaffolded diversion of attention and those who tended to take charge of their infants' experiences. There is some support in the literature that maternal intrusiveness has a negative effect on children's emotional development (Calkins & Johnson, 1998; Grodnick et al., 1998). Perhaps some mothers in the current study effectively helped their infants learn to disengage their attention from an aversive stimulus (a sensitive maternal behavior), whereas other mothers were intrusive in their attempts to engage their infants' attention (an insensitive maternal behavior).

A more likely reason for the null findings regarding the moderating effects of maternal sensitivity on adaptive emotion regulation, and on infant reactivity as well, is that there are many factors that influence changes in temperament, so maternal sensitivity

explains only a small portion of the variability. Learning theory proposes that it is the accrual of experience over time that shapes behavior, and interaction with mothers is just a small portion of infants' experience. Social experiences of infants are rich and varied, including interactions with fathers, siblings, extended family, friends, non-parental child care, and peers. Furthermore, the MRM proposes that it is infants' ability to influence their social partners that establishes their sense of effectance. These other social partners may have varied responses to infants, affecting emotional development in ways that differ from maternal sensitivity. For example, a child may experience very responsive parenting at home, but less responsive caregiving from busy child care providers.

The physical environment may present or limit exposure to stressors such as the high or low occurrence of novelty, degree of chaos, presence of dangers, situations of abuse, neglect, providing infants with varying emotional challenges in which to learn and practice emotion regulation skills. Poverty and the array of developmentally degenerative factors it presents may adversely affect emotional development.

Other influences on the development of reactivity and emotion regulation include characteristics of infants themselves. Maturation of physical characteristics, especially the brain, psychological maturation, and the development of cognitive abilities such as attention and appraisal of the environment also may affect emotional development. Personal resources such as health, intelligence, sociability and curiosity may contribute to emotional development (Bronfenbrenner & Morris, 1998). In summary, parenting may be an important influence on emotional development, but its effect may be difficult to separate from the variety of other factors which also influence emotional development.

Limitations, Conclusions and Directions for Further Study

A limitation of the current study was the small sample size and limited statistical power to detect interaction effects especially in light of the small to moderate expected effect size of maternal sensitivity to distress on infants' emotional development. Also, observational data were collected only at the lab, limiting the generalizability of the results to other contexts.

The laboratory setting and constraints on mothers' behavior (i.e., to refrain from responding during the first minute of each task, to refrain from picking the infants up) might have altered the way mothers normally respond to their infants' distress, thus masking the effects of maternal sensitivity. Also, the desire to be regarded as a good mother by the researchers might have influenced mothers to behave more sensitively to their infants than they normally do in other settings. Such contextual effects were reported by O'Brien, Johnson, and Anderson-Goetz (1989), who noted differences in maternal behavior in home vs. laboratory settings. Therefore, mothers' behavior at home during the 10 months separating the visits to the observation playroom may have exerted considerable influence on infants' emotional development, an effect that would not be discernable in the current study.

Results from the current study conflicted somewhat, but not entirely, with the literature which presents maternal sensitivity as a major influence on infants' temperament. This implies that there may be something more than observed behavior that varies among more and less sensitive mothers. As suggested by Dix (2000) and Leerkes, Crockenberg and Burrous (2004), the focus of mothers' goals as either infant-centered or

parent-centered may influence children's emotional development in important ways. For example, perhaps holding infants is a universal maternal behavior, enacted by both sensitive and insensitive mothers. Given that mothers differ in their emotion goals, as well as their level of sensitivity (Dix, Gershoff, Meunier, & Miller, 2004; Leerkes et al., 2004), sensitive mothers may hold their infants for infant-centered reasons (e.g., to provide physical comfort or emotional support), whereas less sensitive mothers may hold their infants for parent-centered reasons (e.g., to make them stop crying because mothers are embarrassed or irritated), or out of habit. Thus, maternal behavior in the immediate context of the emotion challenge situation is indistinguishable, yet in other settings and for the majority of the time infants experience a different level of sensitivity. Future research on maternal sensitivity may be improved by investigating the impact of mothers' goals and beliefs on children's development.

A strength of the study was the inclusion of mother reported temperament data, which provided a more comprehensive view of infant characteristics than observation alone, because mothers see their infants in many settings and over time. In this study, maternal report and observation of temperament were, indeed, correlated with each other. However, there was no self-report or other report on maternal behavior. Future research on maternal sensitivity may benefit from the inclusion of self-report data such as diaries or video recall, in which mothers would describe the goals and motivations for their behavior as they viewed the videotape of the emotional challenge tasks.

A contribution of this study was the measurement of infants' active engagement of their mothers by looking to them during emotionally challenging situations. Previous

work on emotion regulation has examined infants' ability to shift attention from aversive stimuli, but typically does not take into account the subject of this redirection. Infants look to others for emotion information (Stenberg, 2003), but may or may not receive what they need from mothers. That mother-initiated look-at-mother predicted independent emotion regulation behavior suggests that perhaps it is both infants' ability to shift attention and their propensity to direct it toward mothers that promotes development. The distinction made between infant-initiated and mother-initiated look-at-mother in the current study underscores the bidirectional nature of emotional exchanges between infants and their mothers, as proposed by the MRM and attachment theory.

In conclusion, it appears that different types of adaptive emotion regulation behavior (e.g., independent, mother-oriented) are influenced by different constellations of maternal and infant behaviors. Future research should investigate the influence of maternal sensitivity, assessed in multiple contexts, on both adaptive and maladaptive emotion regulation behaviors (e.g., venting, withdrawal) in larger and more diverse samples.

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APPENDIX A

INFANT REACTIVITY

Code	Description	Definition
1	High Positive	Open mouth, intense smile, can be laughing or squealing.
2	Moderate positive	Definite positive vocalization and/or bright smile. May be accompanied by excited body movement.
3	Mild positive	Brief, low intensity positive vocalization, brief smile, wide-eyed interest/pleasure.
4	Neutral*	No negative or positive affect apparent in vocalizations, facial expressions, or body movements. Includes moderate interest and confusion/bewilderment.
5	Mild negative	Fusses, whines, whimpers, and/or facial expressions that indicate wariness or displeasure (frowning and furrowed brow/wrinkled nose [confusion/puzzlement is not negative]). May be accompanied by body tension, uncoordinated movements, mild startles. May be brief or continual.
6	Moderate negative	Cries and/or facial expression indicating clear distress (fear sadness, anger*). May be brief, but must be more intense than a fuss or whimper. May be continuously moderate sobbing.
7	High negative	Screams, wails, sobs intensely; mouth wide. May include breath holding, breathless crying, tears, eyes closed, angry or fearful facial expressions, red face, body tremors, intense startles. Use when you think: this infant could not possibly be more upset than this. Clear escalation from moderate must be evident.

APPENDIX B

MATERNAL BEHAVIOR CODES

Code	Description	Definition
0	Uncodeable	Either mother cannot be seen or it is part of tape that is not meant to be coded (e.g., warm-up period or break or mother uninvolved portion of activity). Always start and end with this code.
N	Negative	Mother displays negative affect facially or vocally. Must be in reaction to the baby or displayed toward the baby (e.g., baby cries and mother makes a face; or mother appears to be making angry face about the toy but directs the face toward the infant). May include any other negative behavior not captured by the other codes.
I	Intrusive	Mother forces her own agenda on infant. This may include verbally encouraging a frightened infant to look at a toy (tone must have forceful or insistent quality), physically moving the infant's arm, head or body toward an undesired object, distracting the infant with new objects or behaviors when the infant is otherwise engaged/interested, kissing and wiping when the infant is otherwise engaged/interested, engaging in routine care when the infant is highly distressed. If infant does not respond negatively to behavior, only code as intrusive if all coders agree the behavior is clearly egregious. If intrusive co-occurs with mismatched affect, code mismatched affect.
A	Mismatched affect	Mother's affect is not congruent with infants'. Examples include mother laughing or smiling when infant is distressed, even if mothers are making an empathic sound (does not include smiling to reassure infant). The infant does not have to see a smile in order to count as mismatched affect. May also include mother contradicting or denying infant's emotional or behavioral reaction (e.g. "You're not scared," or "That's not scary," or "It's funny," in matter-of-fact tone even though infant is clearly distressed). If intrusive co-occurs with mismatched affect, code mismatched affect.
W	Withdraw	Mother physically moves away from the infant or abruptly stops interacting with the infant. Includes infant-focused behaviors that do not maintain contact/interaction (e.g.,

		moving away to get toy, pick up pacifier, without engaging in other ways like vocalizing). This is a short-term, transitional behavior. After the mom has moved away or stopped interacting, another code should be used to describe her behavior.
D	Distracted from infant	Mother is uninvolved with the infant. She may be expressionless or withdrawn. Mother may be engaged in activities that are non-infant focused (e.g., filling out questionnaires, reading magazines, looking around the room, talking to the experimenter, etc.) or infant focused (e.g., selecting a toy from the box).
P	Persistent ineffective	Mother is uninvolved with the infant. She may be expressionless or withdrawn. Mother may be engaged in activities that are non-infant focused (e.g., filling out questionnaires, reading magazines, looking around the room, talking to the experimenter, etc.) or infant focused (e.g., selecting a toy from the box).
M	Monitor	Mother watches infant or monitors situation (e.g., looking at novel toy or experimenter while taking away toy). May be jointly focused on object with infant. May be accompanied by neutral vocalizations. If there is eye-contact, it is engaged, not monitor.
T	Task focused	Mother engages with infant, focusing on lab activity. Examples include pointing at the toy or experimenter, vocalizing about features of the toy, mimicking sounds of the toy, etc. (Code as intrusive if infant is distressed or disinterested). May include <i>very brief</i> instances of both mother and infant watching toy when preceded and followed by other task focused behaviors. Commenting on B's reaction to toy fits this category if her comments either foster or follow infant engagement. Often involves mother focusing infant's attention on task. (Commenting could be empathy, engagement or mismatched affect depending on the context and mother's tone of voice).
C	Calming contact	Mother soothes/calms infant (may occur even if infant is not distressed). May be physical, vocal or both. Examples include: stroking head or hand, patting gently, vocalizing ("It's all right", "ssh") or smiling as reassurance, or moving the infant to make more comfortable. May include empathic

vocalizations (“Ooh, you don’t like that sound, do you?”).

S	Supportive	Mother provides support (i.e., physical or verbal comfort) for engagement or exploration of task following infant’s lead when infant is distressed or on the verge of becoming distressed. Examples include mother focusing or maintaining infant’s attention on task gently while simultaneously calming or supporting the infant (e.g., rubbing head, holding hand, talking about toy in soothing/playful manner).
E	Engagement non-task	Mother plays with infant (may be infant or mother initiated) or attempts to distract infant. May include vocalizing, making faces, introducing other objects, banging the table, peek-a-boo, reading, singing, eye-contact etc. May include commenting on the task if the focus is on the infant’s well-being, but not the task (e.g., Mom is looking at infant, not task, while talking “You love that toy, don’t you?” or “That’s a funny toy,” while close to baby, holding hand, making eye-contact). Includes responding to infant’s affective reaction (e.g., laughing when infant is excited/enthusiastic).
R	Routine Care	Mother wipes child’s nose or face, puts on sock, straightens clothing, etc. If this co-occurs with engagement, code engagement. If done with intrusive quality, code intrusive.

APPENDIX C
TODDLER EMOTION REGULATION

Category	Code	Definition
Gaze	Inspect stimulus	Behaviors aimed at inspection of the aversive stimulus (i.e., Shrek during the novelty task, or the phone/jar during the limits task). Examples: looking directly at phone/Shrek; tracking phone/Shrek with eyes and head. If the aversive stimulus is out of sight, but toddler's gaze remains directed as before <i>and</i> there is no reason to think that the phone/Shrek has moved to a different position, continue to code as inspect stimulus.
	Look Away	Visual orientation away from the aversive stimulus and towards something else other than mother. Examples: look at some other object (pictures on wall, toys in room), look at experimenter, look at self in mirror. If toddler buries his/her face in mother's legs, chest, etc., code as look away. Do not code as look away if mother is using a toy in a mother-focused play exchange (e.g., peek-a-boo); that is look at mother.
	Look at Mother	Visual orientation away from the aversive stimulus and toward mother. Example: looking at mom's face or torso (or in her direction if she is not on camera), eyes open, might include a smile or a frown. If toddler is on mom's lap and looks at her chest, lap or arms, code as look away; however if toddler turns face up to see mom's face, then code as Look at Mom. Does not include looking at phone/jar when mother is holding it; that is inspect stimulus. Includes face to face play (e.g. peek-a-boo) even if it involves an object (e.g., hiding behind bear) if the object can be viewed as an extension of the mother.
Body Position (relative to aversive stimulus)	Normal	Toddler is in starting position, or is no longer in the process of approaching or withdrawing. Toddler may be in contact with the jar, but is not looking at it and his/her attention seems to be elsewhere. This may happen while toddler is sitting on mom's lap and mom is holding the jar for him/her.
	Approach	Behaviors aimed at being closer to, making physical contact with, engaging with the aversive stimulus (i.e. leaning, walking, or crawling toward, reaching for, or touching aversive stimulus.) Includes dancing along with or attempts to talk to Shrek; also turning body back toward Shrek or jar after a withdraw to mom. (This will be a very brief

		approach, change to normal when toddler stops turning around.) Does not include just staring at stimulus without touching it; that should be coded as Normal. If toddler is on mom's lap and is holding <u>and looking</u> at the jar, code as approach. If mother is holding the jar for toddler and toddler's attention is NOT on the jar, code as normal.
	Withdraw	Behaviors that resemble attempts to remove oneself from the situation, or create distance from the aversive stimulus. May have back toward Shrek or phone/jar, but head is turned toward them. Includes toddler taking a couple steps back from jar or Shrek without being upset. Includes positioning self behind an object (e.g., chair, toy basket). Examples: move/run away from Shrek, turn away from Shrek or phone/jar. Includes pushing the phone jar or Shrek away in a non-aggressive way. If toddler violently shoves jar or Shrek away, then code as Vent.
	Withdraw to mom	Toddler reaches for or approaches mother; tries to climb up on mom, buries face in mom, asks to be picked up by mom, IF it appears to be an attempt to get away from the aversive stimulus. If toddler is sitting on mom's lap, no longer trying to get away, code as Normal. Remember that when toddler turns body around again, this is a brief approach.
Comfort-seeking	Self-soothing	Behaviors that resemble attempts to calm oneself, or maintain composure (toddler may not be upset). Examples: thumb/finger sucking; rocking/swaying; hair twirling, rhythmic arm movements that are not goal-oriented, rubbing feet together while sitting on mother's lap, rubbing tummy or wringing hands (while hands are moving. When hands stop moving, code as no soothe.)
	Passive Soothing from Mother	Toddler sits in mothers lap, holds onto mother IF it appears to be comfort-seeking, not an attempt to withdraw to mother. While toddler is struggling to get down or up, code as No Soothe; soothe should include only comforting touch. If toddler self-soothes while on mom's lap (e.g., sucks thumb) code as self-soothe, but switch back to soothing from mother as soon as the self-soothe ends (not No Soothe).
	No self-soothing	When none of the above occur. Remember to switch to this when other self-soothing behaviors end, unless toddler is on mother's lap. Then switch to mom soothe.
Stimulation	Stimulation/play -toddler	Active stimulation or behaviors that appear playful or engaging/distracting. Touching or playing with toys in basket or elsewhere in room; climbing into toddler chair;

		talking to self or singing if unrelated to the aversive stimulus. Holding on to a toy while engaging with the phone/jar or Shrek is NOT stimulation; stim is <u>distraction</u> away from aversive stimulus.
	Stimulation/play with mother	Bringing another toy to mother (not the phone/jar), accepting a toy from mother, playing with toys with mother, talking to mother, singing songs or dancing with mother if unrelated to the aversive stimulus. Does NOT include watching mother play with a toy. Does NOT include mother playing with toddler when toddler is not responding to her, such as mom tossing the ball (toddler ignores) or mom holding toddler's hands, trying to make him/her dance.
	No stimulation/play	When none of the above occur. Remember to switch to this when other stimulation behaviors end.
Vent	Vent	Throwing phone/jar in an angry/frustrated/disgusted manner (not if it appears to be an effort to open it); hitting Shrek or the jar, pounding on door to leave, throwing a tantrum. Includes pushing jar or Shrek away violently. If toddler slowly or insistently pushes jar away, code as Withdraw. Vent includes only aggressive, out of control actions and shrieking, breathless screaming, emotional outbursts that are a step <u>beyond</u> loud crying. Dropping the phone/jar by accident is not vent. Kicking jar is Vent, standing on jar to get it open is problem solving-object oriented.
	No vent	When none of the above occur.
Problem solving	Problem solving-object oriented	Attempts to open the jar by twisting or prying the lid off, standing on it, shaking it; telling Shrek to go away, moving an object (e.g., toy basket) into position as a barrier between self and Shrek. Does not include going behind an object without moving it; that is withdraw. Does not include throwing jar in anger; that is vent.
	Bid to mother	Asking mother for help in opening jar, taking jar to mother, pointing to Shrek or the jar, trying to direct mother's attention. Include only vocalizations that are clearly directed toward the mom in an effort to gain her assistance.
	Bid to experimenter	Asking experimenter for help, taking jar to experimenter. Include only vocalizations that are clearly directed toward the experimenter in an effort to gain her assistance.
	No problem solving	When none of the above occur. Remember to switch to this when other problem solving behaviors end.